Partial Movement Constructions, Pied Piping, and Higher Order Choice Functions

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1 Introduction

The aim of this paper is to tie together three seemingly unrelated issues discussed in Stechow (1996*a*), Stechow (2000*a*) (also published as Stechow (1996*b*)), and Stechow (2000*b*). The first is Pied Piping at LF, the second is the so-called *Partial Movement* or *Scope Marking* construction, and the third concerns choice functions in natural language semantics. I start with discussing the analysis of partial movement in Horvath (1997) and Horvath (2000), which involves the kind of LF pied piping also discussed (and criticized) in Stechow (1996*a*). I will then, uses higher order choice functions, propose an alternative analysis that is immune against the criticism raised by v. Stechow. Finally, I will show that the method employed to handle the data from Hungarian can also be used to semantically interpret pied piping in general.

2 Combining Pied Piping and "Partial" Movement

2.1 LF Pied Piping

Stechow (1996*a*) argues against the theory of LF proposed by Nishigauchi (1990). The empirical problem under discussion is that in Japanese (which is a *wh*-in-situ language) one would like to analyze certain ungrammatical *wh*-constructions by assuming that they violate an island constraint like subjacency (for *wh*-movement at LF), while other types of constructions are grammatical although their analysis would also imply a violation of the same constraint (e.g. subjacency). For example, Japanese seems to exhibit a *wh*-island constraint which enforces (1-a) to be interpreted as (1-b) but not as in (1-c):

(1) a. Tanaka-kun-wa [$_{\text{CP}}$ dare-ga nani-o tabe-ta- ka]
Tanaka who what ate Q
oboe-te-i-masu- ka?
knows Q
b. Does Tanaka know, who ate what?
c. For which x does Tanaka know who ate x?

However, whereas (1) seems to be blocked by subjacency, a complex NP construction can be understood as involving long movement, thereby violating the constraint:

(2) a. Kimi-wa [$_{\text{NP}}$ [$_{\text{CP}}$ dare-ga kai-ta] hon-o] yomi-masi-ta-
you-TOP who-NOM wrote book-ACC read
ka?
Q
b. For which x does it hold that you read a book that x wrote?

The solution suggested by Nishigauchi (1990) is that in the latter kind of construction we are allowed to do some amount of pied piping that respects the relevant island constraint at LF, parallel to the usual cases of pied piping at S-structure. Schematically, this is illustrated in (3). (3-a) is a grammatical S-structure, with α being an island. (3-b) is an LF for (3-a) which would violate the island condition; this analysis must therefore be rejected. (3-c) is the structure proposed by Nishigauchi:

(3) a. ... [$_\alpha$ ... *wh*-term ...] ...
b. * [$_{\text{SpecC}}$ *wh*-term$_i$] ... [$_\alpha$ ... t_i ...] ...
c. [$_{\text{SpecC}}$ [$_\alpha$ ... *wh*-term ...]$_j$] ... t_j ...

Von Stechow's criticism against this analysis is that the structure in (3-c) cannot be interpreted in any commonly accepted semantic theory.

As another concrete illustration which brings together Stechow (1996*a*) and Stechow (2000*a*), consider the analysis of so called partial *wh*-movement constructions discussed in Horvath (1997):

(4) a. **Mit** kérdeztek, hogy **kivel** találkoztam-e?
what-ACC asked-3pl that who-with met-1sg-Q-prt
'Who did they ask whether I had met?'
b. **Mit** akartak tudni hogy **kit** láttál-e?
what-ACC wanted-3pl know-inf that who-ACC saw-2sg-Q-prt
'Who did they want to know whether you had seen?'

Here, **mit** is analyzed as a scope indicator that marks the logical scope of the correlated *wh*-terms **kivel** and **kit**; cf. Lutz et al. (2000) for an extensive discussion of scope marking in various languages.

On the basis of the ungrammaticality of "ordinary" extractions from subject or adjunct clauses, – cf. (5)–, and in particular on the basis of the ungrammaticality of LF extraction in complex NP condition effects, – cf. (6)–,

(5) a. ?***Kinek** zavarta Marit [$_{CP}$ hogy telefonáltál **t**] ?
who-DAT disturbed Mary-ACC that phoned-2sg
Lit. 'To whom did that you phoned disturb Mary?'
b. ***Kivel** vagy dühös [$_{CP}$ mert találkoztál **t**] ?
who-with are-2sg angry because met-2sg
Lit. 'Who are you angry because you had met?'

(6) ***Mit** hallottál [a hírt [hogy **kivel**
What-ACC heard-2sg.indef.DO the news-ACC that who-with
találkozott Mari t]]?
met-3sg Mary-NOM
Lit.: What did you hear the news with whom had Mary met?

Horvath concludes that a proper analysis of (5) and (6) implies (illegal) movement of the *wh*-term across a subjacency island. However, for the data in (4), we encounter a problem, because movement here would also imply an island violation, but the sentences are grammatical.

As a hint to a possible solution, observe now that the data from Hungarian exhibit another unusual property, namely that the morphology of the matrix *wh*-term agrees with the grammatical function of the embedded CP, cf.:

(7) a. **Mi** zavarta Marit, [$_{CP}$ hogy **kinek**
what-NOM disturbed Mary-ACC that who-DAT
telefonáltál t] ?
phoned-2sg
'What disturbed Mary, to whom you phoned?'

b. **Miért** vagy dühös [$_{\text{CP}}$ mert **kivel** találkoztál **t**] ?
why are-2sg angry because who-with met-2sg
Lit. 'Why are you angry, because who you had met?'

On the grounds of these agreement facts, Horvath suggests that it is not the *wh*-term that moves to the scope marker at LF, but the entire CP, which thereby gets into a local relation to the scope marker in order to agree with it. This is assumed to be a case of (morphologically supported) CP-pied-piping. Note that in such an analysis, CP internal "partial movement" of the *wh*-item is not really partial, because it is not continued at LF.

The strategy pursued here is parallel to that schematized in (1). Observe also, that the situation in Hungarian seems to be the mirror image to that in Japanese: Whereas pied piping is considered a solution for the *wh*-island cases like (4) it cannot be involved in the CNPC-effect in (6), whereas the reverse is required to account for the above mentioned data from Japanese. In what follows these differences are considered less important than the parallelism: The analysis given in Horvath (1997) is subject to the same severe criticism as the one by Nishigauchi – the resulting LF seems semantically uninterpretable.

2.2 Copying or Reconstruction

Stechow (1996*a*) discusses a solution to this problem which is based on the idea of reconstruction at LF. This means that the derivation does not stop at the point described in the last section. Accordingly, (3-c), repeated as (8-a) below, is not the LF of (3); rather, the derivation must proceed as shown in (8):

(8) a. $[_{\text{SpecC}}\ [_{\alpha} \ldots\ wh\text{-term} \ldots]_j\ ] \ldots t_j \ldots$ (pre-LF)
b. $[_{\text{SpecC}}\ wh\text{-term}_i\ [_{\alpha} \ldots \mathrm{t}_i \ldots]_j\ ] \ldots t_j \ldots$ (*wh*-movement)
c. $[_{\text{SpecC}}\ wh\text{-term}_i\ ] \ldots [_{\alpha} \ldots \mathrm{t}_i \ldots]_j \ldots$ (LF)

As is obvious from (8-c), undoing pied piping at LF yields the correct result concerning the semantics; however, as noted by v. Stechow, the derivation of (8-b) reintroduces exactly the kind of island violation that we were trying to avoid.

In fact, two strategies are discussed in Stechow (1996*a*); the first one is reconstruction by movement, as illustrated in (8), the second is reconstruction via deletion within a copy theory of movement. The second strategy is also the one adopted in Horvath (2000). In both cases, the resulting LF is identical to the one schematized in (3-b) (= (8-c)). But as Stechow points out, both analyses are non-solution, because they tend to undermine the theory of islandhood altogether.

I totally agree with this conclusion. So in what follows I will develop a semantic method for interpreting the problematic sentences that does not violate any syntactic island constraints.

3 Introducing Choice Functions

Above we presupposed that at LF the *wh*-phrase is moved to the scope marker. This theory is traditionally called direct dependency approach of partial movement constructions (the DDA). We now switch to an alternative semantics developed in Srivastav (1991), Dayal (1996) and Dayal (2000), also called the indirect dependency approach (IDA). For reasons of space I must assume some familiarity with this theory, it is extensively discussed in the contributions to Lutz et al. (2000) and also in Sternefeld (to appear).

Discussing the IDA, Horvath (2000) correctly points out that this theory does not really help because we do not yet know what a correct semantics for (4) and (7) within that theory looks like. For example, the adjunct CP in (7-b) itself cannot be interpreted as a question, i.e., as a set of propositions, as would be required in Dayal's theory. This is mirrored by the fact that the phrases in (9) cannot be interpreted as ordinary questions:

(9) a. *Because you had met who?
 b. *Who because you had met?

Horvath therefore dismisses with the IDA in favor of the DDA.

Although Dayal's semantics is indeed unable to deal with (4) or (7), we can extend her semantics in a straightforward way in order to cover these cases as well. Following Karttunen and Hamblin in assuming that question formation proceeds by forming sets of *propositions* out of a single open proposition, we may generalize this procedure by forming sets of denotations of other logical types as well. For example, given that an ordinary *because*-clause denotes a property of propositions, the *because*-clause in (9) denotes a set of such properties. With $\{a, b, b, \dots, \}$ as the set of persons, this set can be written as (10):

(10) {the property of p such that p holds because you had met a, the property of p such that p holds because you had met b, the property

of p such that p holds because you had met c, ...}

Technically it would also be possible to implement (10) as a characteristic function, as one would do in type theory. However, in order to make quite clear what the distinguished new parts of the present theory are, we will in what follows stick to the above (unusual) implementation, continuing with sets rather than with their characteristic functions.

Next we modify Reinhart's semantics for *wh*-in-situ as developed in Reinhart (1994). Proceeding parallel to what has been proposed for *which*-questions, we now apply a choice function to the set described in (10). The correlate in the matrix sentence will then be interpreted as shown in (11), namely as a choice function that selects an element from the set described in (10):

(11) $\lambda p \exists f(\text{choice-function}(f) \wedge \ p = \text{I am angry} f((10)))$

This gives us the set of possible answers (12), which is precisely the result we wanted to obtain.

(12) {I am angry because you had met a, I am angry because you had met b, I am angry because you had met c, ...}

Note that (10) is the result of a type shifting operation that builds *sets* of entities of type α (to be described more precisely further below), whereas choice functions *undo* this type-shifting operation, yielding entities of type α again. As a result, applying a choice function to the "questioned" *because*-clause regains the correct type for being interpreted in the usual way, as a property of propositions. Our use of choice functions is therefore different from Reinhart's; we here employ higher order choice functions, and in order to mark this new use of choice functions typographically I will capitalize letters as shown in (11′):

(11′) $\lambda p \exists F(\text{choice-function}(F) \wedge \ p = \text{I am angry } F(\{\mathcal{R} : \exists x(\mathcal{R} = \lambda p[p \text{ because you met } x])\}))$

As another illustration of the proposed method consider *Was*-*w*-constructions in German. As discussed in Sternefeld (to appear) I assume that the embedded partial movement sentence is extraposed in S-structure and reconstructed at LF. The semantically relevant part of the derivation is shown in (13-c-ii):

(13) Was glaubst du wer kommt ?
What believe you who comes

a. *D-Structure:*
$[_{\mathrm{IP}}$ du $[_{\mathrm{NP}}$ **was** $[_{\mathrm{CP}}$ **wer** kommt?]] glaubst]

b. *S-Structure:*
(i) *Extraposition:*
$[_{\mathrm{IP}}$ $[_{\mathrm{IP}}$ du $[_{\mathrm{NP}}$ **was** t_i] glaubst]$[_{\mathrm{CP}_{+Wh}}$ **wer** kommt? $]_i$]
(ii) *Wh*-movement:
$[_{\mathrm{CP}_{+Wh}}$ **was**$_j$ $[_{\mathrm{IP}}$ $[_{\mathrm{IP}}$ du $[_{\mathrm{NP}}$ t_j t_i] glaubst]$[_{\mathrm{CP}_{+Wh}}$ **wer** kommt? $]_i$]
(iii) *V/2:*
$[_{\mathrm{CP}_{+Wh}}$ **was**$_j$ $[_{\mathrm{C'}}$ glaubst$_k$ $[_{\mathrm{IP}}$ $[_{\mathrm{IP}}$ du $[_{t_j}$ t_i] t_k]$[_{\mathrm{CP}_{+Wh}}$ **wer** kommt? $]_i$]]

c. *LF*:
(i) *Reconstruction of V/2 and extraposition:*
$[_{\mathrm{CP}_{+Wh}}$ **was**$_j$ $[_{\mathrm{IP}}$ du $[_{\mathrm{NP}}$ t_j $[_{\mathrm{CP}_{+Wh}}$ **wer** kommt?]] glaubst]]
(ii) *Semantic Interpretation:*
$\lambda p \exists F$(choice-function$(F) \wedge$ p = $[_{\mathrm{IP}}$ du glaubst $F([_{\mathrm{CP}_{+Wh}}$ **wer** kommt]))]

Pursuing the IDA, the embedded CP is interpreted as the set of possible answers, as usual. From this set the choice function, which is the translation of the trace of **was**, selects a possible answer, i.e., a proposition embedded by the verb *believe*; the choice function variable itself is bound by **was**. The resulting truth conditions are logically equivalent to those obtained by the DDA.

Returning to the Hungarian example (4-a), I assume that **mit** and its allomorphs denote existentially quantified choice functions, which select an element from the set denoted by its complement. Given that the *whether*-clause is interpreted as usual (i.e. as the characteristic function of a set {*p*, *not p*}, I interpret the CP *whether I had met who* of (4-a) as a higher order question (a set of questions) (14-a). The complement of *ask* must then be selected by a choice function, as shown in (14-b):

(14) a. $\mathcal{Q}$:= {Q: $\exists x$ person(x) & Q = *whether I had met* x}
b. $\lambda p.\exists F$(choice-function$(F) \wedge p$ = *they asked* $F(\mathcal{Q})$)

This represents the correct truth conditions for (4-a).

Not surprisingly, this method also works for the remaining cases. It immediately solves the problem mentioned above, namely that on Dayal's original account, (4) is not interpretable. It is interpretable if we turn to higher order choice functions. The above proposal also solves Horvath's problem that the embedded *wh*-terms are contained in an island: no syntactic relation whatsoever holds between the embedded *wh*-phrase and the so-called *wh*-expletive (the operator that binds the choice function). As a consequence of having adopted the IDA, all relations involved so far are completely local; cf. also Sternefeld (to appear) for additional discussion of the IDA vs. DDA.

4 A Semantics for Pied Piping

Let us now consider more closely the mechanism that does the type shifting mentioned above. As it turns out this mechanism can be used to interpret pied piping.

Above we assumed that a *wh*-in situ induces an interpretation that yields sets of entities among which a choice function has to pick out an individual. The logical type of such an individual can be quite arbitrary; it has been a reason in (11′), a question in (14), a proposition in (13), and an individual in Reinhart's original theory. Suppose now, it could in fact have any logical type, so that there is a simple mechanism that locally (and in situ) type shifts all expressions containing a *wh*-in-situ. We may conceive of this in the following way:

Assume that a *wh*-phrase like *who* denotes the set of persons, i.e. a subset of the domain D of type e. We say that the logical type of this set is $\langle e//t\rangle$. In general we use the notation $\langle \alpha//t\rangle$ for sets of entities of type α. Assume now that an expression x has type $\langle \alpha//t\rangle$ and that P has the logical type $\langle \alpha/\beta\rangle$.

(15) a. If $[\![x]\!] \in D_{\langle\alpha//t\rangle}$ and $[\![P]\!] \in D_{\langle\alpha/\beta\rangle}$, then $[\![P(x)]\!] = \{b : \exists a(a \in [\![x]\!] \wedge b = [\![P]\!](a))\} \in D_{\langle\beta//t\rangle}$.

b. F is a generalized choice function with $x \in D_{\langle\alpha//t\rangle}$ as an argument iff $F \in D_{\langle\langle\alpha//t\rangle,\alpha\rangle}$ and $F(x) \in x$.

Let us illustrate (15) with the semantic interpretation of pied piping. We now predict that the pied piped material has some category $\langle \alpha//t\rangle$ because it contains a *wh*-phrase (in situ within the pied piped phrase) that induces the interpretation as a set. For example, an expression like *whose mother* (= 'the mother of who') can be interpreted as follows: Given that *mother* is relational in having the type $\langle e, \langle e,t\rangle\rangle$, *mother of who* has type $\langle\langle e,t\rangle//t\rangle$, and *the mother of who* (= *whose mother*) has type $\langle e//t\rangle$, which is the type of the set of DP denotations shown in (16):

(16) {the mother of a, the mother of b, the mother of c, ...}

It is understood that the very same general mechanism also yields the complex denotations we needed above as the argument of the higher order choice functions. But let us now return to the semantic interpretation of pied piping.

According to my view of feature driven movement, the checking relation that triggers movement must be very local, whereas cases of pied piping seems to involve a configuration where this relation is typically not local enough to trigger movement. In other words, feature driven pied piping should, in my view, not be possible at all. As a solution to this syntactic problem, let us assume that the trigger of movement of a DP like *whose mother* is not *whose* but an empty correlate of the entire pied piped constituent, i.e. *whose mother*. Likewise, a PP like *with whose mother* would have an empty correlate as shown in (17-b):

(17) a. $[_{\text{SpecC}}$ $[_{\text{DP}}$ $\emptyset_{+W}$ $[_{\text{DP}}$ whose mother $]]_i$ did $[_{\text{IP}}$ you see t_i $]]$
b. $[_{\text{SpecC}}$ $[_{\text{PP}}$ $\emptyset_{+W}$ $[_{\text{PP}}$ with whose mother $]]_i$ did $[_{\text{IP}}$ you talk t_i $]]$

It is this empty position which solves the problem of the feature checking mechanism, simply because $\emptyset_{+W}$ bears the local *wh*-feature that triggers movement to SpecC. But it also solves the semantic problem of interpreting pied piping. As might be obvious from the above, I assume that $\emptyset_{+W}$ is interpreted as the choice function that selects one of the elements in (16) (i.e., one of the corresponding PPs in (17-b)). All that remains to be done is to add the usual binder of the choice function. We can do this even without syntactic reconstruction, if we assume that at LF the required logical material is adjoined to CP:

(18) a. $\lambda p \exists F$(choice-function(F) $\wedge$ p = $[_{\text{CP}}$ $[_{\text{SpecC}}$ $[_{\text{DP}}$ F $[_{\text{DP}}$ whose mother $]]]$ λx $[_{\text{IP}}$ you see x $]])$
b. $\lambda p \exists G$(choice-function(G) $\wedge$ p = $[_{\text{CP}}$ $[_{\text{SpecC}}$ $[_{\text{PP}}$ G $[_{\text{PP}}$ with whose mother $]]$ λy $[_{\text{IP}}$ you talk y $]])$

By lambda conversion this is equivalent to (19):

(19) a. $\lambda p \exists F$(choice-function(F) $\wedge$ p = $[_{\text{CP}}$ $[_{\text{IP}}$ you see $[_{\text{DP}}$ F $[_{\text{DP}}$ whose

mother]]]])

b. $\lambda p \exists G$(choice-function$(G) \wedge\ p =$ [$_{\text{CP}}$ [$_{\text{IP}}$ you talk [$_{\text{PP}}$ G [$_{\text{PP}}$ with whose mother]]]])

And this is of course equivalent to (20):

(20) a. $\lambda p \exists x(p =$ [$_{\text{CP}}$ [$_{\text{IP}}$ you see [$_{\text{DP}}$ x's mother]]])

b. $\lambda p \exists x(p =$ [$_{\text{CP}}$ [$_{\text{IP}}$ you talk [$_{\text{PP}}$ with x's mother]]])

Given this equivalence and our (formally not really essential) assumption that the semantic part of question formation is not realized in C (there is no such operator in C) it should be clear that simple questions like *which man did you see* could also be analyzed even without invoking the traditional semantics of questions. This is because the set forming mechanism described in (15) yields a set of propositions S such that the characteristic function of S is identical to the traditional Hamblin/Karttunen semantics for questions.

5 Relative Clauses

An obvious question at this point is whether the same method of interpreting pied piping might also work for relative pronouns. The mechanism should be parallel to the one described above, implying an invisible trigger for syntactic movement, and some kind of semantic interpretation for it. By analogy, the relative pronoun itself cannot move into the relevant operator position but must be treated in situ.

Given that the semantics of the relative pronoun is usually described as lambda abstraction, the interpretation of (21-a) would have to assume something like (21-b) which is logically equivalent to (21-c,d):

(21) a. the man whose mother you see

b. (ιz)(man $\&_{\langle e,t \rangle}$ λx [$_{\text{CP}}$ [x's mother] λy [$_{\text{IP}}$ you met y]])(z)

c. (ιz)(man $\&_{\langle e,t \rangle}$ λx [$_{\text{CP}}$ [$_{\text{IP}}$ you met [x's mother]]])(z)

d. (ιz)(man$(z) \wedge$ [$_{\text{CP}}$ [$_{\text{IP}}$ you met [z's mother]]])

If the relative pronoun could be interpreted as a free variable, the semantics would fall out straightforward. However, two problems arise: First, there is no local syntactic trigger for pied piping in (21), and second, the relation between the binder λx and the bound variable x presumably crosses a left branch island. We must therefore reformulate the above semantics in a more roundabout way, as an interpretation of the LF in (22):

(22) the man λx [$_{\mathrm{CP}}$ [$_{\mathrm{DP}}$ $\emptyset_{+R}$ [$_{\mathrm{DP}}$ whose mother]] λy [$_{\mathrm{IP}}$ you met y]]

(22) suggests that the pied piped phrase should be something like λz [z's mother], and that the empty correlate $\emptyset_{+R}$ adjoined to the DP should simply be the variable x bound by lambda abstraction adjoined to CP. This way of iterating lambda abstraction yields the correct truth conditions. What remains to be accounted for is a systematic way of generating the interpretation of pied piped material. This is done parallel to (15):

Assume that the relative pronoun in situ is translated as $\lambda x.x$ with $x \in D_e$ (we here ignore number and gender of the pronoun). We assume that this expression has the type $\langle e///e\rangle$. Assume now that an expression a has type $\langle e///\alpha\rangle$ and that P has the logical type $\langle \alpha/\beta\rangle$.

(23) a. If $[\![a]\!] \in D_{\langle e///\alpha\rangle}$ and $[\![P]\!] \in D_{\langle \alpha/\beta\rangle}$, then $[\![P(a)]\!] = \lambda y.P(a(y)) \in D_{\langle e///\beta\rangle}$.
b. If b is the pied piped material of type $\langle e///\beta\rangle$, then $[\![[\emptyset_{+R}\ b]\ ]\!] = [\![b]\!]([\![\emptyset_{+R}]\!]) \in D_\beta$

Note that this type of iterated lambda abstraction works parallel to the syntactic way of circumventing island constraints via iterated movement by adjunction, as in (24):

(24) the man [$_{\mathrm{CP}}$ who$_i$ [$_{\mathrm{CP}}$ [$_{\mathrm{DP}}$ t$'_i$ [$_{\mathrm{DP}}$ t$_i$'se mother]]$_j$ [$_{\mathrm{IP}}$ you met t$_j$]

The additional trace t$'_i$ left at the adjunction site corresponds to the additional variable $[\![\emptyset_{+R}]\!]$. Although both methods are semantically equivalent, they differ syntactically, because the movement called pied piping is the only movement being involved in (23), so that no other intermediate trace (no additional escape hatch) is required.

6 Islandhood Reconsidered

A central argument in favor of pied piping at LF results from Japanese multiple *wh*-data discussed extensively in Stechow (2000*a*). The observation is the following: Assume that a *wh*-phrase causes pied piping of a clause α at LF. Assume further that α contains a second *wh*-phrase. Then the pied piping theory predicts that both *wh*-phrases have the same scope. This prediction seems to be borne out for the data discussed in the literature mentioned above, and it also seems to hold for the *Was-w*-construction in German:

Whereas *wem* in (25-a) can have either matrix or embedded scope, in can only have embedded scope in (25-b):

(25) a. Wer weiss, was wir wem gekauft haben?
who knows what we whom bought have
b. Wer weiss, was Hans glaubt, was wir wem gekauft haben?
who knows what H. believes what we whom bought have

From the above discussion's perspective, the narrow reading of double *wh*-phrases seems to imply that the use of choice functions must somehow be iterated. The proper way of doing so will be illustrated with a construction also discussed in Stechow (1996*b*), which exhibits an additional problem:

(26) Which$_1$ mountain in which$_2$ country did you climb?

The problem is that Reinhart's choice function approach runs into difficulties, given traditional semantic assumptions about the structure of a DP. In order to see the problem more closely, consider (27):

(27) a. Who climbed [$_{\text{DP}}$ which$_1$ [$_{\text{NP}}$ mountain in which$_2$ country]]
b. $\lambda p \exists x \exists f \exists g [p = x$ climbed f(mountain in g(country))]

The reader should verify that the representation one would expect from the structure in (27-a), namely (27-b), is incorrect because f simply selects a (certain) mountain so that we loose the information expressed by *in which country*. This problem is typical in the context of pied piping. The correct representation of the DP should rather be (28-b), but it seems impossible to arrive at this without modifying the syntactic structure of (27) along the lines of (28-a):

(28) a. [$_{\text{DP}}$ [$_{\text{DP}}$ which$_1$ mountain] [$_{\text{PP}}$ in which$_2$ country]]
b. $\lambda P \exists x (x = f(\text{mountain}) \wedge \text{ in}(x, g(\text{country})) \wedge P(x))$

Putting aside this syntactic difficulty and assuming that (28) would in fact be the correct representation, a LF like (29) would correctly represent the truth conditions within Reinhart's theory:

(29) $\lambda p \exists x \exists f \exists g [p = \lambda P[\exists x (x = f(\text{mountain}) \wedge \text{in}(x, g(\text{country})) \wedge P(x))]$
$(\lambda y.\text{you climb } y)]$

But although these truth conditions are correct, the above formal analysis does not capture the islandhood of the pied piped phrase. As pointed out above, Nishigauchi's mayor argument for LF pied piping is that both *wh*-phrases must have the same scope. Although this is factually the case in (29), it cannot in principle be excluded that the function g used to interpret *which*$_2$ is existentially bound from a scope position different from that of f; hence, the above analysis must be rejected as inedaquate on the explanatory level.

Let us therefore return to our own proposal of interpreting *wh*-in-situ. Given that something like (28) is correct, the expected LF representation to be interpreted semantically is (30):

(30) $\lambda p \exists F(\text{choice-function}(F) \wedge\ p = F(\lambda P[\exists x(x = \text{which mountain} \wedge \text{in}(x,\ \text{which country}) \wedge P(x))]\ (\lambda y.\text{you climb } y))$

From the above we know that *which country* denotes the set of (actual) countries $\{a, b, c, \ldots\}$, and with $\{y, z, \ldots\}$ as the set of (actual) mountains we get the following denotations for the relevant subformulas of (30):

(31) a. $\text{in}(x, \text{which country}) = \{\text{in}(x, a), \text{in}(x, b), \text{in}(x, c), \ldots\}$
b. $(x = \text{which mountain}) = \{x = y, x = z, \ldots\}$

In order to get the denotation of [(31-b) $\wedge$ (31-a)], we now have generalize conjunction in the obvious way, with $A \wedge B$ being defined as $\{a \wedge b : a \in A \text{ and } b \in B\}$. The result is shown in (32):

(32) $\{x = y \wedge \text{in}(x, a), x = y \wedge \text{in}(x, b), x = y \wedge \text{in}(x, c), \ldots,$
$x = z \wedge \text{in}(x, a), x = z \wedge \text{in}(x, b), x = z \wedge \text{in}(x, c), \ldots,$
$x = \ldots, \}$

Proceeding along the lines suggested above the denotation of the pied piped *wh*-phrase is (33):

(33) $\{\lambda P \exists x(x = y \wedge \text{in}(x, a) \wedge P(x)), \lambda P \exists x(x = y \wedge \text{in}(x, b) \wedge P(x)),$
$\lambda P \exists x(x = y \wedge \text{in}(x, c) \wedge P(x)), \ldots \lambda P \exists x(x = z \wedge \text{in}(x, a) \wedge P(x)),$
$\lambda P \exists x(x = z \wedge \text{in}(x, b) \wedge P(x)), \lambda P \exists x(x = z \wedge \text{in}(x, c) \wedge P(x)), \ldots, \}$

It should then be obvious that (30), repeated as (34), gives the desired truth conditions.

(34) $\lambda p \exists F(\text{choice-function}(F) \wedge\ p = F(33)(\lambda y.\text{you climb } y))$

It also yields the correct result as regards the fact that the *wh*-phrases cannot have scope independently from another.

7 Conclusion

Above I have shown that a semantics that uses alternative sets and functions that chose among them can solve a number of problems related to the islandhood of certain constructions. We did not, however, discuss other syntactic problems mentioned at the end of section 2.1, which concern specific language particular differences. It seems to me that these have to be treated by syntactic stipulation. That is, we have to stipulate that with the constructions from Hungarian, a higher order choice is possible, whereas the ungrammaticality of analogous constructions in German (or Japanese) requires that this kind of choice function is unavailable in these languages. Moreover, the overt choice functions, interpreted as "scope marker" in German and Hungarian, require CP complements, whereas the silent choice functions that interpret pied piping seem to take complements on the subclausal level only. This way, the asymmetry mentioned in the last paragraph of section 2.1 can be accounted for.

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