The scope of the future*

James N. Collins
Stanford University

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[Draft, comments welcome]

1 Introduction

The scope taking properties of English future tense expressions like *will, going to, about to*. These expressions introduce both a modal and temporal component. These components should be understood as *scoping independently*. Future tense expressions introduce a *homogeneity/settledness presupposition*, which distinguishes them from similar expressions like *sure to* and *guaranteed to*.

2 Properties of futures

English modal expressions which serve to locate the time of their prejacent at some point after the time of evaluation, e.g., *will*, *be going to*, *be about to*.

(1) He will pass the exam *yesterday/today/tomorrow

(2) $F(\phi)$ is true at t iff there is a t' such that $t \prec t'$ and ϕ is true at t'

2.1 Historical modality

Futurate expressions like *will* and *going to* are modal, not just temporal (Thomason 1970, Enç 1996, Copley 2002, Condoravdi 2002, 2003, Kaufmann 2005, Klecha 2013, 2015, del Prete 2014 cf. Kissine 2008). They behave like modal operators in the following respects:

- Restricted by conditionals (*unless*: Condoravdi 2003, *if*: Klecha 2013)
- Participation in modal subordination (Klecha 2013)
- Non-veridicality/counterfactuality in past tense uses (Condoravdi 2002, Klecha 2013)
- Interaction with predicates of personal taste (Klecha 2013)
- Licensing nonspecific interpretation of indefinites (del Prete 2014)

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Thomason (1984); Condoravdi (2002): *will* universally quantifies over the ways that the world may turn out: the *historical alternatives* of w. $MB_{historical}(w,t)$ = worlds which agree with w on the truth of all propositions evaluated at times prior to t, they 'share histories'. Worlds in $MB_{historical}(w,t)$ may disagree on the truth of propositions evaluated at times after t.

(3) $will(\phi)$ is true at $\langle w,t\rangle$ iff for all w' in $MB_{historical}(w,t)$, there is a t' such that $t \prec t'$ and ϕ is true at $\langle w',t'\rangle$

3 Scope taking properties of futures

3.1 Decomposing the future modal

This semantics for futures combines the modal and temporal components into one operator:

(4) $will(\phi)$ is true at $\langle w,t\rangle$ iff for all w' in $MB_{historical}(w,t)$, there is a t' such that $t \prec t'$ and ϕ is true at $\langle w',t'\rangle$

We can separate it out into two operators:

(5) $\Box\phi$ is true at $\langle w,t\rangle$ iff for all w' in $MB_{historical}(w,t)$, ϕ is true at $\langle w',t\rangle$

(6) $F\phi$ is true at $\langle w,t\rangle$ iff for some t' s.t. $t \prec t'$, ϕ is true at $\langle w,t'\rangle$

Key question: Do the modal ($\Box$) and temporal (F) components of futures decompose and take scope independently?

3.2 The temporal component and negation

(7) $F\phi$ is true at $\langle w,t\rangle$ iff for some t' such that $t \prec t'$, ϕ is true at $\langle w,t'\rangle$

The existential quantifier over times F always scopes *under* negation.

(8) Mary will not drink tea, #but she will.

(9) $\Box F\neg(Mary\ drink)$ ✗a non-drinking time on every branch

(10) $\Box\neg F(Mary\ drink)$ ✓no drinking times on any branch

Temporal component F consistently takes narrow scope.

3.3 Scope and subject quantifiers

The existential quantifier over times also scopes under subject quantifiers (most evident with negative quantifiers).

(11) No student will drink tea, #but some will.

(12) $\Box(F(no\ student\ x(drink(x))))$ ✗on every branch, there's a time where no student drinks and maybe another time where some do drink

(13) $\Box(no\ student\ x(F(drink(x))))$ ✓on every branch, no students have any drinking times

The modal $\Box$ may take variable scope with respect to subject quantifiers.

(14) Someone will fail the exam, (due to the grading scale).

(15) $\Box\exists x(x\ fail)$ identity of x varies across outcomes

(16) Someone will fail the exam, (Mary's been slacking off).

(17) $\exists x\Box(x\ fail)$ identity of x fixed across outcomes

There is evidence that $quantifier > modal$ scopings must be available. Bound readings of pronouns in conditional restrictors of *will* are ok (following Von Fintel and Iatridou (2003) on *must*).

(18) Every boy$_i$ will pass if he$_{i,j}$ works hard.

Assume conditional antecedents restrict quantificational domain of modals (Kratzer 1986, Klecha (2013) on *will, gonna*). The bound reading is only ok if *every boy* can scope over the modal.

(19) $will(\lambda w.x\ works_w)(\lambda w.every\ boy\ y\ pass_w)$
pronoun out of scope of *every boy*, no binding possible

(20) $every(boy)(\lambda y.if\ y\ works\ y\ will\ pass)$
pronoun may be bound by *every boy*

Evidence that $modal > quantifier$ scopings must be available. Nouns in subject quantifiers can be relativized to a world bound by the future modal.

(21) Every winner will be excited.

a. ...so let's find out who will win. identities of winners not settled.

b. ...namely Kim, Sandy, and Alex. identities of winners settled.

(22) $will(\lambda w.every\ winner_w\ is\ excited)$
identity of winners evaluated at every possible future

(23) $every(winner_@)(\lambda x.x\ will\ be\ excited)$
identity of winners evaluated at world of evaluation

Thus, subject quantifiers take variable scope wrt the modal component of futures $\Box$.

4 Scope and negation

The future necessity modal □ always appears to scope over negation.

(24) Mary will not drink tea, #but she may.

(25) $\neg\Box$(*Mary drink tea*) ✗there may be some branches where she drinks

(26) $\Box\neg$(*Mary drink tea*) ✓no branches where she drinks

Excluded middle: Prejacent either holds on all branches, or on none (see also Cariani and Santorio 2015). Diagram fails this condition.

The use of future modals comes with a presupposition of *homogeneity* or *settledness* (following Copley 2009 on futures, Bartsch 1973, Gajewski 2009 on neg-raisers, Homer (2015) on modals, von Fintel 1997 on generics, Löbner 2000 on definites)

Homogeneity: On uttering *will*(ϕ), the speaker commits herself to either ϕ or $\neg\phi$ holding uniformly across future branches.

(27) *Mary will not drink tea*

a $\Box$(*Mary drink*) $\vee$ $\Box\neg$(*Mary drink*) presupposition

b $\neg\Box$(*Mary drink*) assertion

c $\therefore \Box\neg$(*Mary drink*)

Negation and future modals can scope in either order, we derive a strengthened $\Box\neg$ interpretation either way via homogeneity. Thus, we can analyze □ as taking variable scope wrt to both subject quantifiers and negation, if we assume a homogeneity/settledness presupposition.

4.1 Interim summary

The modal component takes variable scope with respect to subject quantifiers, but seemingly fixed wide scope over negation. The temporal component takes narrow scope with respect to subject quantifiers and negation.

Elements of analysis: **Decomposition:** Future modals *decompose* into a modal component (a universal quantifier over possible outcomes), and a temporal component (an existential quantifier over future times). **Split scope:** The modal component may *scope independently* from the temporal component. **Homogeneity:** Future modals introduce a *homogeneity* presupposition, deriving the modal's apparent wide scope over negation.

5 Interaction with non-monotonic quantifiers

Complication: Non-monotonic quantfiers (*exactly one student*) appear to *invariably* scope below the modal component. Does this require an additional stipulation?

(28) Exactly one student will pass the exam, #the rest may pass too.

(29) $\Box >$ *exactly one*
in each outcome, the number of passing students is one

(30) *exactly one* $>\Box$
the number of students x s.t. x passes on every branch is one

(31)

Model 1	**Model 2**
OUTCOME 1 $\{a,b,c\}$	OUTCOME 1 $\{b\}$
OUTCOME 2 $\{b,c\}$	OUTCOME 2 $\{b\}$
OUTCOME 3 $\{a,c\}$	OUTCOME 3 $\{a\}$
false: $\Box >$ *exactly one*	true: $\Box >$ *exactly one*
true: *exactly one* $>\Box$	false: *exactly one* $>\Box$

Compare similar modals *sure to, guaranteed to*, which don't show the same restriction.

(32) Exactly one student will pass the exam.
$\rightsquigarrow$ wide scope modal, false in Model 1, true in Model 2

(33) Exactly one student is sure to pass the exam.
$\rightsquigarrow$ ambiguous, may be true in either model

(34) Exactly one student is guaranteed to pass the exam.
$\rightsquigarrow$ ambiguous, may be true in either model

Why do quantfiers like *exactly one student* necessarily take narrow scope but quantifiers like *every/some student* take variable scope? **Proposal:** This property is actually a prediction of the analysis of futures so far, assuming a homogeneity presupposition ($\Box p \vee \Box\neg p$). A standard semantics for *exactly n* quantifiers has an embedded negation (see, e.g., Keenan (1996)).

(35) Exactly one student passes $\rightsquigarrow$
$\exists x[student(x)\&pass(x)\&\forall y[[y \neq x\&student(y)] \rightarrow \neg pass(y)]]$

Scoping *exactly one student* over *will* gives the unattested reading:

(36) exactly one student x(will(pass(x))) $\rightsquigarrow$
$\exists x[student(x)\&\Box pass(x)\&\forall y[[y \neq x\&student(y)] \rightarrow \neg\Box pass(y)]]$

But recall homogeneity gives us a "neg-raising" inference ($\neg\Box \Rightarrow \Box\neg$). Assume homogeneity in (14) is universally quantified (see Heim (1983)):

(37) $\forall x[\Box pass(x) \vee \Box\neg pass(x)]$

(36) and (37) jointly entail (38), the observed reading (*one student is sure to pass but no others*)

(38) exactly one student(will pass) $\rightsquigarrow$
$\exists x[student(x)\&\Box pass(x)\&\forall y[[y \neq x\&student(y)] \rightarrow \Box\neg pass(y)]]$

The fixed scope of *exactly n* under *will* is due to homogeneity. *sure to* and *guaranteed to* can be understood as lacking a homogeneity presupposition, thus allowing variable scope. This analysis predicts that *sure to, guaranteed to* fail to license a neg-raising inference ($\neg\Box \Rightarrow \Box\neg$). Thus, (39a) and (39b) should be ok.

(39) a. John is not sure to pass, but he may.
b. John is not guaranteed to pass, but he may.

6 Conclusion

Future tense expressions demonstrate some puzzling scopal properties: Both modality and temporality are encoded by future tense expressions, but **the two components scope indepedently**. The modal component of futures may take variable scope with respect to some subject quantifiers. The temporal component of futures obligatorily scopes low. Additionally, the fixed scope with respect to negation and non-monotonic quantifiers motivates **a homogeneity presupposition** for futures, of the kind assumed in analyses of neg-raising. Futures provide a valuable test case and comparison point for studies of homogeneity in the modal domain, and split scope phenomena.

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