Raising Alternatives to Express Dependence:
A Compositional Issue

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1   Introduction

A dependence utterance expresses that a question's resolution depends on another question's resolution (Ciardelli 2018). For example, sentence (1) says that if it is sunny, Amy will go to the beach. Otherwise, she will not.

(1)   Whether Amy will go to the beach depends on whether it is sunny.   (Hui 2021)

This article studies dependence utterances built with an adverbial adjunct phrase in English and French. These utterances can either be assertive (i.e. establishing a classical proposition, like (1)) or inquisitive (i.e. raising a question), as we will show. In French, Adjunct Dependence Utterances (ADUs) are formed using preposition *selon* (lit. 'in accordance with'), *suivant* (lit. 'following') or *en fonction de* (lit. 'in function of') (de Cornulier 2013, Richard 2024a). Henceforth, we refer to any of these interchangeable variants as SELON. This construction translates using English ADUs, built with *depending on*, e.g. (2)[1][2]

(2)   *des   jeunes   des   jeûnes [B ça peut être paronyme   ou homonyme]   [suivant [A comment*
        some youngs some fasts   it can be   paronymous or homonymous SELON   how
        vous le prononcez]]
        you it pronounce
        '[B French words "*jeune*" and "*jeûne*" can be paronymous or homonymous] [depending on [A
        how you pronounce "*jeûne*"]].'   (CIENSFO)

The lexical entry for *depend* proposed by Theiler, Roelofsen & Aloni (2019) captures the meaning of ADUs assertive ADUs but is tailored for a main clause use. It fails to account for the compositional diversity exhibited by ADUs. For example, it incorrectly predicts that the main clause of an ADU

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[1]Note that there exists another use of *selon* and *suivant* that can be translated by 'according to', reporting the source of some information, e.g (i). This reading is impossible with *en fonction de*. Thus, we assume this use of *selon/suivant* is independent and do not focus on it here.

(i)   Selon les prévisions météo, le mercure va baisser à partir de mardi.   (frTenTen23)

        'According to the weather forecast, the mercury will drop from Tuesday.'

[2]Some interrogative clauses introduced by SELON like in (i) have a different distribution. Richard 2024a: § 3.2.6 observes that they succeed government tests, contrary to the other examples. It turns out the clause *en fonction de si y a un train qui y va* should be analyzed as the complement of the verb *choisir* 'choose', and not an adjunct. These utterances are typically not translated using *depending on*. We exclude such complement clauses from this study.

(i)   *je choisis mes activités en fonction de si   y   a   un train qui y   va*
        I choose my activities SELON   whether there has a   train that there goes
        'I choose my activities based on whether there is a train that goes there.'   (CIENSFO)

cannot be declarative. We aim to solve this issue and provide a model for ADUs using Dynamic Inquisitive Semantics (Roelofsen & Dotlačil 2023) and Free Association with focus (Beaver & Clark 2008).

In the following, we take occurrences from the French corpora CIENSFO (spoken extracts from various online sources) (Richard 2024a) and frTenTen23 (written web) (Jakubíček et al. 2013). Disfluencies and transcription mistakes were fixed.

2 Dependence propositions

In this section, we lay out the semantics of *depend* defined by Theiler, Roelofsen & Aloni (2019).

In (2), the speaker highlights that *jeûne* has two pronunciations, $A_1 = $ /œn/ (like for *jeune*) or $A_2 = $ /øn/. Words *jeune* and *jeûne* can either be homonymous (B_1) or paronymous (almost the same pronunciation, B_2). Statement (2) means: if A_1 then B_1 and if A_2 then B_2.

Like in a regular conditional if A, then B, we call antecedent A the complement of SELON/ *depending on* and consequent B the main clause.[3] Saying that B depends on A, noted $\mathbf{dep}(A, B)$, means a functional dependence f exists between A's alternatives and B's alternatives. This functional dependence is evaluated according to a modal base M. For example, (3) holds if there exists a function f from ages to income tax rates such that, for every world w where the Dutch law applies and every people x being y years old in w, x has income tax rate $f(y)$ in w.

(3) $[_M$ According to Dutch law], $[_B$ one's income tax rate] depends on $[_A$ one's age].

In Inquisitive Semantics, declarative and interrogative clauses are both interpreted by propositions of type $\langle\langle s, t\rangle, t\rangle$, i.e. a set of sets of possible worlds (Ciardelli, Groenendijk & Roelofsen 2018). Therefore, propositions are evaluated against a set s instead of a single world $w \in s$. The alternatives ALT(A) of a proposition A are the maximal sets $s \in A$ with respect to inclusion. Proposition A is assertive if it has only one alternative (viz. $|\text{ALT}(A)| = 1$) and inquisitive if it has more than one alternative (i.e. the answers to that question). In the compositional theory, disjunction and indefinites (including wh-words) raise inquisitiveness (i.e. generate alternatives), and other operators can cancel it. At CP, questions are denoted by inquisitive propositions and declaratives by assertive ones. Theiler, Roelofsen & Aloni's lexical entry for depend is given in (4).

(4) a. $\mathbf{dep}_M(A, B) := \lambda s. \forall w \in s. \exists f : \text{ALT}(A) \rightarrow \text{ALT}(B). \text{(4a-i)} \wedge \text{(4a-ii)},$ where
    (i) **conditional dependence:**
       $\forall w \in M. \forall t \in \text{ALT}(A). w \in t \rightarrow w \in f(t)$, and
    (ii) **non-triviality:**
       $\exists t, t' \in \text{ALT}(A). t \cap M \neq \emptyset \wedge t' \cap M \neq \emptyset \wedge f(t) \neq f(t')$

The first condition (4a-i) requires that for any evaluation world w in the modal base M, if alternative t of A is true at w, then $f(t) \in \text{ALT}(B)$ is also true at w. The second condition (4a-ii) eliminates trivial dependence (i.e. constant functions f) by requiring that at least some inputs t, t' intersecting with M are mapped to different outputs $f(t) \neq f(t')$.

Condition (4a-ii) requires semantic arguments A and B to be inquisitive. This restriction correctly predicts the syntactical selection of matrix-level *depend*. Verbs of dependency do not accept declarative clauses for their subjects or objects (5).[4]

(5) a. *That the light is on depends on whether the switch is up.

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[3]To simplify matters, we focus on complete dependence here, excluding cases where a question's resolution might partially depend on another question's resolution. For a discussion, see Karttunen (1977: fn. 6).

[4]See Theiler, Roelofsen & Aloni 2019 for the complete argument linking semantic triviality to ungrammaticality.

b. *Whether the light is on depends on that the switch is up.

3 Compositional problem

The non-triviality condition (4a-ii) requires that the antecedent and consequent of ADUs are inquisitive. However, some of them are not interrogatives. This section exposes the range of syntactic constructions compatible with ADUs.

3.1 Antecedent

The antecedent A of an ADU **dep**(A, B) can be an interrogative (polar, alternative or wh (2)), a declarative CP disjunction (6) (in French only) or an NP (e.g. (8) below). In section 4, we show how to account for this syntactic distribution uniformly.

(6) *[$_B$ Cet effort n' est pas le même] selon [$_A$ qu' on est héritier ou que l'on a que*
this effort NEG is not the same SELON that one is heir or that one has only
sa force de travail].
one's force of work
'This effort is not the same for heirs as it is for those who only have their labor power.'
(frTenTen23)

3.2 Declarative consequent

The vast majority of Adjunct Dependence Utterances in CIENSFO and frTenTen23 have a declarative consequent B. However, we can intuitively retrieve alternatives from these consequents. Some cases involve: disjunction alternatives (2), domain alternatives of an indefinite adjective (e.g. certain in (7a)), lexical alternatives (e.g. *stop* in (7b)) and scalar alternatives (7c). These alternative triggers are marked by F (for focus) in the following.

(7) a. *on projette le fait que selon comment une personne parle [$_B$ elle aurait une*
one projects the fact that SELON how a person speaks she has.COND a
certaine$_F$ identité sociale]
certain identity social
'We project the idea that, depending on how someone speaks, [$_B$ they would have a certain$_F$ social identity].'
(CIENSFO)
(i) e.g. $B_1 =$ they would be a professor, $B_2 =$ they would be a laborer,...
b. *suivant comment se passe le premier tour [$_B$ je vais peut-être arrêter$_F$]*
SELON how REFL goes the first round I go maybe stop
'Depending on how the first round goes, [$_B$ I might stop$_F$].'
(CIENSFO)
(i) $B_1 =$ I stop, $B_2 =$ I continue
c. *le sexisme suivant quel type de sexisme [$_B$ y a eu des associations qu'*
the sexism SELON which type of sexism there has been some associations that
étaient pas$_F$ très fortes]
were not very strong
'Depending on what type of sexism, [$_B$ there were associations (between sexism and hatred of inclusive writing) that weren't$_F$ very strong].'
(CIENSFO)
$B_1 =$ there were strong associations, $B_2 =$ there were not very strong associations

The model we present in section 4 accounts for this variation by attaching SELON/*depending on* adjunct phrase at the right place on the left periphery.

3.3 Interrogative consequent

The consequent of an ADU can be an interrogative, leading the whole sentence to be a question. For example, (8) asks what the set of relevant age periods is and how many eggs it is recommended to eat in those age periods. In other words, the possible answers are the functions f from age periods to diet recommendations. Sentence (8) also presupposes that such a non-trivial functional relation exists.

(8) *Selon* [$_A$ *les âges*], [$_B$ *combien   d' œufs peut -on consommer*] ?
     SELON   the ages   how_many of eggs can we consume   ?
     '[$_B$ How many eggs can people eat], depending on [$_A$ their age]?'   (frTenTen23)

If the consequent of an ADU is declarative, then the whole utterance is assertive. But if the consequent is interrogative, the whole utterance is inquisitive. This phenomenon also appears with an interrogative embedded in the main clause. For example, in (9a), the adverbial modifier phrase is interpreted below the attitude verb and, together with the embedded interrogative, provides an inquisitive proposition feeding the attitude verb. The statement (9a) means that you can know what the dependence relation f is, paraphrased as (9b).

(9) a. *en fonction de* [$_A$ *combien   il   te   reste   d' éléments dans ton   objet*] *tu*
         SELON   how_many EXPL you.DAT remain of elements in   your object you
         peux savoir [$_B$ *depuis combien   de temps il est en train de se   dégrader*]
         can know   since how_much of time it is PROG   REFL degrade
         'Depending on [$_A$ how many radioactive elements you have left in your object], you can
         find out [$_B$ how long it has been decaying].'   (CIENSFO)
     b. 'You can know what the dependence relation f is between the element count and the
         decay duration.'

4 Raising alternatives

In this section, we show how Dynamic Inquisitive Semantics DInq (Dotlačil & Roelofsen 2021) and Free Association with Focus (Beaver & Clark 2008) solve the compositional problem.

4.1 The left periphery

DInq extends Inquisitive Semantics by specifying how the left periphery blocks or raises alternatives depending on scope and clause type. We assume a CP level (clause type/complementizer phrase) and a FocP level (focus phrase), where wh-words rise (Rizzi 1997). The head FOC of FocP cancels inquisitiveness raised below FocP and then generates alternatives if co-indexed with a wh-word. The head of an interrogative CP is INT. It generates polar question alternatives and triggers presuppositions. The head of declarative CPs is DEC. It cancels inquisitiveness raised below CP.

4.2 Antecedents

The complement of SELON/*depending on* is a CP or an NP. Interrogative CPs are interpreted as inquisitive propositions. Antecedent NPs can be semantically lifted to an inquisitive proposition by analyzing them as concealed questions (Aloni & Roelofsen 2011, Hui 2021). By scoping over the complementizer *que* 'that', disjunction in (6) raises alternatives that FOC and DEC do not cancel, and so **dep** can capture them.
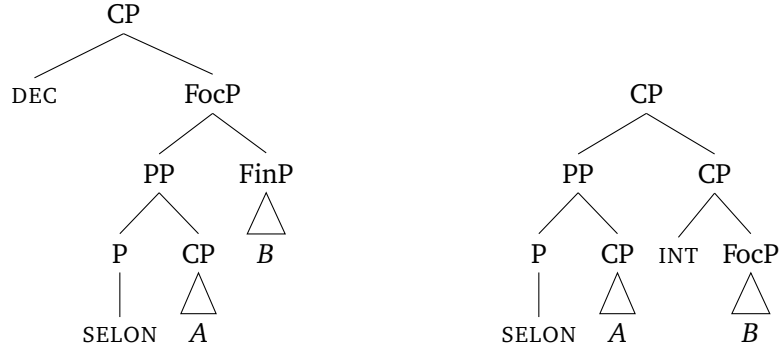
Figure 1: Logical forms of an assertive ADU on the left and an inquisitive ADU on the right.

4.3 Assertive dependence and focus

By attaching the adjunct phrase at B's FOC, any alternative raised in B as a FinP (finite phrase) is captured by **dep**. This accounts for disjunction (2) and indefinites (7a). Moreover, this attachment site correctly predicts that the complement of an assertive ADU cannot be a declarative CP nor an interrogative. The logical form of a French assertive ADU is displayed in Fig. 1. However, DInq fails to model (7b) and (7c) because their alternatives are not based on disjunction or indefinites. Therefore, another analysis is required.

4.3.1 Free Association with focus

Free Association with focus (Beaver & Clark 2008) describes how the implicit modal base of some quantificational operators is provided as the union of the alternatives raised via focus. For example, the reading (10a), where the focus F lies on *ice*, means that, in all cases where Kim tells Sandy something, that thing is "being nice". The alternatives are (10a-i), and their union composes the modal base $M = \bigcup_i B_i$. Sentence (10a) is represented by formula **always**(M, B_1), paraphrased as "In all worlds $w \in M$, then B_1 is true. Conversely, the modal base of (10b) consists of the situations where Kim tells somebody to be nice.

(10)   a.   Kim always tells Sandy to be nice$_F$.
             (i)   e.g. $B_1 =$ Kim tells Sandy to be nice, $B_2 =$ Kim tells Sandy to be strong,...
        b.   Kim always tells Sandy$_F$ to nice.
             (i)   e.g. $B_1 =$ Kim tells Sandy to be nice, $B_2 =$ Kim tells Mary to be nice,...

4.3.2 SELON is fed with focus alternatives

Kaufmann 2016 proposes that, in the constructions "Depending on Q, p", p raises "live issues". Hénot-Mortier 2024b assimilates these "live issues" with the maximal true answers to the question under discussion evoked by p. This question under discussion can be interpreted as a question inquiring about p's focused material (Hénot-Mortier 2024a). I follow this analysis and consider that the alternatives generated in the consequent are focus alternatives.

SELON/*depending on* works as a complex quantificational adverb using Free Association with focus. Focus in the consequent B generates a set ALT(B) of alternatives. When the modal base is not explicitly expressed, the union of these alternatives determines the modal base $M = \bigcup \text{ALT}(B)$ of **dep**$_M(A, B)$ used in definition (4).

Many assertive ADUs contain a modal verb or adverb in their consequent, like *might* in (7b). Sentence (7b) might be read as implying "If the round goes badly, I might stop (but I might also stay)". However, it can also be read as implying "If the round goes badly, I stop, and this situation (where

the round goes badly and I stop) is possible". Under this reading, the modal operator *might* shares its modal base $M = B_1 \cup B_2$ with **dep** and indicates the epistemic stance of the surface alternative of the consequent with respect to this modal base. For example, (7b) has the at-issue inference that, among the situations wherein the speaker stops or continues, his stopping is possible, i.e. $\textbf{might}(M, B_1)$.

4.4 Inquisitive dependence

An inquisitive ADU takes an interrogative consequent. This selection requires the adjunct phrase to attach above an interrogative CP. This logical form is illustrated in Fig. 1 on the right. For embedded inquisitive ADUs like (9a), the adjunct phrase attaches between the attitude verb and the interrogative CP.

To generate a question about the dependence relation, we adopt the same strategy as Richard (2024b) to let inquisitiveness project through a modality. We let the existential quantifier $\exists f :$ ALT$(A) \rightarrow$ ALT(B) scope over the universal quantifier $\forall w \in s$ in formula (4). This way, **dep**(A, B) raises as many alternatives as dependence functions f. This change does not impact assertive ADUs because the adjunct phrase scopes below DEC in this case, thus canceling the inquisitiveness **dep**(A, B) triggers.

5 Conclusion and opening

Adjunct Dependence Utterances (ADUs) capture alternatives raised in their antecedents and consequents. Various elements of different syntactic types can trigger these alternatives. We showed how Dynamic Inquisitive Semantics and Free Association with Focus manage to model this diversity with a single semantic entry for SELON/*depending on* and two attachment sites.

The data presented shows how diverse ADUs can be. Contrary to English, French accepts CP disjunctions as antecedents and the adjunct is introduced by a preposition (*selon*, *suivant* or *en fonction de*) instead of a verb. These constructions exist in other languages, like in German (11), where the adjunct is introduced by *je nachdem* ('according to').

(11)   *Je   nachdem, [_A wie alt dein Kind ist], [_B kann es   in allen Bussen und Bahnen der*
       each after.PRO how old your child is   can they in all   buses and trains the.GEN
       Leipziger Verkehrsbetriebe gratis mitfahren oder zum   ermäßigten Sonderpreis.]
       Leipziger Verkehrsbetriebe free travel   or   to_the.DAT reduced   special_price
       'Depending on how old your child is, they can travel free of charge or at a reduced special
       price on all buses and trains operated by Leipziger Verkehrsbetriebe.'   (deTenTen23)

Moreover, other clause types are possible as consequents, like imperatives (at least in French). For example, sentence (12a) expresses a single suggestion, but this suggestion depends on the interlocutor's personal settings, unknown to the speaker. To model this case as in this article, we would first require an integrated semantics for declaratives, interrogatives, and imperatives.

(12)   a.   *[_B Cliquez ou double-cliquez], selon   [_A vos   paramètres personnels].*
            click   or double-click   SELON   your parameters personal
            'Click or double-click, depending on your personal settings.'   (frTenTen23)

References

Aloni, Maria & Floris Roelofsen. 2011. Interpreting concealed questions. *Linguistics and Philosophy* 34(5). 443–478.

Beaver, David I. & Brady Z. Clark. 2008. *Sense and Sensitivity: How Focus Determines Meaning*. Malden, MA: Blackwell.

Ciardelli, Ivano. 2018. Dependence statements are strict conditionals. In *Advances in Modal Logic*, 123–142.

Ciardelli, Ivano, Jeroen Groenendijk & Floris Roelofsen. 2018. *Inquisitive Semantics* (Oxford Surveys in Semantics and Pragmatics). Oxford, New York: Oxford University Press. 240 pp.

de Cornulier, Benoît. 2013. Les subordonnées dites interrogatives comme compléments de dépendance. *Philologia*. Linguistique comparée des langues romanes (LiCoLaR). 131–143. `https://hal.science/hal-01024873`.

Dotlačil, Jakub & Floris Roelofsen. 2021. A dynamic semantics of single-wh and multiple-wh questions. *Semantics and Linguistic Theory* 30(0). 376–395.

Hénot-Mortier, Adèle. 2024a. "One tool to rule them all"? An integrated model of the QuD for Hurford sentences. In *Proceedings of the 29th Sinn und Bedeutung*, to appear. Noto.

Hénot-Mortier, Adèle. 2024b. Scalarity, Information Structure and Relevance in varieties of Hurford Conditionals. In Fausto Carcassi et al. (eds.), *Proceedings of the 24th Amsterdam Colloquium*, 145–151. Amsterdam, The Netherlands. `https://drive.google.com/file/d/1NDuEXqO4DylI3Ha5l7HFBM4Onz-YAoQN/view`.

Hui, Terence. 2021. *A Compositional Analysis of Dependence Statements*. Amsterdam: Universiteit van Amsterdam MSc. Thesis. 59 pp.

Jakubíček, Miloš et al. 2013. The TenTen Corpus Family. In *7th International Corpus Linguistics Conference CL*, 125–127. Lancaster. `https://www.muni.cz/en/research/publications/1120431` (4 March, 2025).

Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1). 3–44.

Kaufmann, Magdalena. 2016. Free choice is a form of dependence. *Natural Language Semantics* 24(3). 247–290.

Richard, Valentin D. 2024a. « selon comment vous vous positionnez » : Étude des circonstancielles à interrogative. In Frank Neveu et al. (eds.), *9e Congrès Mondial de Linguistique Française*, vol. 191 (Syntaxe), 14010. Lausanne: SHS Web of Conferences.

Richard, Valentin D. 2024b. Dynamic Effects of Modalized Questions. In Fausto Carcassi et al. (eds.), *Proceedings of the 24th Amsterdam Colloquium*, 289–307. Amsterdam, The Netherlands. `https://hal.science/hal-04866506`.

Rizzi, Luigi. 1997. The Fine Structure of the Left Periphery. In Liliane Haegeman (ed.), *Elements of Grammar: Handbook in Generative Syntax*, 281–337. Dordrecht: Springer Netherlands.

Roelofsen, Floris & Jakub Dotlačil. 2023. Wh-questions in dynamic inquisitive semantics. *Theoretical Linguistics* 49(1–2). 1–91.

Theiler, Nadine, Floris Roelofsen & Maria Aloni. 2019. Picky predicates: why believe doesn't like interrogative complements, and other puzzles. *Natural Language Semantics* 27(2). 95–134.