Aspect and Situations: A Situation Semantics Account of the Semantic Variability of Spanish '*al*-Clauses'[*].

Luis Alonso-Ovalle
University of Massachusetts at Amherst

1. The Puzzle

Frege himself noticed that free adjuncts and absolutes represent an intricate case of extra meaning that can neither be attributable to overt expressions nor to Gricean effects (Frege 1892). Thus, (1a), for instance, is semantically equivalent to either (1b) or (1c), among many other possibilities.

(1) a. Napoleon, who recognized the danger to his right flank, himself led his guards against the enemy position.
b. Napoleon, in spite of his recognizing …
c. Napoleon, since he recognized …

Since their meaning does not seem to be directly composed out of the syntactic combination of their parts, absolutes and free adjuncts directly challenge the Compositionality Principle, which fuels model-theoretic semantics. Its strongest version, due to Hintikka (1980), is found in (2).

(2) It is *only* the meaning of the parts and their syntactic mode of combination that matters.

Nevertheless, Stump (1985) has shown that a compositional analysis for these constructions is indeed possible. This paper aims to support his claim by providing such an analysis for a kind of infinitival free adjunct in Spanish: *al*-

[*] For useful comments, encouragement and help, I am most grateful to Franco D'Introno, Angelika Kratzer, Barbara Partee and the participants in Kratzer's UMass Seminar on the semantics of embedding. Usual disclaimers apply.

clauses (henceforth ACs), free infinitival adjuncts of the form of those under (3).

The semantic variability of *al*-clauses is interestingly restricted to three possible interpretations. First, the line of work associated with David Lewis (1975) and Angelika Kratzer (1991) has shown that certain adverbial clauses (mostly *if*-clauses) can restrict the domains of various operators. This is indeed the case for ACs with respect to quantificational adverbs like *siempre* ('always') or *rara vez* ('rarely'), as (3) shows.

(3) *Pedro siempre silba al conducir*
Pedro always whistle:3sPres AL to drive
"Pedro always whistles when he drives."

Second, they can also be adsentential modifiers. The glosses under (4) show that, as adsentential modifiers, they can have either a 'causal-explicative' or a temporal reading.

(4) *Al sonar el teléfono, Pedro se calló*
AL to ring the phone Pedro shut up:3sPast
"Peter shut up when the phone rang."
"Peter shut up because the phone rang."

But the interesting property of ACs is that their semantic variability is 'aspectually restricted', as shown by (6-12). First, ACs cannot be restrictors if they are headed by perfect infinitives (6) and/or i-level predicates (7):

(6) *Pedro (siempre/rara vez) canta al haber conducido*
Pedro (always/rarely) sing:3sPres AL to have driven
*"Pedro always sings after driving."[1]
(7) *Pedro (siempre/rara vez) canta al ser alto*
Pedro (always/rarely) sing:3sPres AL to have driven
*"Pedro always sings when he is tall."

Moreover, when they are adsentential modifiers, ACs headed by both i-level predicates (8) and perfect infinitives (9) only license causal-explicative readings, excluding temporal ones:

(8) *Al ser tan burro enciende las luces por de día*
AL to be so idiot switch:3s the light during the day

[1] "*" indicates that the reading is unavailable.

*"When he is so idiot, he switches the light during the day."
"Because he is so idiot, he switches the light during the day."

(9) *Al haber sido quemado, este elemento genera residuos cancerígenos*
AL to have been cremated, this element generate:3S residues cancerous
*"When it has been cremated, this element generates cancerous residues."
"Since it has been cremated, this element generates cancerous residues."

Finally, the most natural reading for non perfect s-level predicates when adsentential modifiers is the temporal one, even while causal readings, as in (11b), are not excluded.

(10) *Coello se contradijo al ser interrogada por segunda ocasión*
Coello rfxcl contradict:3sPast AL to be asked for second time
"Coello contradicted herself when/while she was asked a second time."
(11) a. *Al correr, Juan se cayó* (Rigau 1995)
AL to run, Juan rfxvcl fall:3sPast
b. "Juan fell down because he ran."
c. "Juan fell down while he was running."

That the availability of a causal or temporal reading for an AC is dependent on the aspectual value of the predicate is shown by the fact that, if a predicate has both an i-level and a s-level reading, the i-level reading yields a causal reading and the s-level a temporal one. The predicate *ser joven* ('to be young'), for instance, is one of those and, therefore, (12) is ambiguous between a temporal and a causal reading.

(12) a. *Piensan que al ser joven tienes que ser drogadicto*.
(They) think that AL to be young (you) have to be drug addict
b. "They think that you have to be drug addict when you are young."
c. "They think that you have to be drug addict because you are young."

Table 1 in next page summarizes the empirical generalizations presented so far. The explanation of its contents constitutes the minimal goal of any analysis of ACs. The one put forth in the next sections proposes that Spanish infinitives can be either VPs or Aspectual Phrases (AspPs) and that *al* merges with either. When it merges with VP-infinitives, it is semantically vacuous and introduces properties of situations, which, unlike AspPs, are suitable arguments for quantificational adverbs.

The organization of the paper runs as follows: section 2 introduces the basics of a kratzerian Situation Semantics (Kratzer 1989), section 3 defends

that Spanish infinitives denote sets of minimal situations and shows how to capture the intuition that perfect infinitives denote sets of completed minimal situations, whereas imperfective infinitives denote sets of uncompleted minimal situations. Section 4 defends that *al* can merge with VPs that, unlike AspPs, are suitable arguments for quantificational adverbs. Section 5 shows how to capture the temporal and causal readings of infinitive AspPs and, finally, Section 6 summarizes the proposal.

Table 1
The semantic variability of ACs.

		Imperfect	**i-level**	**Perfect**
Restrictors		✓	×	×
Mod.	temporal	✓	×	×
	causal	✓	✓	✓

2. The Tools: Kratzerian Situation Semantics

For reasons to be seen in the next section, the analysis of ACs will be cast in a kratzerian Situation Semantics (Kratzer 1989, 1990)[2]. This section is devoted to presenting its basics.

First, throughout this paper, a situation-based ontology is assumed. Specifically, a model for interpreting natural language is a tuple M := <S,D,W,≤, [[ ]]>, where:

(13) S is the set of possible situations.
D is the set of possible individuals. D ⊆ S
W is the set of possible worlds, maximal elements with respect to ≤.
≤ is a partial ordering on S
[[ ]] is the interpretation function

The partial ordering on S satisfies at least the following condition: for all s ∈ S there is a unique s'∈ S such that s ≤ s' and for all s''∈ S: if s'≤ s'', then s'' = s'. Notice, then, that ≤ imposes a mereological summation structure to S, with each world being the supremum of a complete join semilattice and each situation being part of a world. This on its turn implies that one individual can only be part of one possible world, which requires adopting some version of

[2] Portner (1992) includes an interesting comparison between Kratzer's system and the model proposed by Barwise and Perry (1983).

the counterpart theory, as advocated by Lewis (1968, 1986), to speak about possible alternatives of an actual individual.

The type theory of Kratzer's Situation Semantics is standard, except for the fact that the domain of expressions of type *e*, the set of individuals, is a subset of S and the domain of expressions of type *t* is $\wp$(S). Propositions, then, are sets of situations: the set of situations in which the proposition holds.

Finally, the notion of eventualities that exemplify propositions will be relevant for our purposes (Kratzer 1990, 1998)[3]. Intuitively, an eventuality that exemplifies or supports a proposition is a situation in which the proposition is true and is small enough so as not to contain anything irrelevant to its truth:

(14) For each s $\in$ S and any p$\in$ $\wp$(S), *s* is an eventuality that exemplifies p iff for all s' such that s' $\leq$ s, there is an s'' such that s'$\leq$ s''$\leq$ s, and s'' is a minimal situation in which p is true.

In order to map propositions into eventualities that exemplify them, I will make use of an operator $\downarrow$ in the intermediate typed language (see Kratzer 1999), where:

(15) [[$\downarrow$p]] = {s: s exemplifies p}

3. Spanish Infinitives Denote Sets of Minimal Situations

In order to posit an analysis of the semantic variability of ACs, after having introduced the basic tools, we still need to introduce a minimal semantics for Spanish infinitives

3.1. *Propositional and Eventive Infinitives.*

Vendler (1967) noted that English gerunds have either propositional, as in (16a) (intuitively equivalent to *John denied that he studied semantics*), or event-like denotations, as in (16b).

(16) a. John denied studying semantics.
b. Studying semantics was interesting.

[3] In the sense of Bach (1986) that covers both states and proper events.

The observation can be extended to Spanish infinitives. (17a) is equivalent to its propositional paraphrase in (17b), whereas the infinitive in (17c) seems to denote an eventuality of studying semantics.

(17) a. *Juan negó haber estudiado semántica*
Juan deny:3sPerPas to have studied semantics
"Juan denied to have studied semantics."
b. *Juan negó que hubiera estudiado semántica*
Juan deny:3sPerPas that (he) have:3sPasSubj studied semantics
"Juan denied that he had studied semantics."
c. *Fue interesante estudiar semántica*
Be:3sPerPas interesting to study semantics
"Studying semantics was interesting."

Under the position advocated by Vendler (1967), Davidson (1967) and Parsons (1990), among others, there is no direct relation between events and propositions. Therefore, (17) would force us to admit that Spanish infinitives are ambiguous between propositional and eventive readings. However, by using the tools introduced in Section 2, Portner (1992) closed the gap between propositions and events by treating English gerunds as uniformly denoting a specific type of propositions, those formed by minimal situations that can individually play the role of events. This makes Situation Semantics a specially promising framework for the analysis of ACs.

Throughout the paper, I will adopt Portner's position and consider that Spanish infinitives denote properties of minimal situations. Specifically, I want to suggest that the infinitival morpheme gets translated into the intermediate language as the kratzerian minimality operator $\downarrow$. Consequently, by assuming that VPs denote properties of situations, the denotation of *comer una tarta* ('to eat a pie') would be the set of eventualities that exemplify the proposition {s: eats-a-pie' (x) (s)}.[4]

(18) Tr (*comer una tarta*) = $\downarrow\lambda$s[eats a pie' (x) (s)]

2

Tr (-*ar*) = λp[$\downarrow$p] Tr (*VP*)= λs[eat-a-pie'(x) (s)]

6

com- una tarta

[4] The free variable is intended to stand for the trace of the VP-internal subject. This is just a simplification with no significant role in what follows.

3.2 *Completed vs. Uncompleted Events: Infinitives as Aspectual Phrases.*

What about the aspectual values of infinitives and gerunds? We know that sometimes *–ing* forms are interpreted perfectively, as in (19a), and sometimes, as in (19b), imperfectively.

(19) a. Mary celebrated climbing the mountain.
b. Mary enjoyed climbing the mountain.

Portner's treatment of these aspectual differences relies on the notion of point of view: perfect interpretations of gerunds correspond to an external perspective of the minimal situation that it denotes, whereas imperfect gerunds correspond to an internal perspective of the situation. This intuition is formally captured by means of a relation between the situation introduced by the verb of the main clause and that associated with the gerund.

Even when I will depart from Portner's formalization of the aspectual values, I propose to extend this treatment to Spanish infinitives in the following sense: whereas *haber*-infinitives denote complete situations, infinitives without an overt aspectual auxiliary are unmarked for completeness, as the following minimal pairs show:

(20) a. *A Pedro le divirtió comer la manzana*
to Pedro cl enjoy:3sPast to eat the apple
"Peter enjoyed eating the apple." (completed/uncompleted event)
b. *A Pedro le divirtió haber comido la manzana.*
to Pedro cl. enjoy:3sPast to have eaten the apple
"Pedro enjoyed to have eaten the apple." (completed event)

(21) a. *Al rector le enorgullece dar la conferencia***.**
to the Chancellor cl. is proud of to give the lecture
"The Chancellor is proud of giving the lecture." (uncompleted event)
b. *Al rector le enorgullece haber dado la conferencia*
to the Chancellor cl. is proud of to have given the lecture
"The Chancellor is proud of having given thelecture."(completed event)

This is clearly seen with verbs that denote attitudes towards an event that is over, as in (22): in all these cases an imperfect infinitive is excluded.

(22) a. *Conmemoran haber viajado a Roma.*
commemorate:3pl to have travelled to Rome
"They commemorate to have travelled to Rome."
b. **Commemoran viajar a Roma.*

Moreover, when the verb expresses an attitude towards an event that one must be involved in or in direct perceptual contact with, the perfect infinitive is definitely ruled out:

(23) *Vi las flores crecer /*haber crecido.*
I saw the flowers grow / * to have grown
"I saw the flowers grow."
(24) *Oye la orquesta tocar / *haber tocado.*
hear:3s the orchestra to play / *to have played
"He hears the orchestra playing."

Then, we need to formalize the intuitively valid observation that links perfect infinitives with completed events. Instead of reference situations, as in Portner (1992), I will make use of temporal references in order to assume a unified treatment of aspect. Klein (1994) characterized aspect informally as a relation between intervals of time: the running time of an eventuality, what he calls a *situation time* and the time (interval) about which a sentence makes an assertion, what he calls a *topic time*. Kratzer (1998) has formalized this notion by using a predicate of eventualities (*time*) that gives you the running time of an eventuality. Johnston (1995) makes use of a similar device, inspired by the temporal trace function in Krifka (1989) and the running time function in Lasersohn (1990). The analysis proposed in the next sections will use such a device:

(25) [[time' (s)]] = {t: s is running at t}

Now, if we let aspectual operators existentially close the eventuality variable provided by VPs, a perfect AspP-infinitive would denote an event completed with respect to a reference time *t*, if the running time of the situations of which the property expressed by the VP can be truly predicated is previous to *t*. A non perfect infinitive would be unmarked for completeness if we let the running time of the situation it denotes be *non properly* included in the reference time.

Aspectual operators, which presumably appear in the syntax as heads of the AspPs, map properties of situations (in the case of infinitives of minimal situations) and yield properties of times as a result. In the line of Kratzer (1998), I will also posit existential closure of the situation argument as part of the semantics of the aspectual operators. *Haber*, the aspectual auxiliary, would be considered the perfect aspectual operator, whose non perfect counterpart is

covert in Spanish.[5] Assuming all this, we are ready to characterize formally the notion of complete and uncompleted events as follows:

(25) a. Tr (*haber*) =λpλt∃s [↓p (s) & time (s) < t]
b. Tr (∅) = λpλt∃s [↓p (s) & t ⊆ time (s)][6]

(26) is an illustration for the AspP *haber fumado* ('to have smoked'):

(26) Tr (*AspP*) = λt∃s'[↓smoke'(x) (s') & time (s') < t]

…

ei

Tr (*haber*) Tr (*VP*) = λs[smoke'(x) (s)]

=λpλt∃s[↓p (s) & time (s) < t] 5

fum-

The denotation of (26) is a set of times such that there is an eventuality of x's smoking whose running time is previous to them. In (27) we have an example for a non perfect AspP. Its denotation is also a set of times: the set of times such that there is an eventuality of x's smoking whose running time includes them.

(27) Tr (*AspP*) = λt∃s'[↓smoke'(x) (s') & t ⊆ time (s')]

…

ei

Tr (∅-*ar*) Tr (*VP*) = λs[smoke'(x) (s)]

=λpλt∃s[↓p (s) & t ⊆ time (s)] 5

fum-

4. ACs as Restrictors

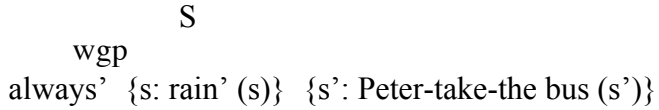
We have seen that infinitives without a perfect auxiliary may be either VPs (18) or non perfect AspPs (27). We are now in the position of explaining why only non perfect s-level predicates can function as restrictors of frequency adverbs. For consider the semantic structure of adverbial quantification (henceforth *a*-quantification, as in Partee (1995)). In spite of the successful

[5] This operator will be represented in the syntax by means of '∅'.

[6] For all sets of times P, Q , [[P ⊆ Q]] = 1 iff every t included in P is also included in Q. Caveat: *t* would be considered a singleton, so the same semantics are extended to expressions like *t* ⊆ *P*.

Kamp-Heim approach that claimed that quantificational adverbs are unselective binders (Kamp 1981, Heim 1982), Von Fintel (1994, 1995) treats adverbs of quantification as uniformly quantifying only over situation variables. Following Berman (1987) and Heim (1990), he points out that, within a kratzerian Situation Semantics, adverbs of quantification can be seen as denoting second-order relations between two sets of situations, i.e. between two propositions, the first of which, as usual, can be either contextually supplied or given by a restrictive clause, as in (28).

(28) a. Always, if it rains, Peter takes the bus

b.


Intuitively, *always* is the situation-sensitive correlate of *every*. Hence, (28) will be true if the set of situations contained in the proposition *it rains* is a subset of the set of situations in which Peter takes the bus, much as *Every cat smiles* is true if the set of individuals that are cats is a subset of the set of individuals that smile.

Interestingly enough, however, Von Fintel has shown that this is too a naïve approach. First, as stated, the proposition denoted by an adverbially quantified statement will either contain all situations or none, because the condition on membership on the proposition does not mention the situation whose membership is decided. This has been solved by proposing that the situations in the restrictor have to be evaluated in the actual world (Von Fintel, 1994:19). Second, the mereological structure of the domain of situations in the model makes it very difficult to count situations and, therefore, to compare the cardinalities of the two propositions. This has been solved by restricting the semantics to take care only of *minimal* situations in the restrictor: more specifically, to minimal situations in the restrictor extendable to situations in the nuclear scope of the quantifier.

This latter condition makes VP-infinitives suitable arguments for a-quantifiers, since we have proposed that the infinitival morpheme contributes a minimality requirement to the denotation of the VP. Consequently, we are able to claim the following generalization:

(29) a. VP-infinitives are suitable restrictors for Q-adverbs
b. AspP-infinitives cannot be suitable restrictors for Q-adverbs.

As a matter of illustration, consider (30). (30) includes a non perfect infinitive that may function as restrictor of a Q-adverb. Applying the proposed translation for VP-infinitives and assuming that *al* is semantically vacuous, the translation of the infinitive in (30a) is (30b), accepting that the denotation of the e-type argument of the infinitive is somehow controlled (an assumption currently made, see Stump 1985).

(30) a. *Juan siempre silba al conducir*
Juan always whistle:3s AL to drive
"Juan always whistles when driving."
b. Tr (*al conducir*) = ↓λs[Juan-drive' (s)]

(30) will have the tripartite LF in (31), translated into (32):

(31) S
qgp
siempre al PRO$_1$ conducir Juan$_1$ silba

(32) S
qgp
$\forall_s$ λs [Juan-drive' (s)] λs'' [Juan-whistles'(s'')]

(32) yields the desired reading: it will be true iff the set of minimal situations of Juan driving is a subset of the set of situations of Juan whistling, i.e. iff the set of situations of Juan whistling includes all minimal situations of Juan driving.

Now it is not difficult to derive the prohibition against perfect infinitives and i-level predicates being restrictors. (33) repeats the denotation suggested for perfect (33a) and non perfect (33b) AspPs.

(33) a. Tr (*haber fumado*) = λt∃s'[↓smoke'(x) (s') & time (s') < t]
b. Tr (∅ *fumar*) = λt∃s'[↓smoke'(x) (s') & t ⊆ time (s')]

From this perspective, it is trivial to explain why these phrases cannot be restrictors: they are just not a suitable semantic type (<i,t>). It will be clear that aspectual operators existentially close the set of situations that they take as arguments and quantificational adverbs cannot be applied to arguments of type <i,t> (where *i* is the type of times).

The same explanation can be given for i-level predicates. Chierchia (1995) considers them inherently generics and does so by letting them incorporate an aspectual habitual operator in the lexicon. If that is the case, then i-level predicates inherently lack the possibility of being restrictors to quantificational

adverbs. (34) tries to capture the fact that i-level predicates are temporally stable by letting the running time of an i-level eventuality include any other salient enough time.

(34) Tr (*ser médico*) =λt∀t'[t ≠ t'& ∃s'[doctor'(x) (s')] & t ⊆ time (s') & t' ⊆ time (s')]

This proposal predicts that every alleged non perfect s-level predicate that serves as restrictor is actually a VP-infinitive. And this prediction can be empirically borne out. First, (35) shows what happens if the eventuality variable of the VP-level infinitive is on its turn bound by an a-quantifier: the restrictor reading is blocked and the only available reading is the adsentential modifier one.

(35) a. *Juan siempre silba al conducir*
Juan always whistle:3S AL to drive
"Juan always whistles when driving."
b. *Juan siempre silba al conducir con frecuencia*
Juan always whistle:3S AL to drive with frequence
"Juan always whistles since he drives frequently."
*"Juan always whistles when he drives frequently."

Furthermore, the presence of any element generated in the syntax above the AspP, like temporal adverbs (Ojea 1994) or negation itself, blocks the restrictor reading, showing that AspPs are not suitable arguments for the a-quantifier.

(36) a. *Juan siempre silba al no conducir*
*"Juan always whistles when he does not drive."
"Since he doesn't drive, Juan always whistles."
b. **Juan siempre silba al conducir al año pasado*
"Juan always whistles since he drove last year."

Notice that, as expected, restrictors are compatible with VP-adverbs, as (37) shows.

(37) *Juan siempre silba al conducir despacio/ despreocupadamente…*
Juan always whistle:3S AL to drive slowly, carelessly…
"Juan always whistles when driving slowly, carelessly…"

5. Adsentential Modifiers

The previous discussion leads us to accept the existence of a semantically vacuous *al* that merges with VP-infinitives, which are suitable arguments for a-quantifiers. I will call it al_1. Al_1 takes sets of minimal situations as syntactic arguments and is semantically vacuous. There are still certain semantic characteristics in this construction that I will not try to deal with here. For instance, it has to be determined why is it the case that in these constructions there are no head restrictor readings as those pointed out in Johnston (1995).

Nevertheless, I will now show how to derive the adsentential modifier readings for ACs and their sensitivity to the aspectual values of their infinitives. The strategy Portner (1992) (inspired by Stump (1985)) employed for free adsentential modifiers is to suppose the existence of a covert operator that denotes a relation between a situation and a proposition. This relation is present in the grammar as a free variable over possible relations of this type. The possible values that the relation takes restrict the interpretation of the modifier.

I will sketch here an analysis that makes use of a relation between properties of times and. propositions. We have seen that AspPs denote properties of times and that aspectual operators close existentially the eventuality argument. We have also seen that *al*, when part of an adsentential modifier (henceforth al_2), takes AspPs as its argument. I will propose in the spirit of Stump (1985) that al_2 is not semantically vacuous, but requires that the sets of times denoted by the AspP it takes as its argument be included in the running time of the situations in the proposition denoted by the main clause:

(38) Tr (al_2) = $\lambda P_{<i,t>} \lambda p \lambda s'[p(s') \ \& \ time\ (s') \subseteq P]$

Notice what happens if al_2 combines with a non perfect infinitive, say *sonar el teléfono* ('to ring the phone'). We obtain:

(39) Tr (al_2 *sonar el teléfono*) = $\lambda p \lambda s'[p\ (s') \ \& \ time\ (s') \subseteq [\lambda t \exists s[\downarrow ring'(the\ phone')\ (s)] \ \& \ t \subseteq \ time\ (s)\ ]]$

(39) takes a proposition as its argument and says that the running time of any situation in the proposition is included in the set of times that are included in the running time of an eventuality of ringing the phone. Let this proposition be (40), where I neglect temporal and aspectual content.

(40) Tr (*Pedro se calló*)= $\lambda s'''$ [shut-up' (Pedro') (s''')]

Then, by regular functional application we obtain (41). (41) denotes a proposition: the set of situations such that they are situations of Peter shutting up and its running time is included in a temporal interval: the set of times t such that there is an eventuality of ringing the phone whose running time includes them.

(41) Tr (*al*$_2$ *sonar el teléfono* (Tr (*Pedro se calló*))) = λs' [shut-up' (Pedro') (s') & time (s') ⊆ λt∃s [↓ring'(the phone') (s) & t ⊆ time (s)]]

(41) summarizes what we have called the 'temporal reading' for ACs as adsentential modifiers. Non perfect AspP infinitivals, then, tend to license this temporal overlapping reading. However, notice that (41) does not exclude a possible causal inference. If a causal chain between the eventuality of ringing the phone and a situation of Peter shutting up is available, then (41) can also have what we have been calling a 'causal-explicative meaning'.[7]

Finally, notice also that the existential quantification over eventualities included in the AspP denotation forces factivity (Stump 1985). The denotation of (41) forces to accept the existence of an eventuality of ringing the phone.

Let us see now what happens in the case of perfect AspP-infinitives. (42a) illustrates the type of denotation for a perfect AspP. It denotes a set of times *t* such that there is an eventuality of *x* being burnt whose running time is previous to *t*. (42b) illustrates the denotation of an AC that takes this type of AspP as argument.

(42) a. Tr (*haber sido quemado*)= λt∃s'[↓being burnt'(x) (s') & time (s') < t]
b. Tr (*al*$_2$ *haber sido quemado*) = λpλs''[p(s'') & time (s'') ⊆ λt∃s' [↓being burnt'(x) (s') & time (s') < t]]

Now, if we apply a proposition like (9) (*este elemento genera residuos cancerígenos* ('this element generates cancerous residues')), we obtain the following denotation:

(43) Tr (*al*$_2$ *haber sido quemado* (Tr (*este elemento genera residuos cancerígenos*)))= λs'[this-element-generates-cancerous-residues' (s') & time (s') ⊆ [λt∃s[↓being burnt'(this element') (s)] & time (s) < t]]

[7] Javier Gutiérrez-Rexach (p.c.) has suggested that a normality condition on extendability of situations can shed some light on the availability of causal readings for some cases. Obviously, this topic deserves far more attention.

(43) states that the denotation of (9) is a set of situations of this element generating cancerous residues whose running time is included in the set of times preceded by an eventuality of this element being burnt. It can be seen that a causal link is easily here on the basis of temporal precedence. And, obviously enough, temporal overlapping is not a possible reading.

Finally, let see what happens when the AspP al_2 takes as its argument is an i-level predicate. (44a) illustrates the type of denotation suggested for i-level predicates like *ser médico* ('to be a doctor'). For our purposes, it suffices to assume that it denotes a temporal interval such that the running time of the eventuality of x being a doctor includes any time (sure, the domain of times is to be pragmatically restricted). (43b) shows the denotation of an AC with an i-level predicate.

(44) a. Tr (*ser médico*) =$\lambda t \forall t'[\ t \neq t' \& \exists s'[\text{doctor'}(x)\ (s')] \& t \subseteq \text{time}\ (s') \&$ $t' \subseteq \text{time}\ (s')\ ]]$

b. Tr (al_2 (Tr (*ser médico*)))= $\lambda p \lambda s'[p(s') \& \text{time}\ (s') \subseteq \lambda t \forall t'[\ t \neq t' \&$ $\exists s[\downarrow \text{doctor'}(x)\ (s) \& t \subseteq \text{time}\ (s) \& t' \subseteq \text{time}\ (s)\ ]]]$

Now, if we apply (44b) to a proposition such as *Pedro se salvó* ('Peter save himself'), we obtain (45b) as result:

(45) a. Tr (*Pedro se salvó*) = $\lambda s'$[save-himself' (Pedro') (s')]

b. Tr (al_2 *ser médico* (Tr (*Pedro se salvó*))) = $\lambda s[\text{save-himself'}\ (\text{Pedro'})\ (s) \ \&\ \text{time}\ (s) \subseteq \lambda t \forall t'[t \neq t' \& \exists s'$ $[\downarrow \text{doctor'}(\text{Pedro'})\ (s')] \& t \subseteq \text{time}\ (s') \& t' \subseteq \text{time}\ (s')\ ]]]$

The denotation of (45b), then, is a proposition: the set of situations of Peter saving himself whose running time is included in the running time of the eventuality of Peter's being a doctor. Since the running time of the eventuality (state) of Peter's being a doctor is temporally stable, temporal inclusion is not informative. I will take this to mean that such an interpretation is pragmatically excluded and that temporal inclusion will have to be reinterpreted as causal dependence.

Stump (1985) notes that i-level predicates have a strong tendency to license causal meanings, since they apply to an individual throughout a single, continuous interval whose boundaries are not precise:

> The essential properties or dispositions of an individual are, of course, naturally viewed as being among the reasons or causes for that individual behavior; that is the cause of or reason for some event or state of affairs is routinely sought among the dispositions of its participants. For this reason,

> individual-level predications are good for specifying reasons and causes; it is, therefore, not surprising that language users tend to infer an explanatory or causative role for strong adjuncts and strong absolutes whose predicate are individual level (Stump 1985:311).

6. Summary

Summarizing: it has been argued for the existence of two kinds of infinitives: VP-infinitives and AspP-infinitives. *Al* can take either VP or AspP-infinitives as arguments. When it applies to a VP-infinitive, *al* has been claimed to be semantically vacuous. Consequently, a VP-level AC will denote a set of minimal situations (eventualities) and can restrict the domain of an a-quantifier.

However, AspP-infinitives cannot be restrictors of a-quantifiers because their situation variables end up being bound by an aspectual operator that closes them existentially. Rather than denoting properties of eventualities, AspPs denote properties of times. Al_2 takes AspPs as its arguments and is thought to denote a relation between the set of times the AspPs denote and a proposition *p*. The semantics of al_2 requires that the set of times denoted by the AspP be included in the running time of the situations included in *p*. In the case of non perfect AspPs, this directly yields temporal overlapping as an accessible reading, without excluding causal dependencies. However, with perfect AspPs temporal overlapping is not possible, and, as a consequence, a causal link is inferred whenever available. I-level AspPs vacuously include the running time of the situations in the denotation of the main proposition and a causal link is inferred.

This proposal sketches an explanation for the generalizations in table 1 and opens a set of questions for further research. A natural one to ask ourselves is whether both denotations for *al* can be reduced to a single one. If one takes temporal overlapping between the restrictor and the nuclear scope in a quantificational structure to be a condition on adverbial quantification, then perfect AspPs cannot satisfy this condition and i-level predicates will vacuously satisfy it (Stump 1985: 310). As a result, only VP-infinitives will be suitable restrictors.

References

Bach, Emmon. 1986. "The Algebra of Events". *Linguistics and Philosophy* 9. 5-16.
Barwise, J. & Perry, J. 1983. *Situations and Attitudes*. Cambridge, MA: The MIT Press.

Berman, Steve R. 1991. *On the Semantics and Logical Forms of WH-Clauses*. Ph.D. dissertation. University of Massachusetts at Amherst.

Chierchia, Gennaro. 1995. "Individual-Level Predicates as Inherent Generics". *The Generic Book* ed. by Gregory Carlson and Francis Jeffry Pelletier, 176-224. Chicago & London: The University of Chicago Press.

Davidson, Donald. 1967. "The Logical Form of Action Sentences". *The Logic of Decision and Action*. ed. by N. Rescher. Pittsburgh: University of Pittsburgh Press.

von Fintel, Kai. 1994. *Restrictions on Quantifier Domains*. Ph.D. dissertation, University of Massachusetts at Amherst.

---, 1995. "A Minimal Theory of Adverbial Quantification". ms. MIT (draft March 1995).

Frege, G. 1892. "Über Sinn und Bedeutung", *Zeitschrift für Philosophie un Philosophische Kritik* 100, 25-50; trans. by Max Black as 'On Sense and Reference', in: P.Geach and M. Black (eds.), *Translations from the Philosophical Writings of Gottlob Frege,* Oxford: Blackwell, 56-78.

Gamut, L.T.F. 1991. *Logic, Language and Meaning. Volume 2: Intensional Logic and Logical Grammar*. Chicago and London: The University of Chicago Press.

Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases.* Ph.D. dissertation. University of Massachusetts at Amherst.

---, 1990. "E-type Pronouns and Donkey Anaphora." *Linguistics and Philosophy* 13. 137-177.

Hinttika, J. 1980. "Theories of Truth and Learnable Language". *Philosophy and Grammar*. 37-57. ed. by S. Kanger and S. Öhman. Dordrecht: Reidel.

Johnston, Michael. 1995. "The Role of Aspect in the Composition of Temporal Adverbial Clauses with Adverbs of Quantification". *Proceedings of the North East Linguistic Society 25*, 319-333, ed. by Jill N. Beckman.

Kamp, Hans. 1981. "A Theory of Truth and Semantic Interpretation." *Truth, Interpretation, Information*.ed. by Jeroen Groenendijk, Theo Janssen, and Martin Stokhof. Dordrecht: Foris.

Klein, Wolfgang. 1994. *Time in Language*. London: Routdlege.

Kratzer, Angelika. 1989. "An Investigation of the Lumps of Thought." *Linguistics and Philosophy* 12. 607-653.

---, 1990. "How Specific is a Fact?" *Proceedings of the 1990 Conference . 825-on Theories of Partial Information*. Center for Cognitive Science and College of Liberal Arts at the University of Texas at Austin.

---, 1991a. "Modality". *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*, 825-834.

---, 1991b. "Conditionals", *ibidem*, 651-656.

---, 1998. "More Structural Analogies Between Pronouns and Tenses". *SALT VIII*. MIT.

---, 1999. "The Expression of Causality in Natural Languages 2: Because". UMass ms.

Krifka, Manfred. 1989. "Nominal Reference and Quantification in Event Semantics" *Semantics and Contextual Expression*, 75-115, ed. by R. Bartsch, J. van Benthem and P. van Emde Boas. Dordrecht: Foris.

Lasersohn, Peter. 1990. *A Semantics for Groups and Events*. Garland Publishers, New York.

Lewis, David. 1968. "Counterpart Theory and Quantified Modal Logic." *Journal of Philosophy* 65. 113-126.

---, 1975. "Adverbs of Quantification." *Formal Semantics of Natural Language*, ed. by Edward Keenan. Cambridge: Cambridge University Press.

---, 1986. *On the Plurality of Worlds*. Oxford: Blackwell.

Ojea López, Ana I. 1994. "Adverbios y categorías funcionales en español." *Revista Española de Lingüística* 24,2. 393-416.

Parsons, Terence. 1990. *Events in the Semantics of English. A Study in Subatomic Semantics*. Cambridge, MA.: The MIT Press.

Partee, Barbara H. 1995. "Quantificational Structures and Compositionality". *Quantification in Natural Languages*, 541-603 ed. by Bach, E. et *al*. eds. Dordrecht: Kluwer.

Portner, Paul. 1992. *Situation Theory and the Semantics of Propositional Expressions*. Ph. D. dissertation, University of Massachusetts at Amherst.
Rigau, Gemma. 1995. "The Properties of the Temporal Infinitive Constructions in Catalan and Spanish". *Probus*. 279-301.
Stump, Gregory. 1985. *The Semantic Variability of Absolute Constructions*. Dordrecht: Reidel.
Vendler, Zeno. 1967. *Linguistics in Philosophy*. Ithaca, NY: Cornell University Press.