"One tool to rule them all"? An integrated model of the QuD for Hurford sentences[1]

Adèle HÉNOT-MORTIER — *Massachusetts Institute of Technology*

Abstract. A recent line of research (Katzir and Singh (2015) a.o.) develops the idea that felicitous sentences should be possible answers to a "good" Question under Discussion (QuD, Roberts (1996); Van Kuppevelt (1995)). It remains a bit unclear whether a QuD model is *needed* as an additional explanatory tool for pragmatics, partly because the formalization of QuD composition at the subsentential level remains understudied. In this paper, we develop a compositional machinery linking assertions to the implicit questions they evoke, and show that relocating a number of pragmatic principles previously associated to assertions, in the domain of their implicit questions, allows to solve puzzles pertaining to Hurford Disjunctions and variants thereof, in an intuitive way.

Keywords: redundancy, relevance, question under discussion

1. Introduction

Hurford Disjunctions (henceforth, HD, Hurford (1974)), such as (1a-1b), are disjunctions which typically feature entailing disjuncts. Such constructions, at least when they do not involve scalemates such as *some* and *all*, appear redundant regardless on the order of the weak (p) vs. strong (p^+) disjunct.

(1) a. # SuB29 will take place in Noto[2] or Italy. $p^+ \vee p$

b. # SuB29 will take place in Italy or Noto. $p \vee p^+$

Such constructions have been a long-standing puzzle for pragmatic theory, because it appears difficult to devise a single principle accounting for them, as well as all their variants (Marty and Romoli, 2022). Hurford Conditionals (henceforth HC, (Mandelkern and Romoli, 2018)) like (2a-2b) for instance, exhibit an asymmetry that is challenging for existing accounts of Hurford Sentences, due to the fact that (2a-2b) are directly derived from (1a) *via* the *or-to-if* tautology and basic principles of classical logic (cf. 3).

(2) a. # If SuB29 will not take place in Noto, it will take place in Italy. $\neg p^+ \rightarrow p$

b. If SuB29 will take place in Italy, it will not take place in Noto. $p \rightarrow \neg p^+$

(3) *Equivalence between HDs and HCs*

a. (2a) $\equiv \neg p^+ \rightarrow p \overset{\clubsuit}{\equiv} \neg(\neg p^+) \vee p \overset{\spadesuit}{\equiv} p^+ \vee p \equiv$ (1a)

b. (2b) $\equiv p \rightarrow \neg p^+ \overset{\clubsuit}{\equiv} (\neg p) \vee (\neg p^+) \overset{\heartsuit}{\equiv} q^+ \vee q \equiv$ (1a)

$\clubsuit$: *or-to-if* tautology; $\spadesuit$: double-negation elimination; $\heartsuit$: variable change of the form $\neg p := q^+; \neg p^+ := q$, with $q^+ \Rightarrow q$.

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[2]Noto is located in Italy and is where the main session of SuB29 was actually organized.

Previous accounts of the above contrast build on the idea that overt negation has a special status when it come to evaluating redundancy. In this paper, I want to argue for an alternative view that is perhaps more in line with basic intuitions on might have about HCs and HDs – namely the fact that disjunctions and conditionals package information differently, in terms of the potential questions they evoke, and as such are not equally sensitive to the "granularity" of their arguments.

2. Previous approaches

In this section I briefly present three existing accounts of Hurford Sentences: Local Redundancy Checking, Local Contexts, Super-Redundancy. I show how the first two fall short in explaining HCs, even if the conditional is understood as non-material. I then show how the last account captures the contrast between HDs and HCs.

2.1. Local Redundancy Checking

2.2. Local Contexts

2.3. Super-Redundancy

HDs feel redundant; while HCs sound locally irrelevant. Talk about repairs: the fact the repairs are differnt suggets the violation stems from a different source.

3. Linking assertions to questions

To explain the contrast between HDs and HCs, I propose a compositional machinery linking Logical Forms of assertive sentences to the implicit questions they may raise. One sentence might be associated to multiple potential questions. This kind of machinery is independently motivated by the fact that sentences are never uttered in and of themselves; their purpose is to answer a question, overt or not, and to induce further questions. A pragmatic model of assertion therefore needs to integrate what sentences mean, but also what kind of information *structure* they evoke. I will start by defining questions evoked by simplex LFs, containing no operator, quantifier or connective. Once this is done, I will extend the model inductively, by assigning a semantics to negation, disjunction, and implication, in terms of how they manipulate questions and create more complex ones.

3.1. Background assumptions on question semantics

Let us start by reviewing the standard view on questions. Questions are usually seen as the set of their potential answers Hamblin (1973), i.e. as partitions of the Context Set (henceforth CS, Stalnaker (1974)). This is formalized in (4).

(4) *Standard semantics for questions*
Given a Context Set S, i.e. a set of worlds compatible with the premises of the conversation, a question on S is a partition of S, i.e. a set of subsets of S ("cells") $\{c_1,...,c_k\}$ s.t.:

- "No empty cell": $\forall i \in [1;k].\ c_i \neq \emptyset$
- "Full cover": $\bigcup_{i\in[1;k]} c_i = S$
- "Pairwise disjointness": $\forall (i,j) \in [1;k]^2.\ i \neq j \Rightarrow c_i \cap c_j = \emptyset$

Given a Context Set S, and a set of propositions $P = \{p_1,...,p_l\}$ a partition of S can be induced by grouping together the worlds of S which agree on all the propositions of P. This is formalized in (5).

(5) *Partition induced by a set of propositions.*
Given a Context Set S and a set of propositions $\{p_1, ..., p_l\}$, one can define:
- an equivalence relation $\equiv_P$ s.t. $\forall(w,w') \in S.\ w \equiv_P w' \Leftrightarrow \forall p \in P.\ p(w) = p(w')$
- a partition of S induced by P as the set of equivalence classes of $\equiv_P$ on S, i.e. the set $\{\{w'|w' \in S \wedge w \equiv_P w'\}|w \in S\}$.

We call PARTITION(S, P) the partition on S induced by P.

We can then define the questions evoked by a proposition p as the partitions evoked either by p alone, or by p and relevant alternatives to p. If p is not settled in the CS, the former partition takes the form $\{p, \neg p\}$ and amounts to the question of *whether p*. If the set $\mathscr{A}_p$ of relevant alternatives to p contains mutually exclusive propositions covering the CS, then the latter partition is simply $\mathscr{A}_p$ and amounts to a *wh*-question for which p is a felicitous answer.

3.2. Questions evoked by simplex LFs
Let us now go one step further and adapt this definition to a more elaborate model of questions, which will eventually reflect the intuition that logically equivalent sentences can "package" information differently. Building on (Büring, 2003; Riester, 2019; Onea, 2016; Zhang, 2024), we take questions to denote *parse trees* of the CS, i.e. ways to hierarchically organize the worlds that are compatible with the premises of the conversation. Such trees ("Qtrees") have the structure defined in (6).

(6) *Structure of Question-trees (Qtrees)*
Qtrees are trees whose nodes are all subsets of the CS and s.t.:
- Their root generally[3] denotes the CS;
- Any intermediate node is partitioned by the set of its children.

The nodes of such trees can be assigned the following interpretation. The root denotes a tautology over the CS, and any other node, a possible answer to the global question denoted by the tree. Intermediate nodes can generally be seen as non-maximal answers, while leaves can generally be seen as maximal answers.[4] By construction, the leaves of such trees form a partition of the CS, and allow to retrieve the previous notion of question-as-partition. In those trees, any subtree rooted in a node N can be understood as conditional question taking for granted the proposition denoted by N. Finally, a path from the root to any node N can be seen as a strategy of inquiry (or a sequence of conditional questions) leading to the answer denoted by N.

We now use this definition to define the possible Qtrees a simplex LF is compatible with. Before doing this, let us add one last ingredient to the current model, which is that, sentences also distinguish specific nodes (typically leaves) within the Qtrees they evoke, namely the nodes that verify the proposition denoted by the sentence (*prejacent*). In other words, a Qtrees associated with an assertion not only specifies which question the assertion addresses, but also how the

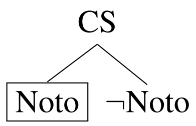
[3]We assume this is the case in the absence of extra presuppositions. In this paper, we will focus on presupposition-less sentences, so all Qtrees will have the same CS as root. But it is reasonable to think that a sentence carrying a presupposition p introduces a questions whose root denotes the CS intersected with p.
[4]We say "generally" here because we think some operators like *at least* can actually influence the relevant level of granularity addressed by a Qtree, such that intermediate nodes can sometimes end up being seen as maximal answers.

assertion actually answers the question. We assume that if a Qtree evoked by a sentence ends up being associated with an empty set of verifying nodes at some point of the Qtree-derivation process, this Qtrees should be deemed ill-formed.

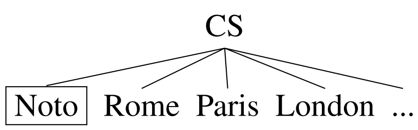
(7) *Qtrees for simplex LFs*
Let X be a simplex LF (no negation, no connective, no quantification) denoting p, not settled in the CS. Let $\mathscr{A}^g_{p,X}$ be a set of relevant alternatives to p, obtained from formal alternatives to X derived *via* the substitution of focused material by a same-granularity alternatives. We assume $\mathscr{A}^g_{p,X}$ partitions the CS. A Qtree for X is either:
  (i) A depth-1 Qtree whose leaves denote PARTITION(CS, $\{p\}$) = $\{p, \neg p\}$
  (ii) A depth-1 Qtree whose leaves denote PARTITION(CS, $\mathscr{A}^g_{p,X}$) = $\mathscr{A}^g_{p,X}$.
  (iii) A depth-k Qtree ($k > 1$), whose leaves denote $\mathscr{A}^g_{p,X}$, and such that removing those leaves yields a Qtree for an LF Y which is a formal alternative to X associated with a strictly coarser granularity.

In any case, the set of verifying nodes is defined as the set of p-leaves.

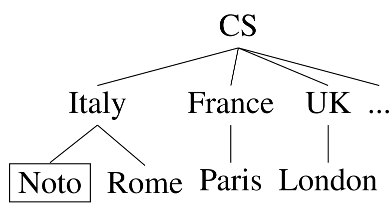
Let us see how this applies to LFs such as X^+=*SuB29 will take place in Noto* and X=*SuB29 will take place in Italy*. The same-granularity alternatives to X^+ different from X^+ are of the form $\{$*SuB29 will take place in Rome*, *SuB29 will take place in Paris ...* $\}$ where *Noto* is replaced by city-level alternatives. The same-granularity alternatives to X different from X are of the form $\{$*SuB29 will take place in France*, *SuB29 will take place in the UK ...* $\}$ where *Italy* is replaced by country-level alternatives. Moreover, X can be seen as a coarser-grained alternative to X^+. This implies that X^+ and X are respectively compatible with the Qtrees in Figures 1 and 2. In such trees, we assume each node denotes the proposition it is labeled after, properly intersected with the CS. Boxed node represent verifying nodes, as induced by the prejacent proposition. Because X is coarser grained than X^+, the Qtrees obtained *via* principle (7iii) for X^+ will always be refinements of the Qtrees obtained for X *via* the same principle. The refinement relation is defined in (8).



(a) Qtree obtained from (7i)



(b) Qtree obtained from (7ii)



(c) Qtree obtained from (7iii)[5]Note this Qtree constitutes a refinement of the Qtree in Figure 2b.

Figure 1: Qtrees for X^+=*SuB29 will take place in Noto*

[5]Note that in principle more tiers can be added to that kind of Qtree, according to principle (7iii). For simplicity we only consider a city vs. country distinction here. The crucial point is that both X and X^+ are parametrized by the same tiers of same-granularity alternatives, whatever they are.

(a) Qtree obtained from (7i) (b) Qtree obtained from (7ii)

Figure 2: Qtrees for *X=SuB29 will take place in Italy*

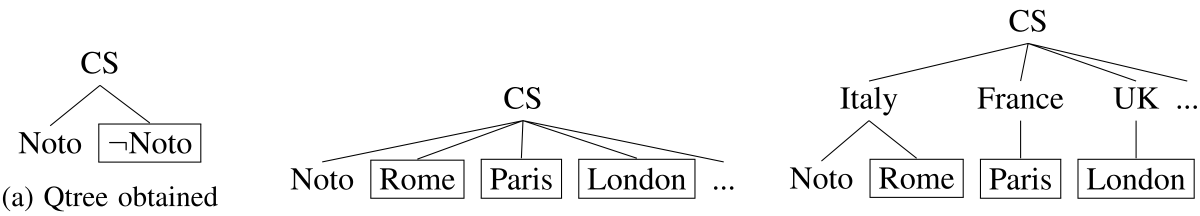
(8) *Qtree Refinement*. A Qtree T is a refinement of another Qtree T' iff T' can de obtained from T *via* some recursive trimming of T's leaves.

3.3. Questions evoked by negated LFs

We assume negated LFs evoke questions that are structurally similar to those evoked by their non-negated counterpart. The only difference resides in the set of verifying nodes, which is flipped by negation. This is formalized in (9).

(9) *Qtrees for negated LFs*
A Qtree T' for $\neg X$ is obtained from a Qtree T for X by:
- retaining T's structure;
- defining the set of T''s verifying nodes, $\mathbb{N}^+(T')$ as $\{N' | N' \notin \mathbb{N}^+(T) \wedge \exists N \in \mathbb{N}^+(T).\ d(N',T') = d(N,T)\}$, where $d(N,T)$ denotes the depth of a node N in a tree T.[6]

Qtrees corresponding to $\neg X^+$=*SuB29 will not take place in Noto* are given in Figure 3. They are derived by simply swapping verifying and non-verifying leaves in the Qtrees from Figure 1, corresponding to X^+=*SuB29 will take place in Noto*.



(a) Qtree obtained from (7i) (b) Qtree obtained from (7ii) (c) Qtree obtained from (7iii)[7]

Figure 3: Qtrees for $\neg X^+$=*SuB29 will not take place in Noto*

3.4. Questions evoked by disjunctive LFs

Building on Simons (2001); Zhang (2024), we assume disjunctive LFs raise questions pertaining to both disjuncts *in parallel*. In other words, disjuncts should mutually address each-other's questions. This is modeled by assuming that disjunctions return all possible unions of the Qtrees evoked by both disjuncts, filtering out the outputs that do not qualify at Qtrees.

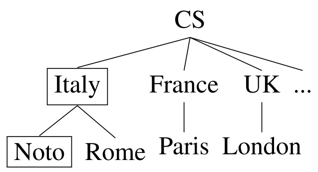
[6]Note that, if all verifying nodes are leaves, this definition is simplified: $\{N' | N' \notin \mathbb{N}^+(T) \wedge leaf(N')\}$. Moreover, because T and T' have same structure, the tree-argument is irrelevant to determine node depth in that particular case: $\forall N.\ d(N,T') = d(N,T)$. We keep it because, in the general case, node-depth depends on tree structure.

(10) *Qtrees for disjunctive LFs*
A Qtree T for $X \vee Y$ is obtained from a Qtree T_X for X and a Qtree T_Y for Y by:
- unioning the nodes, edges, and verifying nodes of T_X and T_Y;
- returning the output only if it is a Qtree.

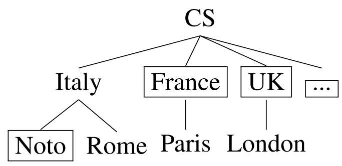
In other words, $Qtrees(X \vee Y) = \{T_X \cup T_Y | T_X \cup T_Y \text{verifies (6)} \wedge (T_X, T_Y) \in Qtrees(X) \times Qtrees(Y)\}$

GIVE PROBLEMATIC CONFIGURATION

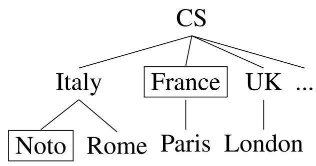
A prediction of this definition is that two Qtrees sharing the same CS can be properly disjoined only iff they appear structurally parallel up to a certain level, and any further partitionings they independently introduce do not "clash" with each other.[8] In our particular case, this predicts that two sentences evoking different levels of granularity (e.g., city-level vs. country level) can in principle be disjoined by picking Qtrees T and T' for resp. the finer-grained and coarser-grained disjunct, s.t. T, constitutes a refinement of T' as per (8). The only Qtree compatible with (1a-1b) is thus given in Figure 4a.



(a) Qtree for the HDs (1a-1b), derived by disjoining Qtrees 1c and 2b



(b) Qtree for (11a).



(c) Qtree for (11b).

Figure 4: Qtrees for disjunctive sentences featuring disjuncts with different levels of granularity.

Why should we predict that Qtrees for odd HDs like (1a-1b) are derivable in the first place? We think this kind of prediction is in fact useful, to derive Qtrees for other closely related disjunctive sentences such as (11a-11b), which feature disjuncts with different levels of granularity (just like (1a-1b)), but that are not in an entailment relation. Qtrees for (11a-11b) are given in Figures 4b and 4b.

(11) a. SuB29 will take place in Noto or will not take place in Italy.

[8]We assume two Q-trees T and T' feature a bracketing clash iff there is $N \in T$ and $N' \in T'$ s.t. $N = N'$ but the sets of children of N and N' differ. We show that if T and T' exhibit such a clash, their disjunction is not a Q-tree. Let's call C and C' the sets of nodes of resp. T and T' that induce a bracketing clash; by assumption, C and C' are s.t. $C \neq C'$, and have mothers N and N' s.t. $N = N'$. Because $\vee$ achieves graph-union, $T \vee T'$ will have a node N with $C \cup C'$ as children, and because $C \neq C'$, $C \cup C' \supset C, C'$. Given that both C and C' are partitions of N, $C \cup C'$ cannot be a partition of N. Conversely, if two Q-trees T and T' sharing the same CS as root are s.t. their union $T \cup T'$ is not a Qtree, it must be because T and T' had a bracketing clash. Indeed, under those assumptions, $T \cup T'$ not being a Qtree means one node N in $T \cup T'$ is not partitioned by its children. Given N is in $T \cup T'$, N is also in T, T', or both. If N was only in, say, T, then it means N's children are also only in T, but then, T itself would have had a node not partitionned by its children, contrary to the assumption T is a Qtree. The same holds *mutatis mutandis* for T', so, N must come from *both* T and T'. Let us call C and C' the partitioning introduced by N in resp. T and T'. The fact C, C', but not $C \cup C'$ partition N entails $C \neq C'$, i.e. T and T' feature a bracketing clash.

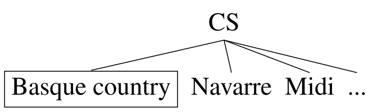
b. SuB29 will take place in Noto or in France.

These two additional examples and their Qtrees also suggest what the issue seems to be in the case of the HDs (1a-1b) and their Qtree in Figure 4a: a strategy of inquiry connecting the root to the verifying node *Noto*, properly contains a strategy of inquiry connecting the root to the verifying node *Italy*. In other words, inquiring about *Noto* amounts to inquiring about *Italy*. We will formalize this intuition in the form of an updated REDUNDANCY constraint in the next Section.

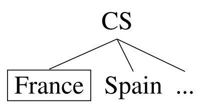
Before moving on to the conditional case, let us point out one case where disjunction fails to produce any Qtree, based on the sentence in (12), whose disjuncts are not in an entailment relation, but still appear mutually compatible Singh (2008).[9]

(12) # Sub29 will take place in the Basque country or France.

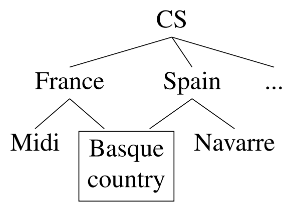
(12) has its first disjunct suggest a partitioning involving regions, and such that the Basque country represents a (verifying) leaf; and its second disjunct suggest a by-country partition, such that France represents a (verifying) leaf. This is exemplified in Figures 5a and 5b using principle (7ii) for simplex Qtree formation (the prediction is the same under principle (7i)). But such trees cannot be properly disjoined together, due to the fact that they introduce different, parallel partitionings. The only remaining way to disjoin Qtrees associated with each disjunct of (12), would be to create a tiered Qtree involving a by-country layer for *Sub will take place in the Basque country*, *via* principle (7iii). But a problem arises in the formation of such a Qtree, which is that building edges between the country-level tier and the region-level tier leads to a cycle, as shown in Figure 5c. In other words, the resulting “Qtree” cannot be a tree in the first place. To summarize, we predict a sentence like (12) to be odd because it cannot lead to any well-formed disjunctive Qtree.



(a) A simple Qtree for *Sub will take place in the Basque country*, given principle (7ii).



(b) A simple Qtree for *Sub will take place in France*, given principle (7ii)



(c) A tentative Qtree for *Sub will take place in the Basque country*, given principle (7iii)

Figure 5: Tentative Qtrees for the disjuncts of (12).

3.5. Questions evoked by conditional LFs

Building on insights from the psychology literature which revealed that subjects tend to massively overlook the eventualities falsifying the antecedent when verifying the truth conditions of conditionals Wason (1968), we assume conditional LFs preferentially raise questions pertaining to their consequent, *in the domain(s) of the CS where the antecedent holds*. This is

[9] Given tat the Basque country is made up of Northern Central Spain and southwestern France.

modeled by assuming that implications return Qtrees evoked by their antecedent whose verifying nodes get replaced by their intersection with a Qtree evoked by the consequent. Similarly to disjunctions, this process is assumed to filter out the outputs that do not qualify at Qtrees.

(13) *Qtrees for conditional LFs*
A Qtree T for $X \rightarrow Y$ is obtained from a Qtree T_X for X and a Qtree T_Y for Y by:

- replacing each node N of T_X that is in $\mathbb{N}^+(T_X)$ by $N \cap T_Y$, where $N \cap T_Y$ (intersection between a node and a Qtree) is defined as T_Y, where each node gets intersected with N and empty nodes as well as trivial ("only child") links get removed; and where T_Y's verifying nodes are preserved;
- returning the result only if it is a Qtree.

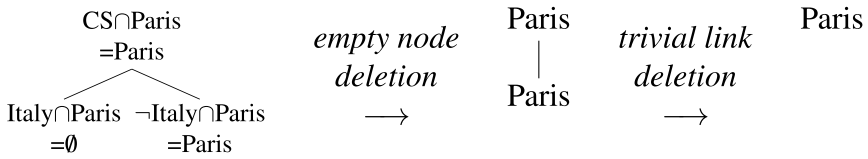
In other words, $Qtrees(X \rightarrow Y) = \{T_X \cup \bigcup_{N \in \mathbb{N}^+(T_X)} (N \cap T_Y) | T_X \cup \bigcup_{N \in \mathbb{N}^+(T_X)} (N \cap T_Y) \text{verifies (6)} \wedge (T_X, T_Y) \in Qtrees(X) \times Qtrees(Y)\}$

A general prediction of this definition is that, for an antecedent Qtree T_X and a consequent Qtree T_Y to be properly combined, the CS (root) of T_Y should be a superset of each verifying node of T_X. In other words, anything the antecedent asserts to be true should be part of the CS of the consequent.[10] Violations of this condition do not arise with the data at stake here, because we assume that antecedent and consequent Qtrees share the same CS. But this is to keep in mind for cases where the consequent may introduce additional presuppositions further restricting the size of its "local" CS.[11]

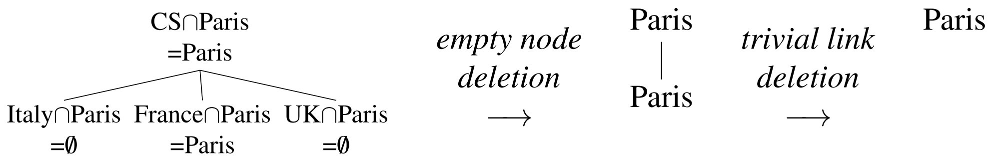
A more targeted prediction of the above definition that directly applies to our case study, is that intersecting a city-level node with a country-level Qtree does not have any effect – consistent with the intuition that answering a question about cities automatically answers the a similar question at the country level. This is shown below, using *Paris* as city-node and the trees from Figure 2to represent country-level questions.

[10]Indeed, if T_X had a verifying node N that were a strict superset of the CS of T_Y, then the intersected tree $N \cap T_Y$ replacing N in T_X by the effect of the Qtree conditionalization operation, would have a strict subset of N as its root, which would entail a violation of the partition property on the resulting conditional Qtree (in particular, $N \cap CS_Y \subset N$ and its sisters would no longer fully cover the set denoted by their mother).

[11]More specifically, if we assume the consequent Qtree's root denotes $CS \cap p$, Cs being the root of the antecedent Qtree, the condition becomes $\forall N \in \mathbb{N}^+(T_X).\ N \subseteq CS \cap p$ which entails $\forall N \in \mathbb{N}^+(T_X).\ N \subseteq p$. In other words, we expect presuppositions carried by the consequent to be entailed by the local context defined by the antecedent Qtree (in the form of $\mathbb{N}^+(T_X)$).



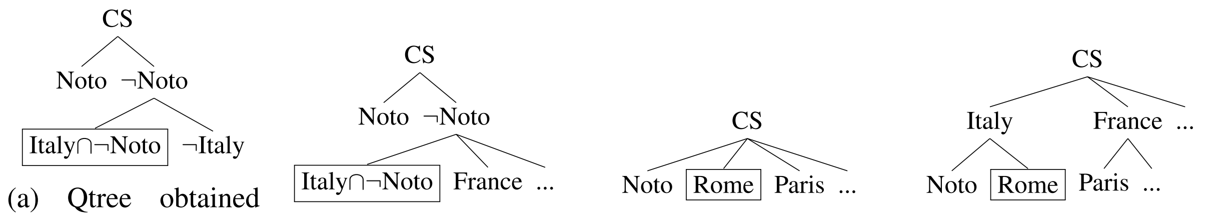
(a) Derivation of Paris∩Tree 2a=Paris



(b) Derivation of Paris∩Tree 2b=Paris

Figure 6: Intersecting a city-level node and a country-level tree yields the input city-level node.

Let us now turn to the HCs (2a-2b) and their Qtrees, shown in Figures 7 and 8. Note that the Trees in Figures 7c and 7d appear structurally similar to the antecedent Qtrees used to form them, due to the above prediction about city-node-country-Qtree intersection.



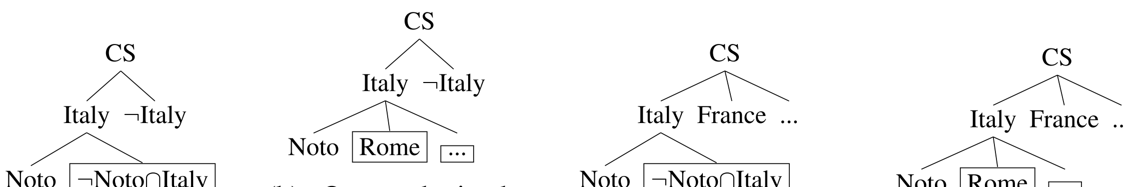
(a) Qtree obtained from Tree 3a and Tree 2a.

(b) Qtree obtained from Tree 3a and Tree 2b.

(c) Qtree obtained from Tree 3b and Tree 2b or 2a.

(d) Qtree obtained from Tree 3c and Tree 2b or 2a.

Figure 7: Qtrees for (2a)=#*If SuB29 will not take place in Noto, it will take place in Italy.*



(a) Qtree obtained from Tree 2a and Tree 3a.

(b) Qtree obtained from Tree 2a and Tree 3b or 3c.

(c) Qtree obtained from Tree 2b and Tree 3a.

(d) Qtree obtained from Tree 2b and Tree 3b or 3c.

Figure 8: Qtrees for (2b)=*If SuB29 will take place in Italy, it will not take place in Noto.*

In any case, it seems that many Qtrees are available, for both the felicitous variant (2b) and the infelicitous variant (2a). What is the difference between these two sets of Qtrees? Intuitively, it seems that *some* Qtrees compatible with (2b), namely Trees 8b and 8d, *still* discuss a by-city distinction pertaining to their consequent (after conditionalization); while *none* of the Qtrees compatible with (2a) still discuss a by-country distinction as introduced by their consequent. In other words, it seems the consequent of (2b) can be taken to be relevant to the global question raised by this sentence, while the consequent of (2a) *cannot*. We will formalize this intuition in the form of an updated RELEVANCE constraint in the next Section.

4. Relocating Redundancy and Relevance to the realm of implicit questions

We now rephrase two constraints originally formulated to apply to sentences, REDUNDANCY and RELEVANCE, in order for them to apply to the *implicit question(s)* raised by sentences. The general enterprise is to make such constraints sensitive to the logical meaning of sentences, but also, to how sentences "package" this logical information, *via* their implicit QuDs. This idea, combined with the distinct semantics we assigned to disjunctions and conditionals at the inquisitive level, allows to account for the contrast between HDs and HCs.

GIVE PROBLEMTIC CONFIGURATION casesin whic replacement kicksin non-terminal node: structure gets overwritten if Germany or Paris then

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