Ability, action, and causation: from pure ability to force

Anastasia Giannakidou & Eleni Staraki
University of Chicago
December 2010
{giannaki, estar}@uchicago.edu

Abstract
In this paper, we show that Greek distinguishes empirically ability as a precondition for action, and ability as initiating and sustaining force for action. In this latter case, the ability verb behaves like an action verb, and the sentence has the logical form of a causative structure φ CAUSE [BECOME ψ] (Dowty 1979). The distinction between ability as potential for action and ability as action itself has a venerable tradition that goes back to Aristotle, and is recently implied in a number of analyses (Mari and Martin 2007, 2009, Thomas on 2005).
We show first that the phenomenon is not just aspectual (pace Bhatt 1999, Hacquard 2006, 2009, Pinon 2003): actualized ability emerges with the ability verb also with imperfective aspect and present tense. They key, we argue is causation, which triggers a shift from pure ability, to ability as force (in the sense of Copley and Harley 2010, i.e. as action initiating energy). In Greek, the action reading of the ability modal comes about with a co-ordinate causative structure, where the two clauses are connected paratactically with conjunction ke ‘and’— a pattern that we find also in other languages, including English, at least with some action verbs such as try, allow. Our analysis implies a meaning of ability richer than mere possibility (pace Hacquard); and, by capitalizing on the causative meaning and the presence of force in causative structures, our analysis enables a principled explanation of the shift to action-ability without positing ambiguity for the ability verb (pace Bhatt 1999).

Keywords ⋅ Ability ⋅ action ⋅ modality, physical force, psychological force, causation, perfective imperfective, co-ordinate causative structure

1 Background: ability, action, and ‘actuality entailment’

Ability in English is expressed through verbs and expressions such as can, be able to, be capable of, etc.:

(1) a Ariadne *can* solve this problem.
   b Ariadne *is able* solve this problem.
   c Ariadne *is capable of* solving this problem.

Portner (2009: 135) characterizes the modality expressed by ability expressions *dynamic* and considers it a subcase of *volitional* modality— thereby distinguishing ability from epistemic or deontic (Portner’s *priority*) modality. Ability verbs tell us that the subject has the ability to do something, i.e., that *if the subject tried* to do what the complement sentence says, *she would succeed doing that* (see especially Thomason 2005, and references therein). The subject of the ability modal is thus agentive (see also Hackl 1998)— in contrast with the subjects of epistemic or deontic modalities. Ability itself is a disposition or precondition for action, though a mere disposition: in the sentences above, Ariadne’s ability to solve this

---

1 In other frameworks (e.g. Brennan 1993, Hacquard 2006), ability is understood as *root* modality, but we agree with Portner that the term “root” is not specific enough to characterize the diverse modals that it is supposed to group together.
problem does not entail that she does, or did solve the problem. Pure ability is thus nonveridical (Giannakidou 2001), and does not trigger actual truth of the complement clause.

The proper treatment of ability has not been an easy task. One dimension of complication has to do with the quantificational force of the ability modal. Kenny (1975, 1976) argued that ability modality cannot simply be analyzed as a possibility operator within modal logic; likewise Giannakidou 2001 and Thomason 2005 propose analyses of CAN as a universal quantifier. Thomason rejects the existential analysis as weak: “To put it roughly, Cross’ theory of the ‘can’ of ability is based on an equivalence between ‘I can’ and ‘If I tried I might’. This doesn’t seem right; ‘If I tried I would’ is a more intuitive conditional explication. This raises a fairly complex and delicate issue, one that is crucial for the logical analysis of ability.” (Thomason 2005: 7). The data that we discuss in this paper support the strong analysis of ability, as we shall see.

Another fact about ability is that it can be understood very broadly in terms of enabling factors. As Thomason puts it: “In general, ability can depend on favorable circumstances, on the presence of appropriate knowledge, and on non-epistemic properties of the agent. I can truly say I can’t write a check either because my bank balance is negative, or because I don’t know where my checkbook is, or because my hand is injured. I believe that the same sense of ‘can’ is involved in each case.” (Thomason 2005: 3). And there is also the contrast between “specific situation” (or occasional) and generic readings. “An example like I can lift that rock attributes a time-bound, circumstance-bound state to an agent. As usual with such attributions, there are corresponding, related generic sentences. An example like I can lift a 50 pound rock would be most plausibly understood as generic; it attributes a property to an agent that holds under a wide variety of times and circumstances—perhaps to all that are “normal” in some sense.” (Thomason 2005: 3). J.-H. Lee 2006 further shows that, in Korean, generic and time-bound CAN are realized by lexically distinct verbs, showing that the difference between generic ability and time-bound ability can be lexicalized in a language.

So, abilities may be generic or time-bound dispositions for action; but neither generic, nor time bound abilities imply acting on the ability, they are nonveridical, as we said. Abilities, however, can also manifest themselves through real actions. Mari and Martin (2007, 2009), relying on a distinction made by Aristotle, suggest specifically that there are two types of abilities, generic abilities (GAs) and action-dependent abilities (ADAs). Aristotle expresses this difference in the following way (On Interpretation 23a 7-13): “Possible itself is ambiguous. It is used, on the one hand, of facts and things that are actualized; it is ‘possible:’ for someone to walk, inasmuch as he actually walks, and in general we call a thing ‘possible:’, since it is now realized. On the other hand, ‘possible:’ is used of a thing that might be realized; it is possible; for someone to walk, since in certain conditions he would.” Crucially, Aristotle aims to distinguish two readings of possible, and possible: expresses an “actualized possibility” (puissance en acte, as Mari and Martin put it). “In fact, if possible: expresses an actualized possibility, on this reading, ◊p entails p, since actualizing an ability involves performing an action” (Mari and Martin 2009: 9).

This actualized ability, as one may think of it, has been studied recently in a number of works under the label “actuality entailment” (Bhatt 1999). This entailment has been assumed, since Bhatt, to be due to the perfective aspect and past tense on the modal verb. We give below two examples from Greek, which, unlike English, has a perfective-imperfective distinction in the past (as well as in present; see Giannakidou 2009 for details):

(2) John was able to escape.

(3) a. O Janis borese na apodrasi. # but he did not
b. The John can.perf.past.3sg subj escape.perf.nonpast.3sg
John was able to, and he did escape (#but he did not)
b. O Janis boruse na apodrasi. (but he did not).

The John can.impf.past.3sg SUBJ.C escape.perf.nonpast.3sg

John {could/was able to} escape (but he did not).

The sentence (3a), with past and perfective aspect borese, entails that John escaped, but this entailment is lacking in the version 3b with imperfective aspect. This is a statement of pure ability, and is nonveridical, since it does not imply $p$. The statement in 3b implies that John engaged actually in a series of actions the result of which was the fact that he escaped. This fact is the ‘actuality entailment’ that renders 3b veridical: John did escape.

Bhatt and others (Hacquard 2006, 2009, Pinon 2003) argue that the veridicality entailment with ability is an aspectual phenomenon. In this paper, however, we present novel data from the Greek ability verb boro ‘can’ that challenge the aspectual analysis, and suggest the relevance of causation in allowing ability to initiate action that bring about a result. We show that when boro appears in a paratactic causative structure, headed by conjunction ke ‘and’, it triggers the veridical inference regardless of tense and aspect, i.e. with both present and past, perfective and imperfective. This causative co-ordination frame is found not only Greek, but also in English with some action verbs like try, allow, and implicatives. We propose that the bi-clausal structure of actualized ability reflects a logical form $\phi$ CAUSE $[become \psi]$ (Dowty 1979). We argue that this configuration, and because CAUSE is a relation between events, imposes an eventive meaning on the verb boro— ability thus becomes, from pure energy, energy as force in the sense of Copley and Harley 2010, i.e. an input of energy into some initial situation, which eventually will lead to the result $\psi$-state.

The discussion proceeds as follows. In section 2, we discuss the aspectual approaches to the actuality entailment, and then in section 3, we show them to be challenged in Greek—since the actuality entailment arises with present and past, perfective and imperfective in the unambiguous causative frame. We also show that the actuality effect arises only with the ability modal in Greek, and never with the necessity modal (unlike French, as claimed by Hacquard; but see Mari and Martin’s for reservations about these data). This is further confirmation that the actuality effect has to do with ability, and it is not due to general modality and aspect interaction, as predicted by Hacquard. In section 4 we discuss abilities in the causative co-ordinate syntactic frame, and offer an analysis of these as action sentences that involve causation and force. Our analysis of actualized ability as relying on causation and force carries over to implicative verbs too, which also appear in the co-ordinate causative frame. This way we explain why the action-result effect is found with both abilities and implicatives, without saying that the ability verb boro is ambiguous— contrary to Bhatt 1999, though we certainly appreciate, and capture his intuition. Implicatives and ability initiated actions are not the same; but what they do have in common is causation.

2 Aspectual analyses of actuality entailment and problems with them

Bhatt 1999, as we said earlier, suggested that the difference between modal and actuality ABLE must be described as a lexical effect brought about by perfective aspect. Actualized ability has the logical structure PERF (able $p$), whereas pure ability is GEN(able $p$). PERF (able $p$) lexicalizes as an implicative verb (in the sense of Kartunnen 1971), e.g. like manage. A parallel between action ability and implicative verbs certainly seems to be supported—apart from the fact that they both allow the veridical inference to the truth of $p$, also by an additional inference effort: in our earlier example John was able to escape, it took some (considerable) effort from John to escape, and the same is true of implicative verbs:
(4) The Ariadne managed.3sg/could.perf.3sg subj fix.3sg the car
Ariadne {managed to/was able to} fix the car.

(5) Karttunen’s 1971
Manage p entails p, and presupposes that it took (some or considerable) effort to do p.

This inference of effort is systematically present with the implicative class: verbs like get, remember, allow etc. have it. Effort seems to be a presupposition (a conventional implicature in Karttunnen), as it preserved under negation:

(6) a. John {didn’t manage/wasn’t able} to fix the car. Still allows:
b. John made an effort to fix the car.

At the same time, though, we see that the inference that p is true does not hold under negation:

(7) a. John {didn’t manage/wasn’t able to} to fix the car. Do not entail:
b. John fixed the car.

Hence, both implicative and actualized abilities assert the result (that p), while both presupposing a certain noteworthy degree of effort to get to that result.

As we see, effort is observed also with actualized ability. Notice that even if we don’t have a verb meaning e.g. like escape or fixing the car (which admittedly implies planning and effort), the effort presupposition will be accommodated:

(8) The John can.perf.past 3sg SUBJ.C stand-up.perf.nonpast.3sg
John was able to stand up—it was a difficult thing!

Stand up is normally easy—but with borese we need a context in which it is difficult to stand up, i.e. John was sick or John is a 4 months infant. So, as regards both reaching the result and effort, actualized ability and implicative verbs are similar. Bhatt 1999 argues that the ability modal in the perfective past is an implicative verb, whereas the pure ability has the structure GEN(able). For him then, perfective aspect is the key in creating a new lexical meaning.

Hacquard 2006, 2009 and Pinon 2003, on the other hand, argue that there is no lexical effect of aspect, and that the actuality effect is simply a case of aspect scoping over the modal verb. In Pinon’s words: “the ‘descriptive content’ of both readings [actualized and non-actualized ability; note ours] is kept constant but a difference is postulated between them in terms of the relative scope of operators” (Pinon 2003: 392). More specifically, “[w]ith ability able, tense takes scope over modality, but with opportunity [i.e., implicative] able, modality takes scope over tense”. Hacquard presents a similar analysis: When perfective aspect scopes over the modal, we have actualized ability, when the modal scopes over perfective we have pure ability. We illustrate here the former:

(9) Hacquard 2009: Aspect scoping over modal: ‘implicative meaning’
a. Jane a pu courir.

Jane was able to run

b. [TP past [Asp perf [ModP can [VP Jane run]]]]

10) (10)

\[
\text{can}_{\text{circ}}^{w,B\leq c} = \lambda w'. \exists w' \text{ compatible with circumstances in } w \text{ such that } P(w')(e)
\]

11) (11)

Modal combined with an intensional predicate via IFA

\[
[\text{can}_{\text{circ}}]^{w,B\leq_c} = [\text{can}]^{w,B\leq_c} (\lambda w'. [\text{run}]^{w',B\leq c})
\]

(12) (12)

Actuality entailment by Hacquard (2009):

\[
[18]^{w,B\leq_c} \text{ is true iff } \exists e \in w \land \tau(e) \subseteq \{t < t^*\} \land \exists w' \text{ compatible with circumstances in } w \text{ s.t. run}(e,J,w')
\]

‘There is an event in the actual world located in a past interval, and there is a world compatible with the circumstances in the actual world where that event is a run by Jane’

In this approach then, as well as in Bhatt’s, actualized ability depends crucially on perfective aspect. There is nothing special about ability; as we see, the ability verb is just an existential circumstantial modal. Since there is nothing special about ability, Hacquard claims that an advantage of her theory is that actuality also arises also with necessity and deontic modals in French if they appear in the perfective:

14) (14)

a. Jane a dû prendre le train pour aller à Londres, #mais elle a pris l’avion.

Jane must-past-pfv take the train to go to London, #but she took the plane

b. Jane devait prendre le train pour aller à Londres, mais elle a pris l’avion.

Jane must-past-impf take the train to go to London, but she took the plane

15) (15)

a. Lydia a pu aller chez sa tante (selon les ordres de son père), #mais n’y est pas allée.

Lydia can-past-pfv go to her aunt (according to her father’s orders), #but didn’t go

b. Lydia pouvait aller chez sa tante (selon les ordres de son père), mais n’y est pas allée

Lydia can-past-impf go to her aunt (according to her father’s orders), but didn’t go.
Lydia could go to her aunt (according to her father’s orders), but she didn’t go.

Mari & Martin (2007, 2009), however, make a couple of empirical points of criticism that are very important. First, they caution that the actualized reading does not arise in perfective sentences on the epistemic and deontic readings, i.e. they question the judgments above. Second, Mari & Martin argue that, at least in French, the actualization with perfective can be cancelled in two cases. First, when the context provides elements making clear that the circumstances (or the ability, the opportunity to reach the goal) are temporally bounded, i.e. with durative adverbs:

(16) La carte a permis pendant dix minutes seulement d’entrer dans la bibliothèque. OK Mais stupidement je n’en ai pas profité.
The card permitted.PERF for ten minutes only to enter the library. OK. But stupidly, I didn’t enjoy the opportunity.

Second, the action meaning can be cancelled when the infinitival complement contains a stative predicate:

(17) T’as pu.PERF avoir un repas gratuit, et tu ne t’es même pas levé !
You could have a meal for free, and you even didn’t get up !

The same is true in Greek:

(18) I karta mu epetrepse ja misi ora na bo sto internet dorean, ala ego i xazi den ekmetaleftika tin efkeria.
The card allowed me to get internet access for half an hour, but I, stupidly, didn’t take advantage of the opportunity.

These data suggest that the correlation perfective aspect and actualized ability is not perfect. We can have perfective CAN, as above in Greek and French, with no actuality entailment. In Hacquard’s analysis it is unclear how to exclude that; and we see next more data from Greek showing that the correlation between perfective aspect and actuality is imperfect and in fact misleading. Just as a prequel notice that the version of (18) with co-ordination ke ‘and’ instead of subjunctive na does force the actuality reading:

(18’) I karta mu {epetrepse/epetrepe} ja misi ora ke bika sto internet dorean the card my alled.perf./allowed.imperf, for half hour and got-in to internet free (#ala ego i xazi den ekmetaleftika tin efkeria)
The card allowed me and I got internet access for half an hour (#but I, stupidly, didn’t take advantage of the opportunity).

We see here that there is no effect of aspect if we use a co-ordinate structure: both perfective and imperfective only license the actuality reading, and that’s because the structure is causative and asserts the result, we will argue. The actuality of CAN, crucially, depends on, the causation, and not on aspect.

Before we proceed with the Greek data, it is important to note a few more points of concern for the aspect-modal scope analysis. Crucially, Hacqard’s approach fails to derive the effort inference. The meaning of CAN is that of a regular existential circumstantial modal, so it is difficult to see how to built in the presupposition of effort. Recall also what we said at the beginning, namely that even in pure ability a component of action is needed, and a stronger
modal force than mere existential circumstantial seems more appropriate (Kenny 1975, Thomason 2005, Giannakidou 2001). Another conceptual point is that some non-standard assumptions about the arguments of modals must be made by Hacquard, for which there is no independent motivation (Mari and Martin 2007, 2009).

With these in mind, let’s move on now to examine in more detail the Greek data.

3 The syntax of actualized ability in Greek: causative co-ordinations

In this section we present data that show that the actuality reading of ability is best understood as depending on causation rather than aspect. We show first that actuality arises in a particular syntactic frame in Greek, one that involves co-ordination. We saw already (in 18’) that in this frame, perfective as well as imperfective aspect gives rise to actuality, and we will see more data to this effect in the present section. The co-ordination is causative, and is observed also with implicative verbs, in Greek as well as (but perhaps more marginally) in English. We show that in this frame, ability is forced into an action reading, and we analyze this as the effect of causation in section 4.

First, some background on Greek modals.

3.1 Background on Greek modals

Greek has three modal verbs: prepi, bori and boro. All three are nonveridical and take subjunctive na complements (Giannakidou 1998, 1999, 2009). The latter two, bori and boro, are impersonal (3rd person singular) and personal variants of the same verb. As we see below, the impersonal bori is an epistemic possibility, whereas the personal is abilitative or deontic, never epistemic. The modal verb prepi is a necessity modal, epistemic or deontic, and is always impersonal:

   The children must.3pl.INP SUBJ be.3pl.INP to-the home 
   Children must be at home

b. Ta pedia prepi na ine sto spiti. 
   The children must.3pl.INP SUBJ be.3pl.INP to-the home 
   Epistemic necessity: As far as I know, the children must be at home 
   Deontic necessity: The laws dictate that it is necessary that children be at home

(20) a. Ta pedia bori na ine sto spiti 
   The children might.3sg.INP SUBJ be.3pl.INP to-the home 
   Epistemic possibility: As far as I know, it is possible that children are at home

d. Ta pedia boru na pane sto spiti mona tus. 
   The children can.3pl.INP SUBJ be.3pl.INP to-the home alone them 
   Ability: Children are able to go home on their own. 
   Deontic: The children are allowed to go home by themselves.

2 Greek also has a polarity modal xriazete “need”, which appears in the 3rd person singular impersonal form as a negative polarity item (Giannakidou 1997). Such polarity modals are common, e.g. German brauchen, Dutch hoeven (van der Wouden 1994), etc. The crucial thing that Giannakidou notes for xriazete is that it is an polarity sensitive only in its impersonal variant; as a personal verb, xriazome means need as in Ta pedhia xriazonde lefta “The kids need money”. This, in conjunction with what is said next in the text, suggests that Greek exploits the personal, impersonal distinction as a generalized quasi-lexical means for differentiation in the modality domain.
Notice that, as expected, in none of these cases do we get the entailment that the na-complement is true, since the modal verbs are, as we said, nonveridical. At the same time, it is important to note the flexibility of the necessity modal prepi with respect to the modality (epistemic or deontic), and the rigidity of the impersonal bori as an exclusive epistemic modal. The personal version, on the other hand, boro, unlike English could, French a pu, and Italian ha potuto (Mari 2010) never receives epistemic readings, not even with statives. Notice the contrasts below:

(21) Jean a pu être malade et c’est pour cette raison qu’il n’est pas venu à la fête.
‘John might have been sick and for this reason he did not come to the party’

(22) a  # O Janis borouze/borese na itan arostos, ji’ afto den irthe sto parti.
  The Janis could.imperf.3sg/ could.perf.3sg na be.past sick
  ( Epistemic: John could be sick, that’s why he didn’t come to the party.)

b  # Ta pedia borousan/boresan na itan arosta, ji’ afto den irthan sto parti.
  The kids could.imperf/ could.perf na be.past.3pl sick
  The kids could sick, that’s why they didn’t come to the party.

Both perfective and imperefective variants of boro are odd in the ability reading; as we see, the impersonal bori is the only possibility for epistemic reading:

(23) a  O Janis bori na itan arostos, ji’ afto den irthe sto parti.
  The John could.imperf na be.past sick, that’s why not came.3pl to-the party
  Epistemic possibility: It is possible that John was sick

b  Ta pedia bori na itan arosta, ji’ afto den irthan sto parti.
  The John could.imperf.3sg/ could.perf na be.past.3pl sick
  Epistemic possibility: It is possible that children were sick

We can then safely assume a lexical split in Greek between the impersonal bori— an epistemic possibility modal form, something like might in English—and personal boro which is never epistemic, but abilitative or deontic. Because prepi and bori are both invariant forms, it is plausible to think of them as higher sentential modals (or even adverbials, as suggested e.g. in Giannakidou 2009). Their behavior and form are at any rate consistent with the literature on the epistemic modals which claims them to be high, sentential operators (for a review see Portner 2009).

3.2 No generalized pattern: actualization only with ability

According to Hacquard (2007, 2009) the ability phenomenon is aspectual, and there is a general pattern in which actuality entailments can be found with necessity and deontic modals too. Greek challenges this claim. For example, the prepi (∀- modal) below does not produce the actuality entailment in Greek:

(24) a. O Janis prepi na milisi ( but he will not)
  The John must.impf.nonpast SUBJ.C speak.perf.nonpast.3sg
  John has to talk (but he will not).

b. O Janis eprepe na milisi (but he did not)
  The John must.impf.past SUBJ.C speak.perf.nonpast.3sg
  John had to talk (but he did not)
We see here that the necessity modal, in both present (*prepi*) and past (*eprepe*) does not entail truth of its complement. Thus, we observe that in Greek the actuality entailment is limited to the ability modal *boro*.

### 3.3 Generalized actualization in the causative frame

Now notice the example below. This example has the actualized ability reading, only instead of the expected subjunctive complement (*na*) we have what appears to be co-ordination with *ke* ‘and’, as indicated also in the translation:

(25) I Maria *borese* ke eftiakse to aftokinito.
    Maria could.perf.3sg and fixed the car

We already saw an example like this earlier—(18’). The use of *ke* is crucial in deriving actualization, and the structure, is also observed with implicative verbs, and verbs of trying:

(26) O Janis *katafere* ke ipje 10 bires.
    The John managed.perfective and drunk ten beers

(27) O Janis *prospathise* ke pire to epidoma.
    The John tried.perf and took the bonus

(27) O jatros mas *epetrepse* ke idame ton astheni.
    The doctor us allowed.perf and saw the patient

Notice that the co-ordinate structure is also available in English, at least with the verbs *try* and *allow*, as we see, so it is not just a quirk of Greek. (Léa Nash informs us that it is also observed in Georgian). Importantly, it is something about these action verbs that enables it; a factive, an epistemic or an assertive verb is not compatible with it:

(28) a * O Janis pistepse ke i ji ine epipedi.
    John believed that the earth is flat

b * O Janis ipe ke i ji ine epipedi.
    John said that the earth is flat

c * O Janis xarike ke i Maria ton agapai.
    John was glad that Mary loves him.

If the co-ordinate frame is an action, causative frame, as we suggest, then the incompatibility with the assertive, factive and epistemic verbs is no surprise: believing, saying, or being glad that *p*, cannot be the *cause* of *p*.

Negation and its interaction with the paratactic frame offers one more argument in favor of idea that we are dealing with a causative structure. The frame cannot be negated:

(29) * O Janis *dhen katafere* ke ipje 10 bires.
    The John not managed.perfective and drank ten beers

John did not manage to drink ten beers.
The John not tried, perf and took the bonus. John did not try to get the bonus. =John made efforts and got the bonus.

Because we have co-ordination, for the sentence to be true it must be the case that both conjuncts are true. Since the second conjunct asserts the result, if you negate the first one, you destroy the causation relation. What kind of causer would a negative event be?

Now notice that once we use the causative frame, we get the actualization entailment not just with past tense and perfective aspect (as in the examples above), but all over the place, e.g. also with imperfective and present. Recall (18’), and consider here first the imperfective.

It is true that every night, in the relevant past period, John was able and he, in fact, he did drink ten beers:

Now consider the present:

Here John is able, and he in fact drinks, ten beers every night (in the relevant present interval). So, once we use the coordination frame, actuality entailments arise with imperfective and present. Thus it is simply false to say that perfective and past tense are the decisive factors for the actuality entailment reading in Greek. The past perfective does facilitate actualization—though not always, as we saw in (18’)— but this, we believe, is epiphenomenal. The true nature of the phenomenon is revealed in the co-ordinate structure, which otherwise indeed may seem peculiar.

3.4 Paratactic frame: ability modals, action verbs, and meaning shifts

We now want to show that the co-ordinate frame allows the veridical inference (that the result \( p \) is true) with the other verbs of action that we observed earlier such as try and allow—even in the present, and even with imperfective aspect:
The doctor allows us to visit the patient, and we do. The doctor used to allow us to visit the patient, and we did.

John tries to have an apple per day, and he does. John tried to have an apple per day, and he did. (= John made sure to eat one apple a day).

One way to interpret this is to say that in the co-ordination frame the veridicality of the verb is affected, so a new verb meaning is created: e.g. veridical allow would be “permission granted, and agent acted on that permission”; veridical try would shift to something like “make sure”. Such meaning shifts are well-known with mood and complement choice, sometimes also with negation, in Greek, Romance and Balkan languages (see Giannakidou 1998, 2009, 2010; for Romance Giorgi and Pianesi 1997, Quer 1998, 2001, Laca 2010; for Balkan languages Siegel 1999). To see the point, consider the example below:

John refused to go. John denied that he went. We see here the same verb arnithike to translate in English as ‘refuse’ when selecting a subjunctive complement, and ‘deny’ when selecting an indicative oti complement. In other words, a lexical choice in English between refuse to deny becomes visible in Greek through choice of the verb the verb will take. Here is another example:

John says that they left early.
The John says that-SUBJ leave.3pl early
John {wants/is planning} them to leave early.

Lei oti is an assertive verb in the a example, but lei na loses its assertive meaning, and acquires a volitional meaning. Again, these might be explained in terms of lexical ambiguity. However, we believe it is more profitable to envision these systematic correlations between verb meaning and syntactic complement as interactions where the syntax affects the meaning of a verb by bringing about components in the verb meaning that were there already—but which, without the syntactic trigger, would remain invisible. The hypothesis we develop for the verb boro in this paper will be guided by this idea: the causality of the syntactic coordination frame affects the interpretation of ability. By asserting the result of an action (in the and-clause), causality forces an eventive meaning of the ability; but in order to be able to do this, ability must contain an eventive, action component—so the purely circumstantial modal analysis (e.g. Hacquard’s version of it) is not sufficient to capture the change.

We are ready now to focus on the semantics of the ke-frame, for which we assume the following syntactic structure:

(45) I Ariadne borese ke eftiakse to aftokinito.
Ariadne can.perf.past.3sg and fixed.perfective.3sg the car
Ariadne tried [to fix the car], and she did fix the car.

(46) [I Ariadne borese [e: fix the car]] and [Ariadne fixed the car]

So, we have a bi-sentential structure, with a null complement in the ability clause corresponding syntactically to the TP of the and-sentence. This syntax, we argue, translates directly into a causative logical form in the sense of Dowty 1979: [φ CAUSE [become ψ]], thereby forcing realization of the action component of the ability. In other words, the coordination structures provide syntactic evidence for the bi-clausality of causation the way Dowty envisioned it all along.

4 Syntax and semantics: ability, action, causation, and force

We start with describing the pure ability meaning of the verb boro in Greek (section 4.1). We will rely on the strong analysis of ability as a universal quantifier and as precondition for action (Giannakidou 2001, Thomason 2005). In section 4.2, we show what it means to be an actualized ability. First, we propose that actualized ability sentences involve a biclausal structure [φ CAUSE [become ψ]] (Dowty 1979). In Greek, as we just saw, the become ψ clause is given as a conjunct, hence we have clear evidence that here we are dealing with two clauses. Then we argue that in this configuration, the verb boro shifts from pure ability—as a precondition for action—, to ability-as-force in the sense of Copley and Harley, i.e. as input of energy; in other words, in the causative frame ability initiates action, and because of causation, the second conjunct will be the result.

4.1 Ability as potential for action

As we mentioned at the beginning, it has been common to admit that the semantics of mere possibility is too weak for ability verbs (see Portner’s 2009 recent discussion and references therein; Chierchia and McConnell-Ginet 1992: 238 also claim that the analysis of can as a
possibility modal is “certainly not right”). The problem with mere possibility is that it conceptualizes ability as occasional, i.e. it makes \( \text{Can } x \varphi \) true in case there is some (and possibly random) outcome associated with a manifestation of \( x \)’s ability (see Thomason 2005, Kenny 1975, 1976, and Mari and Martin 2009, Mari 2010 on this point). But intuitively \( \text{Can } x \varphi \) has to do with what must happen if \( x \)’s ability materializes in action. The basis of our discussion, then, is that ability is a potential for action, and the mere possibility circumstantial modal analysis simply cannot capture this.

Giannakidou 2001 proposes an analysis of the ability CAN as a universal modal. The reasoning is justified as follows. “In an example like John can swim, for each world \( w \) we consider, John will have the ability to swim in that world. Though this definition seems to work fine in worlds where John knows indeed how to swim (and he knows that he knows that), due to training or natural talent, in worlds where John didn’t learn how to swim, or hasn’t discovered his natural talent yet, \( p \) is clearly not true. […] What we need to do is restrict the set of worlds so that it includes only those worlds in which people have abilities to do things (because of proper training, natural talents, or whatever other reason), and where people are aware of these abilities. Let us call these worlds the ability-modal base, and let’s think of it as a function from \( w \) to worlds \( w' \), at least as normal as \( w \), compatible with what an agent \( x \) is capable of doing at \( w \) (cf. the parallel to the epistemic models):”

\[
(131) \quad K_{\text{ability}}(x)(w) = \{w' : \forall p [x \text{ is capable of } p(w) \rightarrow p(w')]\} \quad \text{(Giannakidou 2001: 702)}.
\]

This passage in effect tells us that the ability worlds are worlds in which an agent has tried and therefore knows that he has the ability to do \( p \). Notice that the modal base is defined in a world with respect to an agent \( x \), not just abstractly in a world—so the ability modal differs from the epistemic or deontic ones in that it (and its modal base) is agent dependent. In Greek, the relevance of the agent is suggested clearly by the fact that the ability modal is a personal verb, contrary to epistemic \( \text{bori} \) which has impersonal syntax.

So ability is defined via an action component, since only worlds where the ability has been acted upon will be included in the modal base. \( \text{Boro} \), in this set up, is defined as follows:

\[
(47) \quad \text{Boro } p \text{ is true in a world } w \text{ with respect to an ability modal base } K_{\text{ability}}(x)(w) \text{ and an ordering source } <_w \text{ ("be at least as normal as")} \text{ iff:}
\]

For all worlds \( w' \) in \( K_{\text{ability}}(x) \), there is a world \( w'' \) in \( K_{\text{ability}}(x) \) such that \( w'' <_w w' \), and for every other world \( w''' <_w w'' \) in \( K_{\text{ability}}(x) \), \( p \) is true in \( w''' \).

\[\text{(ABILITY CAN; Giannakidou 2001: (132))}\]

Recall also Mari and Martin’s category of ‘action-dependent ability’. Thomason 2005 pushes the view of ability as potential for action even further: \( \text{Can } x \varphi \) is equivalent to a conditional ‘If \( x \) tries to bring about \( \varphi \), then \( \varphi \)’. Thomason tries to formalize ability “in a way that could be carried out in most formalisms for reasoning about action and change” (Thomason 2005: 12). He uses a Situation Calculus, with a many-sorted first-order logic, and offers the following analysis of CAN. We rely here on Thomason’s discussion in sections 9 and 10.

Thomason’s Situation Calculus has actions, fluents (or states), situations, and individuals. There is also a function \( r \) from actions and situations to situations such that \( r(A,s) = s' \) means that \( s' \) is the situation that results from performing \( A \) in \( s \). (The existence of \( r \) presupposes a deterministic sort of change, at least as far as action-induced change goes.) The formal language contains a function letter Result denoting the function \( r \).

In this set up, Thomason proceeds to “revise the causal axiom of the classical Situation Calculus for a constant \( A \) denoting an action as follows: we are interested in the results of
trying to do an action, rather than the results of doing the action itself.” Planning knowledge is indexed to actions, in the form of causal axioms linking conventional effects and preconditions with actions. The causal axiom for an action \( A \) denoted by \( A \) is the following:

\[
\forall x \ [\text{Pre}(A, x) \rightarrow \text{Post}(\text{Result}(A, x))].
\]

(Thomason 2005: 9.1)

Here, \( \text{Pre} \) is the precondition for action \( A \) and \( \text{Post} \) is the postcondition (or effect) of \( A \). Often, a causal axiom of this form is read: “If \( A \) is done and \( \text{Pre}(A,s) \) is true, then \( \text{Post}(A,\text{Result}(A,s)) \) is true.” This provides a satisfactory basis for reasoning with actions and plans as long as one is only interested in the successful performance of actions. But it is counterintuitive in more cases where it may be important to reason about unsuccessful “performances”—i.e., about attempts to perform an action which may fail. This is exactly the sort of reasoning in which “trying” is invoked in informal, common sense reasoning.

Ability is added in the system in the following way:

\[
\forall x \ [\text{Can}(A, x) \rightarrow \text{POST}(\text{Result}(\text{try}(A, s), x))]
\]

(Thomason 2005: 10.2)

Such axioms correspond to paraphrases like:

(50) If I can open the door, then after I try to open the door the door will be open.

(Thomason 10.3)

\( \text{Can} \) can now be characterized in terms of preconditions and constraints on the action denoted by \( A \). For instance, suppose that \( A \) denotes an action \( A \) of \( s \)-order 0, where \( s \) denotes \( s \). Then the success conditions for \( A \), i.e. the conditions under which trying to perform \( A \) (in this case simply performing \( A \)) will achieve the effects conventionally associated with \( A \) are simply the preconditions of \( A \). Here, the definition of \( \text{Can}(A,s) \) is simply this, where \( A \) denotes a 0-order action.

\[
\text{Can}(A, s) \text{ amounts to } \text{Pre}(A, s)
\]

(Thomason 2005: 10.4)

Now, trying to perform an action may lead us to try to perform other actions—for instance, trying to open a door may involve trying to turn the doorknob. Suppose, then, that \( A0 \) is a 1-order action. For instance, \( A0 \) could be opening the door, and \( \text{try}(A,s) \) (i.e., \( As1 \)) could be turning the doorknob and then pushing the door.

The general reduction of \( \text{Can} \), then, for a constant \( A^*_0 \) denoting an \( n \)-order act, is this.

\[
\text{Can}(A^*_0, s) \text{ amounts to } \text{Pre}(A^*_0, s) \land \ldots \land \text{Pre}(A^*_n, s).
\]

(10.5)

In this analysis, to say that an agent can perform an action provides a condition that ensures the successful performance of the action; and according to Thomason, the advantage of the Situation Calculus is that it provides a method of representing knowledge about actions from which we can recover explicit conditions of success. From this discussion, then, we retain the idea that ability to perform an action is a precondition for the successful outcome of the action being done, and we proceed now to show that the \( ke- \) clause in Greek adds the

---

3 Thomason also notes that: “Nothing, of course, guarantees that these conditions should be anything that the agent can control—in formalizing actions that depend on an element of luck, we may have to resort to unknowable “hidden variables.” But in the cases where classical planning algorithms are appropriate, we can recover useful conditions.” (Thomason 2005: 15).
successful outcome. This yields the so-called actuality entailment—which, in this system, is simply the assertion of success.

4.2 Ability as force and role of causation

Now, recall the basic facts: first, the subject of actualized ability is always agentive:

(52) # To nero borese ke jemise to ipogio. (agentive)
# The water {was able to/ managed to/was allowed} fill the basement

Something inanimate like water is incompatible with the causative frame. Notice that the same is true for implicative verbs like manage, allow.

Second, as we noted, the ke-structures are bi-clausal causatives in the sense of Dowty, with the logical form [φ CAUSE [BECOME ψ]]: an agent x is trying to do a set of actions that cause the result ψ (described by the second conjunct). A first approximation of the action meaning of ability, inspired by Dowty, can thus be as follows:

(53) Action-CAN (first approximation)
[[x action-CAN ψ]] = TRY (α₁, [DO (α₁, πₙ1(α₁, ..., αₙ))]) CAUSE ψ, where ψ may be any non-stative sentence; where α is a term, and π stand for arbitrary n-place predicate. (Dowty’s Intentional Agentive Accomplishments (1979: 125, 4)).

(For the complement of TRY being always clausal, see Larson et al. 1997.). Now consider an example:

(54) I Ariadne borese ke eftiakse to aftokinito. Ariadne can.perf.past.3sg and fix.PNP3sg the car
Ariadne tried [to fix the car], and she did fix the car.

(55) [[Ariadne had the ability to perform actions to the effect of fixing the car] CAUSE [[BECOME [car fixed]]]

(56) [I Ariadne borese [e: fix the car]] and [Ariadne fixed the car]

As we see, TRY (α₁, [DO (α₁, πₙ1(α₁, ..., αₙ))]) in the first conjunct in italics above, contains the ability to perform actions that will result in ψ (where ψ is fix the car). As we suggested in section 3 and we repeat above, the LF in the first conjunct contains a null complement identical to the TP of the and-clause. The first conjunct, with the ability word and the null complement, is the φ clause and the second one is the ψ clause of the CAUSE relation. Causation must be understood as in Lewis 1973:

(57) Lewis 1973 on causation:
An event A causes an event B iff:
(i) When A happens, B happens, and
(ii) If A were not to happen, B wouldn’t happen

Causation is a relation between two events, such that event A happening is a precondition for event B happening. Now, our clause φ contains an ability verb, and recall that Thomason’s ability is a precondition for the successful outcome car fixed. But a precondition is not an action itself. Clearly, on the other hand, in the causative frame we want to say that ability initiates action. And not just that: we want to say that ability initiates and sustains action
through the successful end result.

The causal relation between the two conjuncts forces an event reading of the ability, and we need to enrich the meaning of CAN with a component that will produce this action initiating ability. Dowty’s inertia worlds won’t do the job (for various reasons, see Copley and Harley 2010, Grinsell 2010 for an overview); but Copley and Harley (C&H) 2010 provide the notion of force, which is, we believe, what we need:

(58) “A force is an input of energy into some initial situation. This energy is either generated by an animate entity, or it comes from the motion or properties of an inanimate object. The application of this energy changes the initial situation into a different situation, as long as no stronger force keeps it from doing so…. A force’s observed final situation is thus contingent on the existence and strength of other forces opposing it.” Copley and Harley 2010 (section 3).k

In C&H’s framework, an event is to be understood as force that brings about a result (provided that nothing external intervenes). Forces are, in the most obvious case, physical forces, i.e. contact forces that result in change in the spatiotemporal properties of the object (i.e. in movement or rest, etc). Forces, in this physical sense, can also be understood as ‘tendencies’ (in the sense of Aristotle, e.g. in Physics), or gravitational forces, and they arise, according to C&H in the ‘normal field’ of a given topic situation. The innovation in C&H is the idea that psychological forces, i.e. desires, intentions, and, we will suggest, ability, can also function as physical forces in bringing about change. Surely, though, psychological forces are not ontologically identical to physical forces: intentions and desires involve an agent’s beliefs and thoughts, and are not physical themselves.

In order to bridge the gap between action initiation force and psychological force, C&H propose the following Law of Rational Action:

(59) Law of Rational Action (Copley 2010: (16))

If a volitional entity intends something in a situation s, and is not prevented by anything form acting in such a way (according to his/her beliefs) as to achieve it, the being acts (exerts a force on s) in such a way (according to his/her beliefs) to achieve it.

This law is itself a tendency of volitional entities, “so when it is saturated with an entity and a situation, it is a force. This is why we say it is included in the normal field.” (Copley 2010: 7). It is important to understand what the law of rational action motivates. It says that whenever there is a volitional agent and the agent intents an action, this intention, if nothing else prevents it, will become force. In this general sense, the law is admittedly too strong—since in the normal case, it just doesn’t follow from x wanting or intending something that x will act upon her desire. Desires are, in other words, nonveridical (Giannakidou 1998, 1999; see also Heim 1992, Laca 2010, Yoon 2010), and we have good reasons to keep this characterization (i.e. it accounts for presupposition projection, mood choice, negative polarity items, and triggering of expletive negation, among other things). And conceptually, it is simply true that one may never act on a desire even if there are no forces preventing action. Abilities, as we said, are also nonveridical, since just having the ability doesn’t imply acting on it either. So, it can’t be the case that the law of rational action holds as a general law. Psychological forces generally do not become (or, initiate) forces in the physical sense: there is a difference between the potential (nonveridical) and the actual (veridical) force that needs to be retained.
However, and this is the idea we will pursue, the law of rational action can be
triggered in certain structures because of properties of the structure. In the case of ability, the
causative frame is veridical: it asserts that a result (the second conjunct) holds. This affects
significantly how ability is going to function. We argue that the causative frame triggers the
law of rational action, thereby triggering a transition of ability from pure energy (a
psychological force) to physical force, i.e. applied energy. Ability then, in the causative
frame, and because of the law of rational action being triggered by causality, enables an agent
to perform a series of actions that will bring about the result asserted by the second conjunct.

Application of the force causes change, and the measure of change will depend also
on opposing forces, as stated in (58). We see then instantly that ability as force captures not
just application of energy in initiating action, but also the difficulty component that we
mentioned at the beginning. If ability in the causative frame is force, as we argue, and if
force’s final result partly depends also on opposing forces, then difficulty simply follows.
Hence, we can use difficulty as a diagnostics for the existence of force, and we find it with
various actions verbs, as we noted earlier, in the causative frame.

We will now implement our analysis of ability as force building on C&H 2010. First,
a summary of the ontology and basic types:

(60) Copley and Harley’s 2010 ontology
   a. Eventive vPs are predicates of forces (type <f,t>, that is, type <<s,s>,t>, since type
      f is shorthand for type <s,s>); they will be represented by lowercase Greek letters
      π, ρ..
   b. Predicates of situations, also called propositions, are type <s,t> and are represented
      by lowercase Roman letters p, q, ....
   c. Stative predicates are also type <s,t>.
   d. Situations are given by the variables s, s', s'', ....
   e. We refer to situations in a causal chain both with respect to the forces in that chain
      (i.e., a situation can be referred to as init(f) or fin(f)), as well as with respect to
      other situations in the causal chain; i.e., if s is a situation, s_i is its (ceteris paribus)
      successor, and s_{i-1} is its predecessor.
   f. The net force of a situation is net(s), and all situations are assumed to have a net
      force.

As an example, consider the progressive: it takes a predicate of forces (π, the denotation of
the vP), and a situation (s, the topic situation provided by tense), and says that the property "π
holds of the net force of s''.

(61) [progressive] = λπ. λs_{0} . π(net(s_{0}))

So, for example, if Mary is baking a cake, the net force of the current situation is one which
leads to a situation in which a cake has been baked by Mary, if all else is equal.

Our idea is that ability is the psychological force triggering the initial action init(f)
and is maintained through all intermediate stages leading to the final result fin(f). This
captures the fact that the ability is a precondition for all actions (Thomason’s 10.5) that will
bring about the desired outcome. Since causation triggers the law of rational action, ability
will force actions to the effect that ψ. At this point, the notion of necessary means (Baglini
2010) is useful. Baglini implements 'necessary means’ in her analysis of causative get—as in
Ariadne got the car fixed:

(62) Causative get
      (Baglini 2010)
a. $\psi$ is property of eventualities.

b. **Necessary means:**

An action $\alpha$ is a necessary means ($<$) to $\psi$ in $w$ if the following hold:

1. There is a path $\beta$ such that
   a. the first state of $\beta$ is $w$;
   b. the last state of $\beta$ is a $\psi$-state;
   c. $\beta$ does $\alpha$ along the way.
2. Every path $\beta$ satisfying (1a) and (1b) also satisfies (1c).

A necessary means is an action—or a series of actions—that remain constant through the path in order to bring about the $\psi$-state. In other words, every way to a $\psi$-state involves $\alpha$. Now, ability to bring about the $\psi$-state is a precondition for the $\psi$-state, i.e. the necessary psychological force for bringing about the $\psi$-state. Because of causation, the ability will become physical force (Law of rational action), hence it initiates a path to the $\psi$-state—that is, a necessary series of actions to get to it. Putting all this together, we have the following meaning for force-CAN:

$$(63) \quad x \text{ force-CAN } \psi \text{ is instantiated at time } t \text{ in } w \text{ iff:}$$

i. $x \text{ CAN } \psi$;
ii. The Law of Rational Action holds;
iii. Force initiates a path, i.e., a sequence of eventualities $S$ ($<\text{init}(f), \ldots, \text{fin}(f)>$) such that $S$ is a necessary means ($<$) for $\psi$;
iv. $\psi$ is the $\text{fin}(f)$ of $S$.

This gets us the meaning we want. It captures the “transformation” of ability-as potential for action to action-via-force, but it does so without posing ambiguity in the ability verb $boro$, and without appealing to aspect—since we showed in section 3, that the phenomenon is quite independent of aspect. Rather, our idea capitalizes on the *causative* logical form of sentences with actualized ability: causation forces assertion of the result, thereby triggering the Law of Rational Action, thus coercing a force reading of the ability. This shift, we argued, from pure ability to implemented energy is present in all causative structures with action verbs, including implicatives, so we capture is easily the similarity of force-ability with implicative (that Bhatt observed) without saying that force-ability and implicatives are the same thing. What is common in both cases is the causative logical form.

5 Conclusion

The most important lessons from this paper are two. First, the meaning of ability is richer than mere possibility in containing a potential for action component. This by itself challenges the analysis of Hacquard, where the eventive (action) information comes from aspect, not ability. Second, we showed that, in Greek at least, aspect is not the decisive factor for the so-called actuality entailment—a finding in line with Mari and Martin’s (2009) observations that aspect in French is not the crucial factor for the actuality entailment either. We find past perfectives of $pouvoir$ and $boro$ without actuality, and past imperfectives and present tense with actuality in Greek, as we showed. The crucial factor, we argued, is causation, which is brought about in Greek with a co-ordinate structure directly reflecting, as we suggested, Dowty’s bi-clausal CAUSE logical form. These causative paratactic structures are also possible in English with verbs like *try, allow*—as in e.g. *The doctor allowed us and we saw*.
the patient, John tried and he got us good seats. The causative structure is important because CAUSE is a relation between two events, thereby coercing ability into a force reading in the sense of Copley and Harley 2010, i.e. ability does not remain simply a precondition for action, but becomes action initiating ability. This analysis, crucially, does not posit ambiguity in the meaning of the ability verb (unlike Bhatt 1999). Rather, it builds on the existence of an action component in ability, as argued for e.g. in Thomason 2005 and more indirectly in Giannakidou 2001, and postulates an interaction between structure (causative) and lexical meaning that affects the latter. Such interactions are common crosslinguistically when it comes to complementation and mood choice, areas that are affected in the ability case too.

One final question: If the key to action initiating ability is causation and the role of perfective aspect is epiphenomenal, as we claim, then why is it generally so easy to get the actualization with perfective past? This is a fair question to ask, and the answer to it, not surprisingly, supports the role of causation that we argued for here. Accomplishment verbs in the perfective past, especially those with incremental themes such as e.g. *Ariadne fixed the car, Nicholas wrote a letter*, etc., come with telic interpretation typically, i.e. one that guarantees reaching the result. Dowty argues that these telic interpretations are also causatives—though, admittedly, the syntax offers only one clause. If Dowty’s idea is right, then there is nothing surprising about the telic perfective past: it creates a causative structure like the complex paratactic frame we discussed, thereby implying again a key role for causation. And our co-ordinate causatives are important because they allow us to see what is really doing the work: causation, and not aspect.

Acknowledgements
We were extremely fortunate to have received lots of useful comments from people that have have been thinking intensely about the questions we address in this paper. Many thanks to Bridget Copley, Valentine Haquard, Alda Mari, and Brenda Laca for their very helpful comments and suggestions. Their own work has been obviously a source of inspiration, as can be seen. We would also like to thank Léa Nash for the information that Georgian also exhibits the co-ordinate frame we discuss here with the ability verb— and we hope that in future work we will be able to discuss also the Georgian data. The material of this paper was presented on two occasions in Paris: the Workshop on Dispositions and Attitudes (June 2010), and the Paris Working Sessions on Modalities, Goals, and Events (November 2010), both at the ENS. We thank the audiences for inspiring discussions, and for helping us with sharing generously their ideas, especially Jacqueline Guéron, and Susan Schweitser. A special thanks, finally, to the editors of this volume Alda Mari, Claire Beyssad, and Fabio del Prete for inviting us to contribute with this paper. Working on this paper has been a great pleasure.

References


Hackl, Martin. 1998. On the semantics of ability attributions. Ms. MIT.


