Sprouting in HPSG:
MAX-QUD and Lexico-Syntactic Constraint

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Shin, Jaeyeon. 2014. Sprouting in HPSG: MAX-QUD and Lexico-Syntactic Constraint. *SNU Working Papers in English Linguistics and Language 12, 138-164.* Although sluicing is one of the most discussed topics in the literature, sprouting, where the *wh*-remnant has no correlate in its antecedent clause, still remains theoretically uncertain. The present paper thus aims to investigate the licensing condition of sprouting by examining its syntactic peculiarities and propose a unified account on both merger and sprouting in the framework of Head-Driven Phrase Structure Grammar (HPSG). Specifically, we will modify the non-elliptical analysis on sluicing suggested by Ginzburg and Sag (2000), as MAX-QUD, a contextual attribute, takes the ARG-ST list of the verb head in its antecedent clause, so that the *wh*-sluice can encompass the lexico-syntactic information from the antecedent clause. **(Seoul National University)**

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1. Introduction

Sluicing, exemplified as in (1) below, is one of the most discussed challenges to both the syntactic and semantic literature, since it raises a fundamental question on the issue of form-meaning correspondence.

> (1)   The students are reading something, but I don't know **what**.

In (1), the stranded *wh-* phrase in the second clause "what" (referred to as *(wh-) remnant*) requires a full interrogative interpretation as questioning 'what the students are reading'. In addition, the *wh*-phrase is linked to the overt material in the antecedent clause, "something" (referred to as *correlate*).

There is, however, a subtype of sluicing, on which surprisingly little research has been conducted. The correlate of the *wh*-remnant can often be omitted, as in (2) and (3) below:

(2)   The students are reading, but I don't know **what.**
(3)   The students are reading books, but I don't know **where/how fast/why**.

In (2), the object of the verb *read* is absent in the antecedent clause but its corresponding *wh*-phrase can be sluiced as "what" in the following clause, which means sluicing can occur when its correlate is an implicit argument. Furthermore, the *wh*-phrase in (3) is linked to no overt argument but rather to some covert adjunct. Chung et al. (1995) first termed this kind of construction as *sprouting*, and distinguished it from the canonical instance of sluicing as in (1), which was named *merger*.

Although sluicing has been studied mostly in terms of one particular instance of elliptical constructions, that involves *wh*-movement and the following TP ellipsis under a semantic licensing condition (Merchant 2001), a labyrinth of phenomena that cannot be accounted for by this approach remains in sprouting. For example, as pointed out by Chung (2006), the fact that English does not allow preposition stranding in sprouting that should otherwise be possible in any environment involving *wh*-movement can be a possible challenge to Merchant's account. Since the choice between pied-piping and preposition stranding of *wh*-phrase does not affect the semantic condition that is claimed to license the ellipsis under the Merchant's analysis, his deletion-based account on sluicing does not hold here.

Therefore, it is required to reexamine not only sprouting but also sluicing itself. Chung (2006), realizing the need for some refinement of the transformational analysis, suggested that semantics alone does not suffice but the lexicon and perhaps syntax should be considered crucial in licensing the ellipsis, to extend the previous analyses to sprouting.

Nevertheless, she also failed to propose a unified account that can encompass both merger and sprouting, admitting that merger can be best explicated by the deletion theory.

The present paper aims to investigate the licensing condition of sprouting by examining the peculiarities of sprouting that are not observed in merger. In particular, non-elliptical analysis on sluicing in the framework of Head-Driven Phrase Structure Grammar (HPSG), suggested by Ginzburg and Sag (2000), will be employed to propose a unified account on merger and sprouting. The key attribute here will be MAX-QUD, a pragmatic notion introduced from the discussion of Questions-Under-Discussion (QUD) (Ginzburg 1996, among others). The current work attempts to modify MAX-QUD to the extent that the ARG-ST list of the verb head in the preceding discourse can be specified. In other words, lexical and syntactic, or lexico-syntactic information is to be carried under the pragmatic attribute.

The organization of the paper is as follows: Section 2 will briefly discuss the previous literature on sluicing, that is, on the canonical *merger*, including the elliptical analysis by Merchant (2001) and non-elliptical analysis by Ginzburg and Sag (2000). The reason why the present work employs the latter will also be presented. Section 3 will delineate the sprouting-peculiar properties. In addition to the properties presented by Chung (2006), new finding from the current work will also be presented. The present work's proposal on the licensing condition of sprouting will then be followed in Section 4. Conclusion and direction to future research will be suggested in Section 5.

2. Previous Literature on Sluicing
2.1 Merchant's (2001) Analysis: *Wh*-movement and TP ellipsis

While a number of studies have attempted to provide their own accounts for the form-meaning disparity that occurs in sluicing, there in

fact seems to be general agreement on the ellipsis-based analysis (Ross 1969, Sag 1976, Merchant 2001, 2006, among others). In particular, Merchant's (2001) PF-Deletion theory is indeed regarded as one of the most successful account on the nature of sluicing. Under his analysis, the example (1) can be illustrated as in (4) below:

(4)   a. The students are reading something, but I don't know [$_{CP}$ [$_{+Q}$] [$_{IP}$ the students are reading [**what**]]].
b. *Wh-movement*
...but I don't know [$_{CP}$ [$_{+Q}$ **what**$_i$] [$_{TP}$ the students are reading ___$_i$]].
c. *TP ellipsis*
...but I don't know [$_{CP}$ [$_{+Q}$ **what**$_i$] [$_{TP}$ *e*]].
(The deletion of TP is possible just in case '[**something i** [the students are reading **i**]]' is '*e*-GIVEN'.)

As can be seen in (4), Merchant employs a transformational operation involving *wh*-movement and the following TP ellipsis. He suggests as the licensing condition of TP ellipsis, the mutual entailment condition that a (content-) redundant TP under the *wh*-interrogative phrase is elided just in case the given semantic condition, *e*-GIVENNESS, is fulfilled. It is then assumed that this elided (i.e., unpronounced, or PF-deleted) TP is present at a certain level of syntactic representation, thus allowing a full sentential interpretation.

Accordingly, sluicing, under the Merchant's analysis, should display the same properties with other constructions involving *wh*-movement. This has been supported by connectivity effect between the sluice and its antecedent clause in terms of case marking, which was first discussed as German contrasts in Ross (1969) as in (5) below:

(5)   a. Er will   jemandem schmeicheln,   aber sie wissen nicht,
          he wants someone.D   to.flatter   but they know not

> **wem/*wen.**
> who.D/who.A
> 'He wants to flatter someone, but they don't know who.'
> b. Er meinte, er h¨atte geholfen,   aber   wir w¨ussten nicht,
>   he thought he had helped   but   we   knew   not
>   **wem/*wen.**
>   who.D/who.A
>   'He claims he had helped, but we couldn't say who'

In (5), when the correlate in the antecedent clause has the dative/accusative case, the *wh*-remnant should maintain the same case. In order to account for this connectivity, it should be presumed that in the sluice, there be the same syntactic structure with that in its antecedent. This connectivity has also been widely reported from other languages that involve case-marking morphology.
Another piece of evidence comes from preposition stranding allowed in sluicing as in (6):

  (6)   Peter was talking with someone, but I don't know **(with)
         whom**.

In (6), neither the pied-piping nor the preposition stranding affects the grammaticality of the sentence. This accords with the semantic licensing condition presumed by Merchant, in that the alternation has nothing to do with the mutual entailment condition since these two are generally considered semantically equivalent. Based on this, Merchant (2001) has defined a universal generalization on it as in (7):

  (7)   *P-Stranding Generalization*:
         A Language L will allow preposition-stranding under
         Sluicing just in case L allows preposition stranding under
         regular *WH*-Movement. (Merchant 2001)

According to him, those languages that allow a preposition to be stranded under the *wh*-movement should also do the same under sluicing, which supports the assumption that *wh*-movement is involved in the derivation of sluicing. Many other languages have also been proved to hold such property.

2.2 Ginzburg and Sag's (2000) Analysis: Direct Interpretation as Fragment and MAX-QUD
2.2.1 Evidence for Direct Interpretation Analysis

Although connectivity effect and preposition stranding seem to be strong arguments for the elliptical analysis on sluicing, there in fact exists syntactic and semantic evidence that are against Merchant (2001) but call for another approach, one of which is Ginzburg and Sag's (2000) direct interpretation analysis in the framework of HPSG.

Unlike the other linguistic frameworks on grammar, HPSG allows us to enjoy an integrated view of grammar, particularly with its capability of rich description on lexicon. Moreover, it can represent in a single structure not only the information about syntax, semantics, morphology, phonology, and potentially all other components of the grammar, but also the complex interactions between each component. It is thus useful for representing the syntax-lexicon interface such as subcategorization.

In this framework, Ginzburg and Sag (2000) treats sluicing as one kind of fragments that has its own direct interpretation by itself. This means sluicing does not any longer involve transformational operation as that in Merchant (2001) but rather has its own peculiarities other than those of *wh*-interrogatives.

Evidence against the deletion theory comes from the fact that the *wh*-remnants of sluicing often behave distinctively from other *wh*-interrogatives. First, sluicing seems not to be affected from island constraints as in (8) (Ross 1969). This is also called as island amelioration effect.

(8)   a. They want to hire someone who speaks a Balkan
       language, but I don't remember **which**.
       b. *I don't remember which (Balkan language) they want to
       hire someone [who speaks__].

In (8a), the *wh*-phrase "which" can bind a variable that is located in position internal to a relative clause island in the antecedent TP, which should be banned in those instances involving *wh*-movement. Its overt *wh*-interrogative counterpart in (9) thus displays no such immunity to island, only to hold ungrammatical.

(9)   ***Which Balkan language** they want to hire someone who
       speaks? (Ross 1969)

Second, as shown in (10) below, the *wh*-remnant of sluicing cannot be modified by a certain modifiers, such as "the hell", those known as modifying *wh*-phrases in overt *wh*-questions.

(10)   The students are reading something, but I don't know **what
       (*the hell)**. (Ginzburg and Sag 2000)

This kind of modifiers is assumed to work only for the extracted, fronted, *wh*-phrases. The example in (10) can thus be counterevidence to the claim that sluicing does involve *wh*-movement.

Third, sluicing often converges with short answers, in that a CP fragment receives a sentential interpretation. Short answers function nearly identical to sluices, except that the sluice itself here is not a *wh*-phrase, as in (11) (Ginzburg and Sag 2000).

(11)   a. Who attended the meeting?
       b. **Millie/No students/A friend of Jill's**.

These fragments, along with sluicing, touch on a large question whether ellipsis is syntactic or semantic in nature. For example, those examples in (12) (Sag 2011) that can take place without any source in the preceding context cannot be explained under the Merchant's (2001) assumption that there is a fully articulated syntactic structure at a certain underlying level.

(12) **What floor? Where to? How many more? What else? WTF?**

Although Merchant (2004) distinguishes these examples by pointing out what should be considered as sluicing, the fact that both sluicing and short answers are tied to the discourse demands us to try a different approach.

2.2.2 Type Constraint for Sluices Involving MAX-QUD

Ginzburg and Sag (2000) adopts a new perspective, where they posit a type for sluicing, *sluiced-interrogative-clause (slu-int-cl)*, under the phrasal type *interrogative-clause (inter-cl)* and *headed-fragment-phrase (hd-frag-ph)*, not under the *wh-interrogative-clause (wh-int-cl)*. That is, sluicing is no longer treated as one instance of *wh*-interrogatives but as an interrogative fragment that inherits all the constraints of both interrogative and fragment, but not those of *wh*-interrogative. The type constraints from which *slu-int-cl* inherits the constraints are as following (Ginzburg and Sag 2000):

(13) *inter-cl:* [CONT   *question*] → . . .

(14) *hd-frag-ph:*

$$
\begin{bmatrix}
\text{HEAD} & \begin{bmatrix} v \\ \text{VFORM} & fin \end{bmatrix} \\
\text{SUBJ} & <\ > \\
\text{SPR} & <\ > \\
\text{CTXT} \mid \text{SAL} - \text{UTT} & \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{CONT} \mid \text{IND} & \boxed{2} \end{bmatrix}
\end{bmatrix}
$$

$$
\rightarrow \quad \mathbf{H} \begin{bmatrix} \text{CAT} & \boxed{1}[\text{HEAD} \quad nominal\ ] \\ \text{CONT} \mid \text{IND} & \boxed{2} \end{bmatrix}
$$

From (13), where general attributes of interrogatives are specified, *slu-int-cl* inherits as its semantic value the type *question*. In (14), the feature-structure that represents common properties of fragments is presented. Notice that the categorical value (CAT) of the head daughter is specified as *nominal*, either a noun or a preposition, while that of the mother is a finite verb. This allows a fragment to stand alone as NP or PP, while possessing the sentential meaning. In addition, the SAL(IENT)-UTT(ERANCE) value, which will be further elaborated later, is also coindexed with the value of head daughter. This operation unifies the content of the former into a contextually provided content.

As can be seen in such features as SAL-UTT, Ginzburg and Sag encompasses the contextual background where sluicing takes places and delineates what kind of attributes should be introduced. As an update from the framework of KOS (Ginzburg 1996), which takes into account each conversation participant's view of the common ground, the notion of Questions-Under-Discussion (QUD) is employed here; a new attribute MAX(IMAL)-QUD is posited under the context (CTXT) feature in the feature-structure representation of fragments.

The concept of QUD was originally defined as a partially ordered set of questions, which constantly changes by nature, and MAX-QUD is the maximal element of QUD which corresponds to the current topic of discussion. (Ginzburg 1996) The type of MAX-QUD assumed for

sluices by Ginzburg and Sag (2000) is thus of *question*, carrying the relevant parameters (PARAMS) and proposition (PROP) values. Along with MAX-QUD, SAL-UTT is also of the CTXT attributes in *hd-frag-ph*. It corresponds to the most focal (sub)utterance receiving the widest scope, thus associated with the value of the parameters.

The contextual attributes and their values relevant in this framework can be restated as in (15) below, thus yielding a feature structure of the type *slu-int-cl* as in (16):

(15) *Contextual Features:*

TYPE	FEATURES/VALUE TYPE		IST
conx-obj	**C-INDICES**	*c-inds*	*feat-struc*
	SAL-UTT	*set(local)*	
	MAX-QUD	*question*	

(16) *slu-int-cl*:

$$
\begin{bmatrix}
\text{CONT} & \begin{bmatrix}
question \\
\text{PROP} & \begin{bmatrix}
proposition \\
\text{SIT} & \boxed{1} \\
\text{SOA} & \begin{bmatrix} \text{QUANTS} & \boxed{A} \\ \text{NUCL} & \boxed{3} \end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\
\text{STORE} \quad \{\} \\
\text{MAX} - \text{QUD} & \begin{bmatrix}
question \\
\text{PARAMS} \quad \{\} \\
\text{PROP} & \begin{bmatrix}
proposition \\
\text{SIT} & \boxed{1} \\
\text{SOA} & \begin{bmatrix} \text{QUANTS} & < pquant-rel > \oplus \boxed{A} \\ \text{NUCL} & \boxed{3} \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

$\rightarrow$ **H**[STORE $\quad neset(param)$]
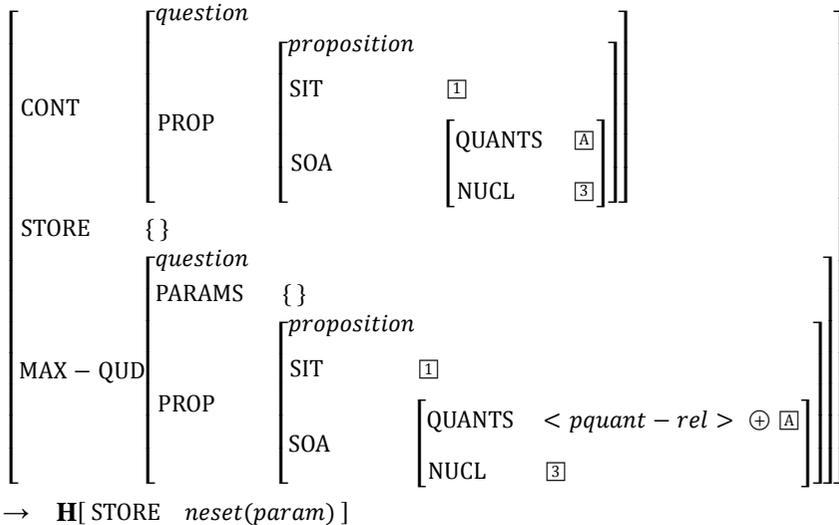
In (16), the QUANTS of the MAX-QUD and that of the clause' CONT are linked in a peculiar way. The widest scoping quantifier of MAX-QUD is excluded from the QUANTS list of the CONT, which is the

main difference from the type constraint of other fragments such as those in (11b), that of the type *declarative-fragment-clause (decl-frag-cl)*[1]. Instead, the (sub)utterance whose content provided the widest scoping quantifier will also provide the SAL-UTT value. Beside this sluice-specific property, *slu-int-cl* inherits all the relevant type constraints from its mother types.

On the issue of sprouting, Ginzburg and Sag (2000) has once mentioned a possibility of positing a new non-canonical *synsem* type, similar with *gap-ss* or *pro-ss*, to assume a portion for an implicit argument. However, they have not sought for it further, and the peculiarities observed in sprouting have little been dealt with in the framework of HPSG yet.

3. Sprouting and the Lexico-Syntactic Constraint
3.1. Peculiarities of Sprouting

Sprouting has first been mentioned in Chung et al. (1995), which claimed that LF is taken for the level of syntactic representation that determines sentential meaning of sluices, which employs copying operation of the antecedent clause. Accordingly, sprouting as in (17) also occurs by means of the same copying, or recycling, process but holds under the condition that the sprouted form must be in the right category type and must satisfy the licensing constraints imposed by lexical items within the recycled TP. These involve two requirements including argument structures and adjunct licensing conditions, on which no further account was presented. (Chung et al. 1995)

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[1] In the type constraint for *decl-frag-cl*, the QUANTS value of the clause arises by retrieving from the head daughter's store the set, possibly empty, of quantifiers and quantifying it in wider than MAX-QUD'S QUANTS value. SAL-UTT here will be the one whose content provides the interrogative parameter. (Ginzburg and Sag 2000)

(17)   John ate dinner but I don't know **with whom**.

According to Chung et al., the sluice in (17) contains only one option for the internal TP structure whose LF can be copied into the TP of the sluice, thus reconstructing such TP as "with whom John ate dinner". Although their analysis seems to successfully account for those simple examples, however, it does not suffice to shed light on the puzzles of sprouting that we will examine.

3.1.1 Preposition Stranding

Chung (2006) was the first attempt to focus on the fact that English sluicing allows preposition stranding only if there is a correlate, while pied-piping is always possible, as shown in (18) and (19) below.

(18)   *Merger*
        They're jealous of someone, but it's unclear **(of) whom**.
(19)   *Sprouting*
        They're jealous, but it's unclear ***(of) who**.

The alternation between preposition stranding and pied-piping does not make any difference for the grammaticality in (18), while it does in (19). Moreover, the overt *wh*-question form is perfectly fine with either option, as in (20).

(20) a. They are jealous, but it's unclear **who** they are jealous **of**.
        b. They are jealous, but it's unclear **of whom** they are jealous.

In other words, the *wh*-phrase in sprouting does not function the same with that in the over *wh*-question that involves *wh*-movement as well as that in merger. This thus strengthens the claim of Ginzburg and Sag

(2000) that sluicing is not derived from *wh*-movement.

In fact, this is not an English-specific phenomenon but can be observed in other languages, such as in Germanic languages as in (21) and even in Korean in (22), which is somewhat surprising, since Korean is generally claimed not to strand a preposition due to its language-specific morphological constraints.

(21)   *Norwegian* (Chung (2006))
       Per   spilte   en duett, men jeg vet ikke ***(med) hvem**.
       Per was playing   a   duet, but I know not   with   who

(22)   *Korean* (Park (2001))
       con-i   kkoch-ul   ssassta-ko tuless-nuntey,
       John-Nom flowers-Acc   buy-Comp heard-Circum
       na-nun (kukey) nwukwu-***(lul wuyhayse)-**inci molu-kess-ta
       I-Top   it-Nom whom-   for   −Interr don't know
       'I heard that John bought flowers, but I don't know for whom.'

Merchant (2001), which suggested the P-stranding generalization and took it as universal evidence on his semantic condition-based account on sluicing, does not seem to hold anymore.

3.1.2 Fixed Diathesis Effect

Following Chung (2006), Chung et al. (2011) further suggested other sprouting-peculiar properties. If we assume a full syntactic structure under the sluice as did Merchant (2001), sluicing should allow argument alternation within the TP, but sprouting does not, as in (23).

(23)   a. She served the soup, but I don't know **to whom**.
       b. *She served the soup, but I don't know **who**.

In (23a), the TP assumed under the *wh*-sluice (whether it is via ellipsis or via copying) would be the same with the antecedent TP "She served the soup __", which involves a ditransitive verb realized with a prepositional object, while in (23b), the relevant TP is "She served __ the soup", the realization with double objects[2]. It thus seems that the TP under the sluice and its antecedent TP should take the same form in argument structure. This alternation, however, does not seem to affect the instances of merger, as in (24).

(24)   a. She served the soup to someone, but I don't know **to whom**.
b. She served the soup to someone, but I don't know **who**.
c. She served someone the soup, but I don't know **to whom**.
d. She served someone the soup, but I don't know **who**.

The mutual entailment condition, suggested as the licensing condition of sluicing by Merchant (2001), does not differentiate the results of alternation. In other words, the argument alternation under the same verb should not affect the grammaticality of sluicing in Merchant's analysis, as suggested in (24). However, the fact that sprouting does not allow argument alternation will not be explained.

3.1.3 Island Amelioration Effect

As was examined in (8) above, merger seems to be immune to all kinds of island constraints. However, sprouting, indeed, is affected by the position of its correlate, as in (25). (Chung et al. 2011)

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[2] Although Chung et al. (2011) suggested the problem of preposition stranding and that of argument alternation separately, the examples in (23) can in fact be analyzed as those of preposition stranding as well.

(25)   a. *Sandy was trying to work out which students would speak, but she refused to say **who to**.

b. *Agnes wondered how John could eat, but it's not clear **what**.

c. *That Tom will win is likely, but it's not clear **which race**

This seems to call for different approaches for merger and sluicing. The fact that sluicing, which has long been claimed to involve *wh*-movement, does not affected by island constraints, while sprouting does, will be one of the most difficult challenges in investigating the nature of sluicing.

3.2 Lexico-Syntactic Constraint (Chung 2006)

In order to account for these peculiarities, Chung (2006) seeks for the answer beyond semantics and pragmatics. She suggests a lexico-syntactic requirement which utilizes the notion of *numeration*[3] in the Minimalist framework. Chung et al. (2011) further developed this idea, claiming that the antecedent TP is not elided under the sluice but is re-used at a certain level, perhaps where *Internal Merge* takes place.

The notion of *use* and *re-use* originates from the very pragmatic nature, which the current work will also follow. To use a linguistic material is as same as introducing it into the collaborative game of constructing shared contexts, a model of discourse which has been suggested by Ginzburg (1996). Then, to re-use a linguistic material means taking an already constructed syntactic object with its lexical and syntactic interpretation, which has already established in the discourse, in a new and different context. (Chung et al. 2011)

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[3] "Every lexical item in the numeration of the sluice that ends up (only) in the elided CP must be identical to an item in the numeration of the antecedent CP." (Chung 2006) This requires the lexical information in the antecedent to be kept in the following clause involving the sluice.

By means of the lexico-syntactic constraints and the derivation by *re-use*, Chung (2006) and Chung et al. (2011) account for the sprouting-peculiar properties as following: First, for the preposition stranding issue, the reason why it is prohibited to strand a preposition in sprouting comes directly from the derivational process of re-use, as demonstrated briefly in (26) (Chung et al. 2011).

(26) a. She is jealous, but it's unclear **(of) who**.
    b. . . . [unclear [$_{CP}$ who c [$_{TP}$]]]
    c. . . . *[unclear [$_{CP}$ who c [$_{TP}$ she is jealous]]]

For the sentence in (26a), they assume its beginning as a fragment-like structure as in (26b). Then, the antecedent TP is re-used, or copied in the sense of LF-copying process in Chung et al. (1995), into the empty TP, as in (26c). The resulting structure in (26c) violates the lexical requirements of the adjective "jealous" that mandates a PP object involving "of", which determines the grammaticality of the sprouted sluices.

With regard to the argument alternation, they elaborate that the lexical choices made in the antecedent TP limit further possibilities of lexicalization in the elided IP.

(27) a. She served the soup, but I don't know **to whom**.
    b. *She served the soup, but I don't know **who**.

In (27), replicated from (23), the verb *serve* in (27a) lexicalizes itself as <NP, NP$_{GOAL}$, NP$_{THEME}$> in the antecedent TP, thus restricting the elided TP to recover the very same argument structure, leaving the rightmost theme NP as remnant. The lexical choice in the antecedent TP in (27b), on the other hand, is <NP, NP$_{THEME}$, PP$_{[to]GOAL}$>, which only permits the prepositional object form. In other words, the very lexical choice made in the antecedent TP is re-used in constructing a sluice.

Nonetheless, the constraints on lexicon and syntax may seem to provoke too rigid an identity condition between the antecedent TP and the sluice. A possible set of counterexamples would be as follows.

(28)   a. Decorating for the holidays is easy if you know **how**.
　　　 b. John seems to be happy and I can guess **why**.

The *wh*-remnants in (28) require a re-use of the existing materials but with different categorical or syntactic information. For (28a), the reconstructed material should be a *to*-infinitive, "to decorate for the holidays", while for (28b), a different sentence, "John is happy." To defend the analysis, Chung (2006) adds that the lexical items referred to here are not fully inflected forms but rather comprised of bundles of features, allowing for somewhat loose identity condition. These examples indeed show us that the nature of sluicing is not entirely syntactic.

Taken together, Chung (2006) and Chung et al. (2011) have attempted to devise the licensing condition on sprouting as a form of a constraint on the lexicon and syntax with a derivational process called *re-use*. Still, however, there is no unified account on both merger and sprouting yet.

3.3 New Finding: Selection of Implicit Correlate

New finding on sprouting, which has little been mentioned, is on the *wh*-remnant's selection of its correlate. In sluicing, the *wh*-remnant and its correlate are linked tightly in semantics, which is to be included in any kind of representation on sluicing. For instance, Ginzburg and Sag (2000) devised a type constraint for sluicing as the value of SAL-UTT should be coindexed with that of head daughter. See the following example (29), however.

(29)   They're going to eat, but I don't know **where/how fast/why**.

In this sentence, even though the object of the verb *eat* is absent in the antecedent clause, which can be a strong candidate for sprouting, a covert adjunct other than the argument is sprouted. For this sentence, the hearer would assume that the speaker wants to know some other information, such as the place where they eat something, than the thing they are going to eat. More precisely, the speaker would not deliberately look for what they are going to eat, perhaps because it is already known in the context or it does not matter with the current discourse. In other words, the *wh*-sluice does not automatically take its correlate from an implicit element in the antecedent TP, but rather chooses what to question with regard to its context.

This kind of property has been mentioned neither in the discussion of Merchant (2001) nor in that of Chung (2006). The present work will thus take into consideration that the *wh*-remnant chooses which to address among the candidates.

4. Proposal: The Licensing Condition of Sprouting in the Framework of HPSG
4.1 Proposal
4.1.1 ARG-ST under MAX-QUD

In order to account for the licensing condition of sprouting, the current study will first update the previous implications drawn from the lexico-syntactic constraints in Chung (2006) to the framework of HPSG, by means of some modification on MAX-QUD.

The definition of MAX-QUD assumed in Ginzburg and Sag (2000) in fact seems to be somewhat more restricted than its original intention[4]

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[4] Starting from Stalnaker's (1979) theory to capture the dialogue at a given point, KOS (Ginzburg 1996) presumed a metaphor of a constant-updating game board, thus coined as *dialogue-gameboard* (DGB). It is comprised of FACTS, QUD, and LATEST-MOVE,

in Ginzburg (1996). To restate the point, QUD originates from the need for positing in the syntactic representation an attribute that instantiates the current topic of discussion, not the exact semantics of the antecedent. In other words, Ginzburg did not restrict the usage of MAX-QUD to the area of semantics, but rather conceived a pragmatic notion that can be used where it is required.

To sharpen the analysis, MAX-QUD will thus be modified to encompass the lexical and syntactic information of the currently discussable question. The ARG-ST list, which specifies the selected argument structures of a given head, is posited under MAX-QUD as one attribute, assuming that this manipulation does not violate the original motivation of MAX-QUD.

The modified version of MAX-QUD can thus be described as follows:

(30)   MAX-QUD (modified)**:** $\begin{bmatrix} ... \\ \text{ARG} - \text{ST} \quad nelist \end{bmatrix}$

Then, the list of ARG-ST under the MAX-QUD will be coindexed with that of the mother, to specify that the particular lexical choice made by the verb in the antecedent TP is passed on to the contextual information of the current topic, which again passes it on to the head daughter, the resulting sluice. This will also clarify the source from which SAL-UTT inherits its categorical value, which has also been theoretically uncertain.

4.1.2 *ini*

A new operation that helps select the correlate of the *wh*-sluice will also be added. A new type that instantiates an attribute of indefinites will be

which respectively stands for the distinct viewpoint of each participant in a dialogue. FACTS is defined as a set of facts corresponding to the information taken for granted by the participants. LATEST-MOVE represents a content of latest-move in the course of conversation. (Ginzburg, 1996)

introduced here. Fillmore (1986) and Fillmore et al. (2003). introduced a notion of null instantiation to represent absent semantic constituents, where two options arise. When a constituent is definite enough to be recovered from the context, it is called *definite null instantiation (dni)*. On the other hand, when a constituent is genuinely absent, whose semantic value is null but functions as free variable, as if it were an indefinite, it is called *indefinite null instantiation (ini)*. Not all kinds of null argument but only the latter can thus be sprouted[5], since no one would question what is definitely known to them. Considering that sluicing is of the type *question*, it seems necessary that the nature of question should be taken into account in the representation of sluicing. The type *ini* can be specified as in (31), and by means of this, we can make a proposal such as in (32).

$$
(31) \quad ini: \quad \begin{bmatrix} \text{PHON} & <> \\ \text{CAT} & [\text{HEAD} & noun|prep] \\ \text{CONT} & [\text{IND} & i \quad] \end{bmatrix}
$$

(32) A constituent can be sluiced only when its correlate has the semantics of *ini*, not when *dni*.

The type *ini* has an empty value for the phonological information, and is realized as either a noun or a preposition. It has an index value that is to be coindexed with that of SAL-UTT.

4.2 Application on Sprouting and Merger

According to this modification, the sprouted *wh*-remnant in sprouting in (33) can now be analyzed as (34).

---

[5] The motivation to posit *ini* was first hinted from the study of Sag and Nykiel (in progress).

(33)   The students are reading, but I don't know **what**.

(34)

```
┌ slu − int − cl                                                                    ┐
│           ┌ v                ┐                                                     │
│ HEAD      │ VFORM   fin      │                                                     │
│           └                  ┘                                                     │
│           ┌ question                                          ┐                    │
│           │           ┌ INDEX      ②          ┐              │                    │
│           │ PARAMS  ① │ RESTR   {thing(②)}    │              │                    │
│           │           └                        ┘              │                    │
│           │           ┌ proposition                        ┐ │                    │
│ CONT      │           │ SIT      ③                         │ │                    │
│           │           │          ┌ QUANTS   < >          ┐ │ │                    │
│           │ PROP      │          │          ┌ read − rel  ┐│ │ │                    │
│           │           │ SOA      │ NUCL  ④ │ READER    ⑤ ││ │ │                    │
│           │           │          │          │ BEING − READ ②││ │ │                  │
│           │           └          └          └              ┘┘ ┘ │                    │
│ STORE     { }                                                                      │
│           ┌ ini                                              ┐                    │
│           │ PHON   < >                                       │                    │
│ ARG − ST  ⑥ < NP, │ CAT    ┌ HEAD  ⑦ noun|prep ┐            │ >                  │
│           │       │ CONT   └ IND    ② i         ┘            │                    │
│           └                                                  ┘                    │
│           ┌                 ┌                 ┌ question                         ┐│
│           │                 │                 │ PARAMS  { }                      ││
│           │                 │ CONTENT         │          ┌ proposition         ┐ ││
│           │                 │                 │          │ SIT      ③          │ ││
│           │ MAX − QUD       │                 │ PROP     │          ┌ some − rel ┐│ ││
│ CTXT      │                 │                 │          │ SOA  QUANTS│ INDEX  ② ││ ││
│           │                 │                 │          │          └ RESTR  { } ┘│ ││
│           │                 │                 │          │          NUCL   ④      │ ││
│           │                 │ ARG − ST  ⑥                                         ││
│           │                 └                                                     ┘│
│           │ SAL − UTT  ┌ CAT        ⑦ ┐                                           │
│           │            │ CONT | IND  ② │                                           │
│           └            └               ┘                                           │
└                                                                                    ┘
                                    |
                       ┌            ┌ CAT         ⑦ ┐ ┐
                       │ SS    LOC  │ CONT | IND   ② │ │
                       │            │ STORE    {①}  │ │
                       └            └               ┘ ┘
                                    |
                                 **what**
```
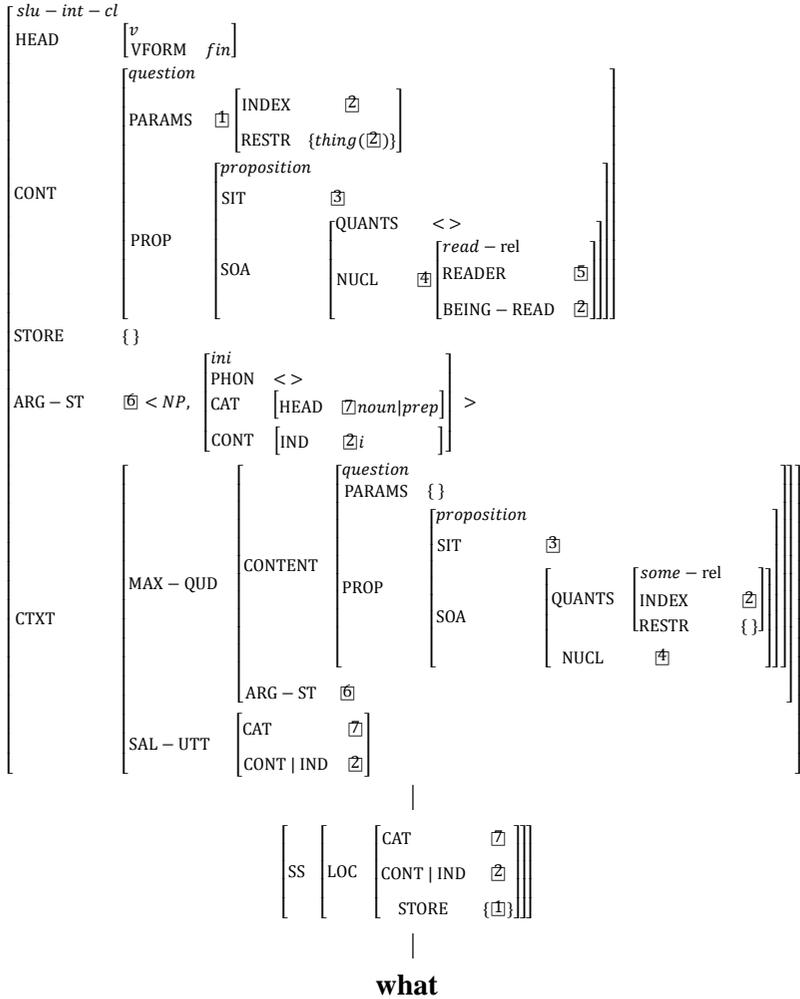
Although the addition of ARG-ST under MAX-QUD may first sound improbable, it rather can account for the fact that sluices in fact have a sentential meaning. Furthermore, since *slu-int-cl* inherits all the constraints from its supertype, those of *hd-frag-ph* that specifies a finite verb as the categorical value, it is natural to assume the ARG-ST list as

well, which is to be coindexed with that in MAX-QUD in the current work.

(35)   They're going to eat, but I don't know **where**.

(36)

$$
\begin{bmatrix}
slu-int-cl \\
\dots \\
\text{CONT} \quad question \\
\text{ARG}-\text{ST} \quad \boxed{1} < \boxed{2}\text{NP}, \boxed{3}\begin{bmatrix} dni \\ \text{PHON} \quad <> \end{bmatrix} > \\[2em]
\text{DEPS}^{6} \quad \boxed{7} < \boxed{2}\text{NP}, \boxed{3}\text{NP}, \boxed{4}\begin{bmatrix} ini \\ \text{PHON} \quad <> \\ \text{CAT} \begin{bmatrix} \text{HEAD} \quad \boxed{5}noun|prep \\ \text{MOD} \begin{bmatrix} \text{HEAD} \quad v \\ \text{CONT}\,|\,\text{KEY} \quad \boxed{6} \end{bmatrix} \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{KEY} \begin{bmatrix} place-\text{rel} \\ \text{ARG} \quad \boxed{6} \end{bmatrix} \end{bmatrix} \end{bmatrix} > \\[3em]
\text{CTXT} \begin{bmatrix} \text{MAX}-\text{QUD} \begin{bmatrix} \text{CONTENT} \quad question \\ \text{ARG}-\text{ST} \quad \boxed{1} \\ \text{DEPS} \quad \boxed{7} \end{bmatrix} \\ \text{SAL}-\text{UTT} \begin{bmatrix} \text{CAT} \quad \boxed{5} \\ \text{CONT}\,|\,\text{KEY} \quad \boxed{6} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

$$
\mid
$$

$$
\begin{bmatrix} \text{SS} \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT} \quad \boxed{5} \\ \text{CONT}\,|\,\text{IND} \quad \boxed{6} \end{bmatrix} \end{bmatrix} \end{bmatrix}
$$

$$
\mid
$$

where

---

[6] To represent the extraction and adjunction properties of a syntactic element, Bouma et al. (2001) suggested a DEP list, which functions similarly with ARG-ST but specifies the local independents, including adjuncts. We thus employed DEPS instead of ARG-ST to include the information on adjuncts.

"Both ARG-ST and valence features, together with a third level of dependency structure, DEP, play a role in the grammar of adjunction and extraction." (Bouma et al., 2011)

In the list of ARG-ST in (34), the IND value of the type of *ini,* which enables sprouting, is also coindexed with the value of IND under SAL-UTT. The definition of *ini* in the framework of HPSG can be stated as an operation which marks an implicit argument in the antecedent that is currently being questioned. Therefore, this coindexation makes the free variable, which is being questioned, realized as a fragment.

In addition, since we generally question one question at a time, only one argument or adjunct is specified as *ini*, and this allows us to capture the peculiarity that has been pointed out in the previous section: When there are several null candidates that can be sprouted, one of them should be selected, with regard to the context. The *wh*-sluice in (35), which is linked to a covert adjunct in the antecedent clause, can be represented as (36).
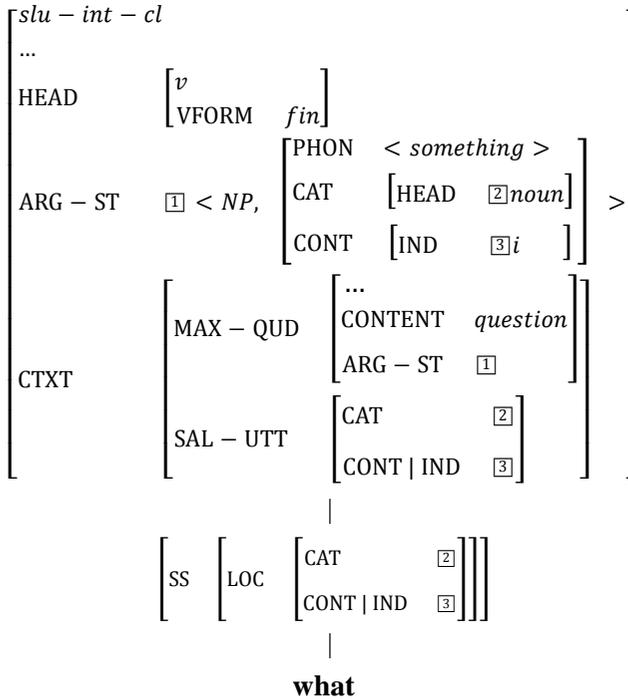
To specify that the correlate is a covert adjunct which has a meaning of the place, the distinction between *ini* and *dni* was employed here, as we suggested in a form of generalization as in (32). The implicit argument of the verb *eat* is treated as *dni,* which has nothing to do with any derivational process of the sprouting of a *wh*-sluice. In contrast, the covert adjunct which is of the type *ini* is coindexed with the values of the head daughter as well as SAL-UTT.

Since the current study attempts to propose a unified account on both merger and sprouting, this proposal should also be able to be applied to the instances of merger, which is the case as in (37) and (38).

Except that merger does not count on the type *ini* but on the overt correlate, the same analysis has been applied. The ARG-ST list specified in MAX-QUD will function as lexico-syntactic constraints and determine the syntactic and semantic behavior of the *wh*-sluice.

(37)   The students are reading something, but I don't know **what**.

(38)

$$
\begin{bmatrix}
slu-int-cl \\
... \\
\text{HEAD} \quad \begin{bmatrix} v \\ \text{VFORM} \quad fin \end{bmatrix} \\[2em]
\text{ARG}-\text{ST} \quad \boxed{1} < NP, \begin{bmatrix} \text{PHON} & < something > \\ \text{CAT} & [\text{HEAD} \quad \boxed{2}noun] \\ \text{CONT} & [\text{IND} \quad \boxed{3}i \quad] \end{bmatrix} > \\[3em]
\text{CTXT} \quad \begin{bmatrix} \text{MAX}-\text{QUD} & \begin{bmatrix} ... \\ \text{CONTENT} \quad question \\ \text{ARG}-\text{ST} \quad \boxed{1} \end{bmatrix} \\[2em] \text{SAL}-\text{UTT} & \begin{bmatrix} \text{CAT} & \boxed{2} \\ \text{CONT | IND} & \boxed{3} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

|

$$
\begin{bmatrix} \text{SS} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \boxed{2} \\ \text{CONT | IND} & \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix}
$$

|

what

4.3 Resolution of Sprouting-Peculiar Properties

Now that we have examined that new operations can explicate both sprouting and merger, we now should see whether these can resolve the sprouting-specific peculiarities, which were previously suggested.
For the argument alternation, where the lexical choice made in the antecedent TP is not altered in the elided TP, the ARG-ST list of the sluice will determine the very lexical choice of the verb in the antecedent.

(39)   a. She served the student, but I don't know **what**.
         b. She served the soup, but I don't know ***(to) who(m)**.

(40)   a.

$$\begin{bmatrix} slu-int-cl \\ \dots \\ \text{CTXT} \mid \text{MAX} - \text{QUD} \begin{bmatrix} \text{CONTENT} & question \\ \text{ARG} - \text{ST} & < \text{NP, NP}i, \begin{bmatrix} ini \\ \text{PHON} & <> \\ \text{CAT} & [\text{HEAD} \quad \boxed{1}noun] \\ \text{CONT} & [\text{IND} \quad \boxed{2}j] \end{bmatrix} \\ \text{SAL} - \text{UTT} & \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{CONT} \mid \text{IND} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

   b.

$$\begin{bmatrix} slu-int-cl \\ \dots \\ \text{CTXT} \mid \text{MAX} - \text{QUD} \begin{bmatrix} \text{CONTENT} & question \\ \text{ARG} - \text{ST} & < \text{NP, NP}j, \begin{bmatrix} ini \\ \text{PHON} & <> \\ \text{CAT} & [\text{HEAD} \quad \boxed{1}prep[\text{to}]] \\ \text{CONT} & [\text{IND} \quad \boxed{2}i] \end{bmatrix} \\ \text{SAL} - \text{UTT} & \begin{bmatrix} \text{CAT} & \boxed{1} \\ \text{CONT} \mid \text{IND} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Regarding the issue of preposition stranding, the type *ini* seems to play a certain role. Since we take advantage of *ini* only when in sprouting, it is natural to assume that *ini* restricts the possible change of the category type in sprouting. The covertness of *ini*, that is phonologically null, seems to close off the possibilities of allowing for category alternation. In merger, in contrast, *slu-int-cl* inherits the type constraints from its supertype *hd-frag-ph*, one of which is that the value of SAL-UTT is nominal, so that it allows either a noun or a preposition as its form.

5. Conclusion and Suggestions

The present paper accounted for the peculiarities of sprouting,

particularly for the issues on the selectional properties of the *wh*-sluice as well as preposition stranding and argument alternation, in the framework of HPSG. We modified MAX-QUD to involve the related lexico-syntactic constraints, positing the list of ARG-ST as an attribute of MAX-QUD to specify the very lexical choice made by the verb in the antecedent TP. In addition, we operated a new type *ini* to mark the implicit argument that is to be sprouted. Compared to other deletion-based theories, such as Merchant (2001, 2006) and Chung (2006), this HPSG-based account seems to provide a more refined representation in that it incorporates all the relevant information, including semantic, contextual, and lexico-syntactic specification on merger and sprouting in a unified way.

Future research, however, should be conducted on DP sprouting as suggested in (41), since the present work covered only the cases sensitive to verbal subcategorization.

(41) She seems to read a novel, but I don't know ***(by) whom**.

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