Intensional Predicates as Complex Predicates: a Perspective from Restrictions on Intensional Interrogative Complements in Uyghur*

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1. Introduction

In work on question semantics, linguists often distinguish between extensional and intensional complements. Generally, extensional complements, like those under the predicate 'know,' are analyzed as propositions, while intensional complements, like those under the predicate 'wonder' are analyzed as the sense of the proposition, or propositional concepts (Groenendijk and Stokhof 1982, Partee and Rooth 1983, Suñer 1993). In some languages, these differences are not only semantic, but carry morphosyntactic distinctions as well (Suñer 1993, Kim 2004, Etxepare 2010). It is generally assumed that intensional complements are semantically and syntactically more complex than their extensional counterparts, typically built up through the addition of an intensional operator, sometimes with overt morphosyntactic realizations. In languages where extensional and intensional complements are distinguished, it is assumed that predicate-complement mismatches are ungrammatical as a result of a type mismatch, where intensional predicates are incompatible with propositional complements, and extensional predicates are incompatible with proposition concept complements.

In this paper, I present novel data from Uyghur (Turkic) and argue that Uyghur is a language with such a morphosyntactic distinction between extensional and intensional complements. Namely, I show that the CPs headed by the complementizer *dep* generally resist embedding under extensional predicates, with the exception that *dep*-headed CPs can be embedded under extensional predicates if the extensional predicate is itself embedded under a modal verb. I argue that this exception comes about naturally by assuming two changes to previous analyses, namely that: (1) intensional predicates are actually complex predicates which license quantification over two worlds, and (2) intensional complements

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are propositional in type with two unabstracted world arguments rather than a propositional concept as assumed by previous analyses.

In section 2, I give background on the intensional-extensional divide in both its semantics and in its morphosyntax through a discussion on Suñer's (1993) account of the syntactic differences between intensional and extensional complements in Spanish. In section 3 I present the novel Uyghur data and discuss how previous accounts which account for Suñer (1993) cannot be extended to account for this data. In section 4, I propose a new account in which intensional and extensional complements are of the same type, and show that this analysis accounts for both previous data, as well as the novel Uyghur data. I briefly discuss the implications of such an approach, namely what it predicts in terms of the distribution of complementizers and verbal decomposition cross-linguistically. The Uyghur data presented in this paper was collected with a native speaker in the United States.

2. Background

Extensional and intensional attitudes are most commonly distinguished by their 'index dependence,' whether or not the interpretation of an attitude complement is dependent on the conditions in the world in which the attitude is held. For instance, in (1), the predicate 'know' is extensional. The complement 'whether Liam rides a motorcycle' is understood as referring to either the proposition 'Liam rides a motorcycle' or 'Liam does not ride a motorcycle' depending purely on which proposition is true of the real world (the world of evaluation of the attitude predicate). Thus, Sean's knowledge is contingent on the world of evaluation; the embedded proposition is evaluated with respect to the matrix clause, and the embedded clause can be said to be 'index dependent.'

(1) Attitude: Sean knows whether Liam rides a motorcycle.
   a. Condition: Liam rides a motorcycle.
      ∴ Sean knows that Liam rides a motorcycle.
   b. Condition: Liam doesn't ride a motorcycle.
      ∴ Sean knows that Liam doesn't ride a motorcycle.

In (2), the predicate 'guess' is understood as intensional. The complement 'whether Liam rides a motorcycle' is not reliant on the facts of the world of evaluation; whether or not Sean's guess is correct is irrelevant to the understanding of the sentence.

(2) Attitude: Sean is guessing whether Liam rides a motorcycle.
   a. Condition: Liam rides a motorcycle.
      ∴̸ Sean is guessing that Liam rides a motorcycle.
   b. Condition: Liam doesn't ride a motorcycle.
      ∴̸ Sean is guessing that Liam doesn't ride a motorcycle.

In Partee and Rooth (1983), it is argued that the difference between extensional and intensional interrogative complements can be derived from a difference in semantic type.

Interrogative complements are built from propositions by equating the truth value of the proposition applied to two different worlds. For extensional interrogative complements, one of these world arguments is open, while for intensional interrogative complements, both world arguments are open (3). Thus declarative complements and extensional interrogative complements are propositional (of type $\langle s,t\rangle$), while intensional interrogative complements are proposition concepts (of type $\langle s,\langle s,t\rangle\rangle$).

(3) Complement Distinctions (Partee and Rooth 1983, Suñer 1993)

a. Declarative Complement: $\lambda w.\phi(w)$
b. Extensional Interrogative: $\lambda w.\phi(w) = \phi(w')$
c. Intensional Interrogative: $\lambda w'\lambda w.\phi(w) = \phi(w')$

Under this analysis, predicates take these propositions and proposition concepts directly, as seen by the semantic analyses of (1–2) in (4). For extensional interrogatives, the internally unabstracted world argument is abstracted over in the matrix clause, thus making the interpretation of the complement dependent on the conditions of the world in which the attitude event occurs. Thus (4a) is interpreted as 'Sean knows that Liam rides a motorcycle' if Liam rides a motorcycle, and 'Sean knows that Liam does not ride a motorcycle' otherwise. The lack of identity between the world of evaluation and a world of the complement in (4b) ensures that such index dependence cannot occur for intensional attitudes.

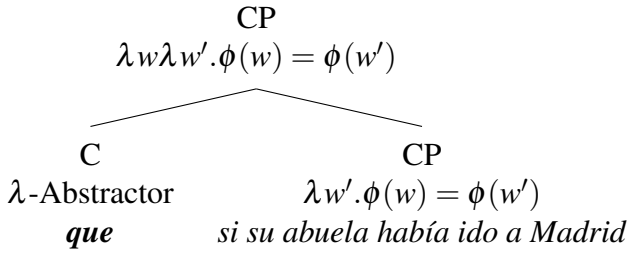
(4) a. (1) = know(Sean, w, $\lambda w'$.Liam-rides(w) = Liam-rides(w'))
b. (2) = guess(Sean, w, $\lambda w'\lambda w''$.Liam-rides(w') = Liam-rides(w''))

This distinction surfaces overtly in the morphosyntax in Spanish, where intensional interrogative complements are headed by the complementizer *que*, absent in extensional interrogative complements, as shown by the distinction between the complements of the extensional *saber* 'know' and the intensional *preguntar* 'ask' in (5).

(5) a. Sue sabía [si su abuela había ido a Madrid.]
Sue knew [if 3SG.POSS grandmother had gone to Madrid]
'Sue knew whether her grandma went to Madrid.'
b. Sue preguntó [**que** si su abuela había ido a Madrid.]
Sue asked [COMP if 3SG.POSS grandmother had gone to Madrid]
'Sue asked whether her grandma went to Madrid.'
[Spanish; Suñer 1993:53]

Such an overt marker on intensional complements suggests, as Suñer (1993) argues, that the intensional complement is syntactically built upon its extensional equivalent. For Suñer (1993), the complementizer *que* signals the presence of an additional C-head, which acts to abstract over the second world argument of the underlying extensional complement, turning it into an intensional complement (6).

(6)



Intensional Complement
Complement of *Preguntar* 'Ask'

Extensional Complement
Complement of *Saber* 'Know'

Such an approach assumes that the ungrammaticality of intensional complements embedded under extensional predicates is the result of a type mismatch, namely that the extensional predicate of type $\langle\langle s,t\rangle,\langle e,t\rangle\rangle$ cannot take a complement of type $\langle s,\langle s,t\rangle\rangle$, and similar for extensional complements under intensional predicates. In the next section, I discuss data from Uyghur which suggests that such an approach to the intensional-extensional distinction in complements is undesirable.

3. Intensional Complements under Extensional Predicates

In Uyghur, the complementizer *dep* embeds fully finite clauses, and can embed interrogative complements under intensional predicates such as *sori* 'ask' (7).

(7) Reyhan [kim tort-ni yé-d-i **dep**] sori-d-i.
Reyhan [who cake-ACC eat-PST-3 COMP] ask-PST-3
'Reyhan asked who ate the cake.'

However, *dep* is generally incapable of embedding interrogative complements of extensional predicates, such as *bil* 'know' (8).

(8) *Reyhan [kim tort-ni yé-d-i **dep**] bil-i-du.
Reyhan [who cake-ACC eat-PST-3 COMP] know-NPST-3
Intended: 'Reyhan knows who ate the cake.'[1]

Instead, such an intended meaning is only possible under a different embedder, *liq* (glossed LIQ), as shown in (9). While commonly assumed to be a form of nominalization, Asarina (2011) argues that *liq* is a complementizer due to its ability to occur with an overt head noun. In either case, the embedded material under *liq* is noticeably less than that under *dep*, lacking agreement and tense.

(9) Reyhan [kim tort-ni yé-gen-**lik**-i-ni] bil-i-du.
Reyhan [who cake-ACC eat-PFV-LIQ-POSS.3-ACC] know-NPST-3
'Reyhan knows who ate the cake.'

[1]The sentence in (8) can be interpreted as having a wide scoping *wh*-item, meaning 'Who did Reyhan know ate the cake?' I would argue that in this case, the complement is not truly an interrogative complement but rather a declarative complement containing a *wh*-item (which moves at LF into the matrix clause); either way, the original interpretation in (8) is blocked, and the account in this paper derives this effect.

This difference in syntactic size between *dep* and *liq*, as well as the outright ban on interrogative embedding with *dep* under extensional predicates, suggests that *dep* embeds only intensional complements. An exception arises, however, in sentences like (10), where the extensional predicate is itself in the complement of a modal verb. Note that (10) uses the desiderative mood nominalization (glossed DES) of *bil* 'know', which would be ungrammatical in the place of the finite *bilidu* in (8) for independent reasons.

(10) Reyhan [[kim tort-ni yé-d-i **dep**] bil-gü-si] kel-d-i.
Reyhan [[who cake-ACC eat-PST-3 COMP] know-DES-POSS.3] want-PST-3
'Reyhan wondered/wanted to know who ate the cake.'

This construction in which a seemingly intensional complement is embedded under an extensional predicate, heretofore the 'intensional-under-extensional' construction, poses a serious problem for previous analyses. If the ungrammaticality of (8) is due to a type mismatch, then (10), in which the same predicate takes the exact same complement should necessarily be ungrammatical as well.

4. Intensional Attitudes are Propositional

I account for the restricted availability of the 'intensional-under-extensional' construction in Uyghur by assuming the following: first, *dep* is a complementizer which, as suggested by the data in Section 3, only takes intensional complements; second, intensional complements are more complex than previously thought, and contain three world arguments rather than two; third, intensional predicates are inherently composite as to ensure quantification over two world arguments. In this section, I will first discuss my proposal, and how it maintains the desired effects accounted for previously by 'index independence' in intensional complements, and then I will then show how this analysis accounts for the grammaticality of 'intensional-under-extensional' constructions.

I assume the semantic structure of complements in (11). Declarative propositional complements and extensional interrogative complements remain the same as in earlier approaches, but intensional interrogative complements have three world arguments, each of which are equated with one another with respect to a proposition. Only one of these world arguments is open, and as a result, all three complements are propositional $\langle s,t \rangle$ in type.

(11) Complement Distinctions (This Paper)

a. Declarative Proposition: $\lambda w.\phi(w)$
b. Extensional Interrogative: $\lambda w.\phi(w) = \phi(w')$
c. Intensional Interrogative: $\lambda w.[\phi(w) = \phi(w')] \wedge [\phi(w) = \phi(w'')]$

Such an approach allows us to adopt the position developed in Kratzer (2006) and Moulton (2009) that complementizers do the work of world quantification, as all three complements in 11 easily embed under the same type-shifting complementizer. The typical complemen-

tizer (12) quantifies over an open world argument and introduces an entity such that for all worlds compatible with the entity, the embedded proposition is true of those worlds.

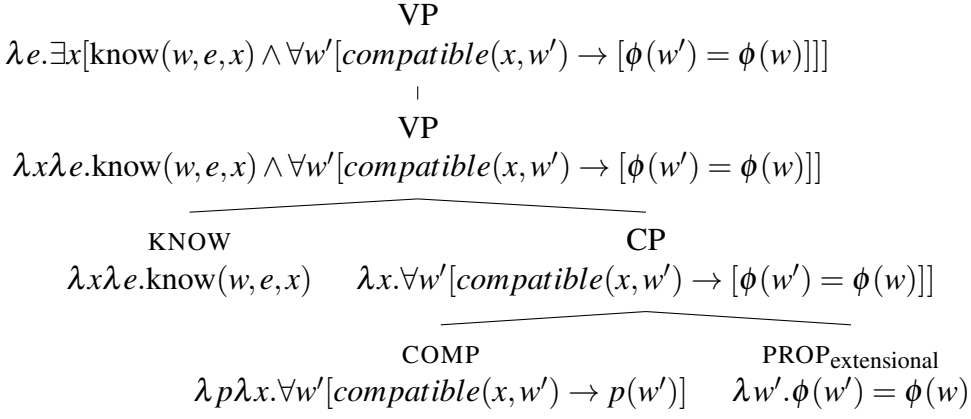
(12) $[\![\text{COMP}]\!] = \lambda p_{\langle s,t\rangle}\lambda x.\forall w[compatible(x,w) \rightarrow p(w)]$

After combining with a complementizer, the CP typically undergoes RESTRICT (Chung and Ladusaw 2004) with its embedding attitude predicate, which Kratzer (2006) takes to be a one place predicate whose complement is the content of the attitude. I additionally assume an event argument, as well as a world argument (assigned to the world of the index) denoting the world in which the event takes place.

(13) $[\![\text{VERB}]\!]^w = \lambda x\lambda e.\text{verb}(w,e,x)$

After combining with a complementizer, extensional interrogative CPs contain one unabstracted world argument. I assume that when undergoing RESTRICT with an attitude predicate, this world argument in the CP is necessarily conflated with the world index of the attitude predicate. Such a conflation ensures index dependence, as the proposition's truth in the attitude world are dependent on the proposition's truth in the world in which the attitude is held. Finally, as is typical of Chung and Ladusaw (2004) style complements, the argument of the predicate undergoes existential closure. Such a derivation is demonstrated in (14), with cumulative meaning and interpretation in (15).

(14)



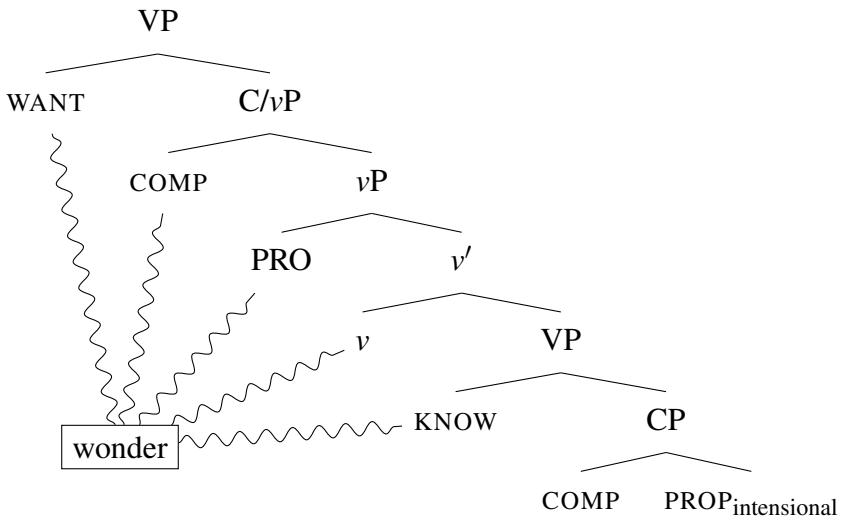
(15) $\lambda e.\exists x[\text{know}(w,e,x) \wedge \forall w'[compatible(x,w') \rightarrow [\phi(w') = \phi(w)]]]$
For a given event e, there is some some knowledge x which is known in knowing event e in world w, and for all worlds w' compatible with x, the truth value of ϕ evaluated at w' is the same as ϕ evaluated at w.

Thus, for extensional complements, one world argument is quantified over and associated with the content of the attitude, while the other is associated with the world in which the attitude occurs.

4.1 Intensional Predicates are Composite Attitudes

For intensional complements, an additional world argument is included, which must also undergo some kind of abstraction and closure. Intensional predicates are able to do this by licensing quantification over two world arguments. To do this, I propose that intensional predicates are inherently composite, formed from two attitude predicates, each taking an argument with propositional content. For instance, a predicate such as 'wonder' may be composed of two predicates approximating the meaning of 'want' and 'know', as shown in (16). I assume that the lower predicate projects an external argument which is obligatorily controlled by the external argument of the higher predicate.

(16)



The conflation of a world argument with the index as discussed with extensional complements occurs twice for intensional complements, once between a world argument and the index world of KNOW, and once between the other world argument and the index world of WANT. The resulting structure has the interpretation in (17).

(17) $\lambda e.\exists x[\text{want}(w,e,x) \wedge$
$\forall w'[\mathit{compatible}(x,w') \rightarrow \exists e'\exists y[\text{know}(w',e',y) \wedge \text{AGENT}(e',\text{PRO}_i) \wedge$
$\forall w''[\mathit{compatible}(y,w'') \rightarrow [[\phi(w'') = \phi(w')] \wedge [\phi(w'') = \phi(w)]]]]]]$
There is a desire x in w such that for all worlds w' compatible with x, PRO_i knows some knowledge y such that in all worlds w'' compatible with y, the truth value of ϕ evaluated at w'' is the same as ϕ evaluated at w' and the truth value of ϕ evaluated at w'' is the same as ϕ evaluated at w.

The resulting sentence seems, at least structurally, to be index-dependent: the evaluation of the embedded proposition is dependent on the truth conditions of the world in which the attitude is evaluated. However, this turns out to not be an issue, as the decompositional version of intensional attitudes pattern with extensional attitudes in the diagnostic for index dependence. In (18), the sentence 'Sean wonders whether Liam rides a motorcycle'

is paraphrased as its decomposed attitudes. In the case that Liam rides a motorcycle, then Sean's desires are met in worlds in which he knows that Liam rides a motorcycle (18a). In the case that Liam does not ride a motorcycle, then Sean's desires are met in worlds in which he knows that Liam does not ride a motorcycle (18b).

(18) Sean wonders whether Liam rides a motorcycle. =
λw Sean$_i$ wants $\forall w'$ [PRO$_i$ knows $\forall w''$ [whether Liam rides a motorcycle]].

a. Condition: Liam rides a motorcycle.
$\therefore$ Sean wants a world in which he knows that Liam rides a motorcycle.

b. Condition: Liam doesn't ride a motorcycle.
$\therefore$ Sean wants a world in which he knows that Liam doesn't ride a motorcycle.

The distinction between intensional and extensional complements then is not whether the evaluation of the complement's proposition is dependent on the world of evaluation — in both cases they are dependent — instead the distinction lies in whether or not the attitude holder is aware of which worlds are compatible with the attitudes they are holding. In extensional attitudes, the world in which the attitude holder is aware of the content of their attitude is the world of evaluation, but for intensional attitudes, the presence of an intermediate world, such as the world of desire in the case of 'wonder', allows a disjunction between the world in which the attitude holder holds an attitude and the world in which they are aware of the content of their attitude.

We now come to why Uyghur *bil* 'know' can only embed interrogatives under *dep* if *bil* is itself in the complement of a modal verb. Taking *dep* to attach only to intensional complements, it follows that a *dep* headed CP is different from their extensional equivalents not by their semantic type, but by the number of world arguments which must undergo quantification/abstraction. In (7), repeated below, *sori* 'ask' is already an intensional complement and does the work of licensing the quantification of two world arguments.

(7) Reyhan [kim tort-ni yé-d-i **dep**] sori-d-i.
Reyhan [who cake-ACC eat-PST-3 COMP] ask-PST-3
'Reyhan asked who ate the cake.'

In (10), repeated below, each predicate does the work of licensing the quantification of one world argument. Thus while 'ask' has a single form in Uyghur as *sori*, Uyghur demonstrates overt decomposition of the sense of 'wonder' into *bil* 'know' and *kel* 'want'.

(10) Reyhan [[kim tort-ni yé-d-i **dep**] bil-gü-si] kel-d-i.
Reyhan [[who cake-ACC eat-PST-3 COMP] know-DES-POSS.3] want-PST-3
'Reyhan wondered/wanted to know who ate the cake.'

When a modal verb like *kel* 'want' is not present, like in (8), repeated below, one of the world arguments is never abstracted or quantified over, leaving an unbound variable, resulting in the sentence's ungrammaticality.

(8) *Reyhan [kim tort-ni yé-d-i **dep**] bil-i-du.
Reyhan [who cake-ACC eat-PST-3 COMP] know-NPST-3
Intended: 'Reyhan knows who ate the cake.'

With this we are able to predict predicate-complement incompatibility without relying on semantic mismatching or a syntactic ban on 'intensional-under-extensional' constructions.

Following Asarina (2011) in assuming that *dep* and *liq* are both complementizers in Uyghur, and following the assumption in Groenendijk and Stokhof (1982) and Suñer (1993) that intensional attitudes are built on top of their extensional equivalents, we should expect a structure as in (19), where an operator shift declarative propositions into extensional interrogatives, and extensional interrogatives into intensional interrogatives, where *dep* and *liq* necessarily attach above and below the intensionalizing operator, respectively.

(19) $[_{\text{CP-Intensional}}$ (*dep*) OP_{Int} $[_{\text{CP-Extensional}}$ (*liq*) OP_{Ext} [Proposition]]]

The exact nature of these operators in terms of their syntax and semantics, and whether or not they have overt counterparts in other languages, are questions for future research.

5. Conclusion

One of Karttunen's (1977) criticisms of Hintikka (1976) is that intensional verbs would need to be 'lexically decomposed' in order to account for their meanings in a Hintikka-style semantics. This paper takes this criticism seriously as a valid approach to intensional attitudes and argues that such an analysis is not only tenable but is preferable in the face of 'intensional-under-extensional' constructions in Uyghur, which arise precisely in environments where constructions look like decomposed intensional verbs. This paper follows the spirit of Kratzer (2006) and Bogal-Allbritten (2015) in arguing for the decomposition of attitudes, albeit from a different angle. Such a perspective allows us to tease apart index-dependence in its technical sense from the phenomena with which it is often associated, namely, the attitude holder's awareness of which worlds are compatible with their attitude. Such a distinction may suggest that other phenomena, such as factivity, referentiality, and givenness — which are related to the dependence of embedded clause interpretation on matrix world state of affairs and often syntactically associated with extensionality (Roussou 1994, de Cuba and Ürögdi 2009, Djärv 2019) — may be derivable in similar ways.

This analysis, in which all intensional attitude predicates are composed of multiple attitude predicates, predicts that intensional predicates should often surface in their decomposed forms cross-linguistically, just as 'wonder' does in Uyghur. Future typological work may aim to find the distribution of intensional predicates cross-linguistically, and assuming that this analysis is on the right track, we may expect languages in which most or all intensional predicates are decomposed, or languages with novel intensional predicates, typically represented as two extensional or modal predicates in more well documented languages.

Additionally, we may expect languages which distinguish complementizers which take extensional and intensional complements to have some coersive effect, where canonically intensional predicates are interpreted extensionally when embedding a clause headed by an

extensional complementizer. Such may be the case in Korean, where the nominalizer *kes* seems to enforce extensional readings even under intensional predicates (Kim 2004).

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