Licensing Constraint of Negative Polarity Items in English

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Yoon, Su-won. 2003. Licensing constraint of Negative Polarity Items in English. *SNU Working Papers in English Language and Linguistics 2,* 108-132. The purpose of this paper is to investigate on NPI-licensing constraint focusing on English interrogative sentences and clarify their behavior within the formalism of HPSG. The Polarity Operator in questions and imperatives will be examined to clarify their syntactic and semantic properties. In this paper, Tonhauser (2001), most of which I basically agree to, will be modified to have a stronger power incorporating all relevant NPI-licensing phenomena into one single principle - (non)veridicality. **(Seoul National University)**

Keywords: NPI-licensing constraint, HPSG, Polarity Operator, (non)veridicality

1. Introduction

The English language has a class of expressions called "Polarity Sensitive Items (PSIs)". As the term implies, their distributions are confined to two extremes, either positive or negative environments. The former is a Positive Polarity Item (PPI) such as *some* in (1a) and the latter is a Negative Polarity Item (NPI) such as *any* in (1b). Other examples pertaining to this class are the following : *some, already, too, would rather*, *can just as well*, adverbial *pretty* are PPIs and *any, yet*, *either, can* *help*, *ever*, *lift a finger* are NPIs.

(1) a. *I don't see something. / I see something.
b. *I see anything. / I don't see anything.

There have been numerous researches to clarify what operates this peculiar connection between a lexical item and the polarity of the environment. Based on the assumption that Negative Polarity Items should be licensed by an element within the sentence, various licensing elements have been proposed : a lexical operator (Israel 1996), a semantic operator (Ladusaw 1979), a syntactic operator (Progovac 1994) and a pragmatic operator (Linebarger 1987).

Among many analyses, one of the most influential theories is Ladusaw's (1979) semantic characterization, Downward Entailment (DE). With DE, Ladusaw tries to explain many PSI distributions consistently. It, however, cannot account for the detailed contextual requirements of each NPI, such that some NPIs like *lift a finger* requires a stronger context than other NPIs such as *any*. Besides, another problem which all the previous studies have in common is that they cannot completely cover all the distributions of NPIs. Non-negative environments such as questions in (2), (3) and imperatives in (4) cannot be explained.

(2) Who has ever been to China?
(3) Did you ever smoke marihuana?
(4) Take any apples.

Tonhauser (2001) adopts the DE of Ladusaw. His constraint-based approach is formalized in terms of the

Minimal Recursion Semantics (MRS) within the Head-Driven Phrase Structure Grammar (HPSG) framework. Founded on Fauconnier's (1975, 1980) Scale and Ladusaw's (1979) DE, Tonhauser imposes a lexical constraint on each polarity item according to the condition concerning its licensing domain and strength. The licenser also should meet the requirement of the constraint. To illustrate, the NPI *ever* has the constraint that it should have a strong licenser within the licensing domain. Although his analysis provides a detailed condition on NPI distribution, it still needs to be revised because some NPI-licensing environments such as questions and directions cannot have such lexical constraints.

Observing the limits of Tonhauser's lexical constraint, I come to the conclusion that a more general factor which controls all NPI-licensing environments is necessary. The notion of '(non)veridicality' raised by Zwarts (1995) and Giannakidou (2002) is the most successful candidate. Accordingly, the strength of Ladusaw will be substituted by this newly-advocated concept - (non)veridicality. With (non)veridicality, constraint can be imposed on not only specific lexical items but some semantic modes such as question and direction and they will correctly predict all the distributional phenomena of NPIs in English.

The main purpose of this paper is to investigate NPI-licensing constraints focusing on the exceptional cases like English interrogatives & imperatives and finally clarify their behavior within the formalism of HPSG. By describing with feature structures how the semantic property of a lexicon or a mode in a sentence decides its syntactic NPI-licensing property, I will acquire the phenomena of polarity sensitivity in English on the level of the syntax-semantics interface. In this paper, the strength analysis of Tonhauser (2001) will be modified to have a stronger power for explaining all the NPI−licensing phenomena with one single principle − (non)veridicality.

2. Theoretical Framework : Minimal Recursion Semantics

In this paper, I will adopt Minimal Recursion Semantics (MRS), a version of Underspecified Discourse Representation Theory (UDRT). MRS is dynamic semantics which allows for underspecied representations of sentences. For an easy compatibility with Head−Driven Phrase Structure Grammar (HPSG), MRS is adopting the formalization of feature structures.

As an underspecified semantic analysis, MRS has the advantage that it will simplify the analysis of natural language processing and allow them tractable in computational language processing. Besides, a transparent semantic representation of an isolated sentence is acquired through capturing the semantic ambiguities in utterances of natural languages. Syntax−semantics interfaces finally become simpler. Example (5a) shows how MRS works, and its representations in First−Order Predicate Logic is in (5b) and (5c).

(5) a. Every woodpecker claims a tree.
b. $\exists x(tree(x)) \land \forall y(woodpecker(y) \rightarrow claim(y,x)))$
c. $\forall y(woodpecker(y) \rightarrow \exists x(tree(x) \land claim(y,x)))$
(Tonhauser 2001)

(5a) is ambiguous because it has two quantificational noun phrases, which bears two possibilities in scopal relations. In

(8b), *a tree* outscopes *every woodpecker*, while *every woodpecker* outscopes *a tree* in (5c). In this way, the MRS representation can capture both possible interpretations.

The underspecified semantics is a 'flat' semantics, in which the scopal relations are represented by co−indexation instead of structure. Moreover, the semantic arguments in this formalism do not necessarily be filled, but may be left underspecified to allow alternative resolutions for this slot. Underspecified semantic representation of (5a) is given in (6) by Tonhauser.

(6){top(*l*0),*l*1:exist(x,*l*2,*l*6),*l*2:tree(x),*l*3:every(y,*l*4,*l*7),*l*4:woodpecker(y),*l*5:claim(s,y,x)}

The two possible resolutions for (6) are presented in (7a) and (7b) which has the same meaning as (5b) and (5c), respectively.

(7)a.{top(*l*1),*l*1:exist(x,*l*2,*l*3),*l*2:tree(x),*l*3:every(y,*l*4,*l*5),*l*4:woodpecker(y), *l*5:claim(s,y,x)}

b.{top(*l*3),*l*1:exist(x,*l*2,*l*5),*l*2:tree(x),*l*3:every(y,*l*4,*l*1),*l*4:woodpecker(y), *l*5:claim(s,y,x)}

In MRS, the feature structure expresses the semantic relations and the scopal relation between labels. In the feature structure in (8), the feature HANDEL indicates the semantic relation which is presented as a label in the underspecified semantic representation in (6) and (7). The feature INDEX has the semantic relation as its value, a *situation* in this case. The feature LISZT has the list of semantic relations of a proposition as its value, which is the union of the LISZT value of the semantic relations of the sentence. The feature HANDELs identify both the semantic relations in LISZT and their argument positions. The feature H-CONS in (8) has the set of constraint on the resolution of the scope relation between handles as its value.

(8)

HANDEL □
INDEX *s*

every_rel	*woodpecker_rel*	
HANDEL □	HANDEL □	
BV *i*	INST *i*	
RESTR □	SCOPE □	
LISZT		
claim_rel	*some_rel*	*tree_rel*
HANDEL □	HANDEL □	HANDEL □
INDEX *s*	BV *u*	INST *u*
ACTOR *i*	RESTR □	
UND *u*	SCOPE □	

H-CONS { □ <□ , □ <□ , □ <□ , □ ∈{□ <□ } }

(Tonhauser 2001)

As for questions, I consent to Karttunen & Peters's (1980) argument that the semantics of a question is interpreted as the set of propositions, as the semantics of propositions are assumed to be sets of possible eventualities. In question (9a), the property 'x is coming at s' characterizes its eventualities in the propositions represented in (9b), which has the variable λ at the front to mark itself as a question.

(9) a. Who is coming?
b. $\lambda p\ \exists x(person'(x) \wedge p = \lambda s.come'(x)(s))$

I presuppose that *wh*−questions and polar−questions owns an interrogative operator, and this can be inferred from the question MODE. The questionness of the sentence (9a) can be represented in *wh*−handles for *wh*−questions and non−*wh*−handles for polar−questions.

As I have observed until now, the MRS has many advantages in that it can designate detailed semantic factors such as a scope relation between handles in a sentence. Moreover, it also enables us to suggest a constraint on semantic relation in H−CONS. In this paper, I will adopt the efficient and dynamic MRS framework for providing a clear explanation on the phenomena of NPI−licensing in English.

3. PREVIOUS ANALYSES

3.1. Ladusaw's (1979) Downward Entailment

Ladusaw attempts to completely reduce the polarity sensitive phenomenon to semantics. With relation to Fauconnier's scale, Ladusaw argues that an NPI is licensed only in the scope of a downward entailing operator and gives the following principle: an NPI must appear in the scope of a downward−entailing trigger. If its trigger is in the same clause as the NPI, the trigger must precede the NPI. A definition of DE is given in (10).

(10) DEFINITION (Downward entailing function)
A function f is downward entailing iff for every arbitrary

element X, Y it holds that: $X \subseteq Y \rightarrow F(Y) \subseteq F(X)$

Although Ladusaw's analysis has the advantage that it appears to provide a consistent explanation on the phenomena with one semantic principle, it still has many exceptional cases such as *only, be surprised.*

Another serious problem in Fauconnier and Ladusaw is that it cannot account for the detailed contextual requirement of each NPI such that an NPI like *lift a finger* needs to have a stronger context than other NPI such as *any*. Furthermore, they cannot correctly predict all the licensing contexts including questions and imperatives, despite the advantage of being simple enough to treat these phenomena in one principle. Among all NPI−licensing environments, questions are one of the trickiest to predict their behaviors correctly, because positive or negative polarity items seem to be almost freely distributed in questions, regardless of the occurrence of triggers such as negation as Ladusaw (1979) observes. Consequently a finer structure is necessary to cover all licensing conditions.

The validity of DE, especially on questions, needs to be reviewed here. First, it is difficult to account for the reason why questions license NPIs. As Klima (1964) argues, questions license NPIs without any negation within themselves or downward entailing context as in (11).

(11) yes/no question

Do you have a pet? $\nrightarrow$ Do you have a cat?

On PSI−licensing questions, Ladusaw (1979 in Ch.8) takes a whole different viewpoint. His idea is that the licenser of the NPI or PPI is the expected answer, not the question itself. For polar questions this means when the question has a negative answer expected, the hearer can use the embedded clause of the question with a negation, as a licenser of the NPI. According to Rooy (2002), however, Ladusaw's prediction that *wh*-questions do not allow for weak NPIs at all is wrong because weak NPIs are also licensed in infor-seeking questions. In sum, the two previous analyses on NPI-licensing still remain unsuccessful to provide a complete solution to this phenomenon. The element which controls the behavior of NPIs is not only dependent on overtly and non-overtly negative words but sometimes even on semantic modes such as questions and imperatives. As a natural result, it is so difficult to capture a common principle comprising all NPI-licensing cases by whatever element it is caused.

3.2. Tonhauser (2001)

Tonhauser (2001) attains the explanatory level on the phenomenon of NPI-licensing using the framework of Minimal Recursion Semantics in HPSG. For this purpose, he suggests a semantic constraint on the lexical entry of each NPI. In the course of describing the semantics of NPI-licensing phenomena, Tonhauser basically adopts the semantic assumptions and the terms of Fauconnier's (1975) Scale approach and Ladusaw's (1979) Downward Entailment.

Adopting Fauconnier's (1975) scale, Ladusaw's (1979) DE and also the refinement by van der Wouden (1994) and Zwarts (1996), Tonhauser (2001) suggests Figure 1 showing a detailed classification of PSIs and their licensers. According to this Figure, each type of PSIs can be licensed in particular environments only.

operator R	Environment created	PSI licensed	example
weak SRE (e.g.,at most n)	downward−entailing $\alpha \subseteq \beta \rightarrow R(\beta) \subseteq R(\alpha)$	weak NPI weak PPI	any rather
strong SRE (e.g., no one)	anti−additive $R \subseteq \beta \rightarrow R(\beta) \subseteq R(\alpha)$ and $R(\beta \cup \alpha) \rightarrow R(\beta) \cap R(\alpha)$	weak NPI strong NPI	any yet
superstrong SRE (e.g., not)	anti−morphic $\alpha \subseteq \beta \rightarrow R(\beta) \subseteq R(\alpha)$ and $R(\beta \cup \alpha) \rightarrow R(\beta) \cap R(\alpha)$ and $R(\beta \cap \alpha) \rightarrow R(\beta) \cup R(\alpha)$	weak NPI strong NPI superstrong NPI	any yet a bit
upward entailing (e.g., at least n)	upward−entailing $\alpha \subseteq \beta \rightarrow R(\alpha) \subseteq R(\beta)$	weak PPI strict PPI	rather some

Figure 1: Strength of Entailment and PSIs (Tonhauser 2001)

According to above Figure, weak SRE creates downward−entailing environment, strong SRE creates downward−entailing and anti−additive one, and superstrong SRE creates downward−entailing, anti−additive and anti−morphic one. From a lexicalist perspective, Tonhauser (2001) assumes that a PSI introduces constraint on the context within which it may appear and a presupposition which ensures that the context is suitable for the PSI. Which gives the following inference: each PSI in questions would characterize the context. This is illustrated in Figure 2:

PSI	constraint on context
weak NPI	weak SRE
strong NPI	strong SRE
superstrong NPI	superstrong SRE
weak PPI	weak SRE or upward entailing operator
strict PPI	upward entailing operator

Figure 2 : Lexical Constraints of PSIs (Tonhauser 2001)

Tonhauser (2001) also presents a type hierarchy in Figure 3 in order to encode the strength of each operators. The maximal types of this type hierarchy such as upward entailing, weak, strong, and anti-additive encode the respective strength of the operators. The requirements of each PSI on the context are also represented in the type hierarchy: as Figure 1 shows that each PSI needs an appropriate operator in the environment with a specific strength and direction as upward entailing in case of strict PPIs or up_ent_or_weak in case of weak PPIs.

strength

up-ent_or_weak downward-entailing

anti-additive

upward-entailing weak strong superstrong

Figure 3 : Type Hierarchy for strength of operators (Tonhauser 2001)

Assuming for PSIs to be assigned in the type *psi_rel*, Tonhauser argues that a PSI is required to have a constraint on the context. This constraint ensures for each context of PSIs to contain an appropriate operator. According to the constraint imposed on the operator, Tonhauser shows the lexical entry for the NPI *ever* in (12).

(12)

ever_rel
LISZT 〈 HANDEL □
LIC [DOM □]
〉
<
LIC DOM □
H-CONS STR *downward-entailing*
PSI □

(Tonhauser 2001)

In the feature structure in (12), it can be inferred that the underspecified constraint represents the presupposition of PSIs by the outscope relation between handles in H-CONS. Therefore, the lexical representation in (12) means that *ever* presupposes a requirment that the context must have a licenser (LIC) which has a downward-entailing strength (STR) and also outscopes the PSI.

For representing licensing environments, Tonhauser provides the feature structure in (13). The operator *every,* a subtype of the type *lic_rel*, identifies itself as a licenser in Figure 1. Here an inference can be drawn that this *lic_rel* type demands for the operator to include the feature LIC, which indicates both the STR(ength) and the DOM(ain) of licenser itself in the semantic relation.

(13)

every_rel
HANDEL □
LISZT RESTR □

SCOPE □
DOM □
LIC STR *strong*

(Tonhauser 2001)

With above two feature structures in (12) and (13), both the semantic licensing and the scope disambiguation of the sentence like (14) are acquired.

(14) Every child who has ever eaten chocolate is addicted to it.

According to Tonhauser, the NPI *ever* is licensed by the NPI-licenser *every* in (14) because *ever* satisfies the condition imposed on *every*. The semantic relation between the NPI *ever* and the licenser *every* is represented within the framework of Minimal Recursion Semantics as in (15).

(15)
every_rel
HANDEL □
RESTR □
LISZT SCOPE □ , *ever_rel*
HANDEL □
LIC [DOM □]
DOM □
LIC STR *strong*

<
DOM □
H-CONS LIC STR *downward-entailing*
PSI □

(Tonhauser 2001)

In (14), the feature H-CONS, which is lexically triggered by the NPI *ever*, contains an underspecified constraint on the handle ☐ and ☐ . The constraint decides first the scope relation between the NPI and the licenser in the LISZT value, and secondly the licenser's compatibility with the STR value that the NPI requires. In other words, *every* is identified as a licenser and its licensing strength *strong* is sufficient for *ever*. Likewise, it seems that all the PSIs can correctly predict all their licensers.

So far, I have inspected Tonhauser's lexical constraint analysis based on Fauconnier (1975) and Ladusaw (1979) closely and found out that Tonhauser's proposal has many advantages: first, it puts the phenomenon of PSI-licensing onto the explanatory level using the Minimal Recursion Semantics in HPSG. Second, it gives such detailed conditions on the scope and the strength of each operator. Finally, diverse distributional behaviors of NPIs have become totally predictable within their constraint.

In order for Tonhauser's analysis to acquire a complete validity, it must be applied to every PSI-licensing context. Unfortunately, however, there still remain some problematic cases. *Wh*-questions, polar-questions, and imperatives, all of which appear to license NPIs without having any lexical item as a licenser as seen in the examples in (2), (3) and (4).

In those constructions, it is hard to find any common lexical element which characterizes themselves as interrogatives or imperatives. One might think of the *wh*-word as a candidate on which the lexical constraint is imposed, which seems to be a good idea. Those *wh*-words such as *what* or *where*, however, reside only in 'constituent-questions' (i.e. *wh*-questions). But what about 'polar-questions' (i.e. yes/no-questions)? For this reason, I need to modify Tonhauser's analysis for a more general and broad constraint which will cover all licensing condition in a straightforward way. Above two exceptional examples do not require a total opposition to the lexical constraint by Tonhauser. Rather, an extension which will exert it to the contextual information is necessary, which will be discussed in the next Chapter.

4. PROPOSED ANALYSIS

4.1. (Non)veridicality

Initially the investigation on (non)veridicality was motivated by the fact that the range of affective environments in English includes many cases that cannot be characterized as downward entailing or negative. Monotonicity based approaches like Ladusaw's DE and even the fine-grained version of Zwarts (1993) cannot completely explain all the affective environments such as questions or imperatives in English. As a result, the introduction of a broader concept which includes the DE is essential.

The notion of (non)veridicality has completely formulated by Giannakidou (2002). To begin with, let's take a look at the following definition on Polarity Items in (16) and on (non)veridicality operators in (17), repeated here, that Giannakidou provides.

(16) DEFINITION 1 – *Polarity item*

a linguistic expression a is a polarity item iff:

i. The distribution of α is limited by sensitivity to some semantic property β of the context of appearance; and

ii. β is (non)veridicality, or a subproperty thereof: β ∈

{veridicality, nonveridicality, antiveridicality, modality, intensionality, extensionality, episodicity, downward entailingness}.

(17) DEFINITION 2 – *(Non)veridicality for propositional operators*

i. A propositional operator F is veridical iff Fp entails p: Fp→ p;

otherwise F is nonveridical.

ii. A nonveridical operator F is antiveridical iff Fp entails *not* p: Fp→¬ p.

According to the DEFINITION 2, positive operator in (18) is analysed to be veridical. The operators in question and modal verb in (19) are nonveridical, and the ones in negation and *without* in (20) are antiveridical.

(18) Yesterday, Paul saw a snake. → Paul saw a snake.

(19) a. ? Did Paul see a snake ↛ Paul saw a snake.

b. Paul may have seen a snake. ↛ Paul saw a snake.

(20) a. Paul didn't leave. → It is not the case that Paul left.

b. without Paul leaving. → It is not the case that Paul left.

Based on the definition 2 on (non)veridicality, propositional operators can be classified as three types in (67).

(21) (Non)veridicality of propositional operators

I. veridical operators: e.g. positive operators, past tense adverbials

Ⅱ. nonveridical operators

ⅰ. unveridical operators, which license weak NPIs:

e.g. modal verbs, intensional operators, questions, imperatives

ⅱ. antiveridical operators, which license weak and strong NPIs:

e.g. negation, *without,* rhetorical questions

The veridical operator in (21Ⅰ) contains a positive operator, the proposition of which is always supposed to be true, as F(*p)* → *p*. All nonveridical operators are divided into two types - unviridical and antiveridical ones. I termed the first class of nonveridical operators in (21Ⅱⅰ) as 'unveridical' because the question does not entail the proposition *p*. 'Unveridical' is a subtype of Giannakidou's (2002) term 'nonveridical'. Secondly, the operator like negative sentence or *without* should be treated as antiveridical, because the proposition evidently results in the negated one: F(*p*) →∼*p*. This is another subtype of 'nonveridical' operator.

As the major concern of this paper is about interrogatives and imperatives, the applicability of the definition 2' to questions and directions needs to be considered first. Providing the classification of propositional operators in (21), Giannakidou (2002) assumes that questions and imperatives are propositional operators which embed functions. For a while, let's see how Giannakidou's (2002) logical decomposition of the semantics of questions support his idea. Firstly, the polar question is represented as follows:

(22) the meaning of a yes/no (polar) question

a. Did Ruth see Jacob?

a'. λp [p= ^[see' (Ruth, Jacob)]] = A
a". A = {Ruth saw Jacob ∨ Ruth did not see Jacob}

In the case of the polar question in (22a), the logical form articulated in (22a'), (22a") indicates that the relevant set A includes affirmative and negative propositions simultaneously as possible answers. That is, the polar question (22a) entails *p* ∨ *q*, not just *p*. Which fact supports its classification as an unveridical operator. Secondly, the logical meaning of the constituent question can be represented as follows:

(23) the meaning of *wh*-question
a. Who did Ruth see?
a'. λp [(∃x: person (x)) [p= ^[see' (Ruth, x)]]]
a". A = {Ruth saw Jacob ∨ Ruth saw Roxanne ∨ Ruth saw Lucy ∨ Ruth saw Jacob and Roxanne ∨ Ruth saw Jacob and Lucy ∨ Ruth saw Roxanne and Lucy.... }

Since (23a) is a *wh*-question, its answer is made up of an infinite number of propositions as in (23a"). Again, this will lead *wh*-questions to be unveridical in that they have boundless positive answers and even a negative answer like *Ruth saw nobody.*

Now the (non)veridicality can be considered to be a syntactically active feature in controling the licensiblity of NPIs, as Giannakidou proposes, and it is proved to be more efficient than the strength. At this point of time, I propose a veridicality hierarchy which is represented in Figure 4. This new hierarchy with veridicality is suggested to replace the hierarchy for strength of operators by Tonhauser (2001) in

Figure 3, and will play an important role in my analysis.

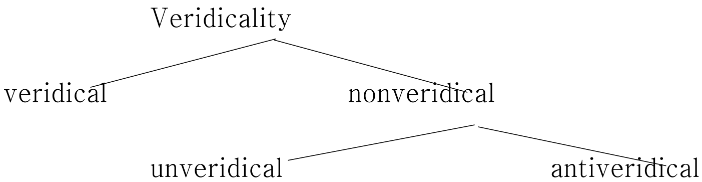

Figure 4 : Veridicality Hierarchy

4.2. An Extended Licensing Constraint

Giannakidou (2002) indicates that DE-hierarchies (Zwarts 1993, van der Wouden 1994) cannot comprise all the cases because strong NPIs, which are presumed to be licensed roughly by negative triggers, are grammatical in non-DE sentences such as questions, habituals and modals. Since assuming DE functions are a proper subset of the nonveridical (Zwarts 1995), Giannakidou states as "the theoretical move from DE to nonveridicality is not at all in conflict with the previous alternative, but rather an extension of it."

Among diverse NPI-licensing environments, I am concentrating on questions (and imperatives) in this paper, because they appear to be most problematic within many theories proposed before: first of all, questions cannot be explained within the downward entailment analysis as Ladusaw (1980) also admits. Strong NPIs, which are predicted to be licensed only by antiadditive or antimorphic triggers only, are grammatical in questions. This fact is one of the strongest obstacles in fitting questions into the DE−hierarchies. Secondly, Progovac's (1994) syntactic analysis within GB framework also fails to explain the yes/no−question as an NPI−licenser. In addition, Tonhauser's (2001) lexical constriant analysis, on which I put my agrees most, does not provide any solution to interrogatives.

For a complete constraint covering all PSI−licensing environments, I reviewed the brand−new notion − (non)veridicality, and proposed the veridicality hierarchy in former section. In the hierarchy, I termed questions as the class of unveridical in that they do not entail the truth or falsity of the proposition. Now I need to observe how the interrogative sentences in English are operated within the (non)veridicality theory.

To begin with, the relationship between (non)veridicality and PSIs, examined so far, can be condensed to Figure 5, and this will replace Tonhauser's table on the strength of entailment and PSI, presented in Figure 1 before.

<table>
<tr><th colspan="2">Semantic Operator</th><th>Environment created</th><th>PSI licensed</th><th>Example</th></tr>
<tr><td colspan="2">Veridical Op</td><td>veridical
Fp $\rightarrow$ p</td><td>weak PPI
strong PPI</td><td>rather,
some</td></tr>
<tr><td rowspan="2">Non−veridical Op</td><td>unveridical Op</td><td>unveridical
Fp $\nrightarrow$ p $\vee$ $\neg$ p</td><td>weak NPI
weak PPI</td><td>any,
rather</td></tr>
<tr><td>antiveridical Op</td><td>antiveridical
Fp $\rightarrow$ $\neg$ p</td><td>weak NPI
strong NPI</td><td>any,
lift a finger</td></tr>
</table>

Figure 5 : the veridicality of environment and PSI

In above table, Tonhauser's SRE operators are substituted by three types of veridicality operators − veridical, unveridical and antiveridical one. Firstly, let's take a look at some veridical sentences in (24) to prove this: veridical environments, created by veridical operators, cannot license any NPIs – neither weak nor strong ones.

(24) Veridical
a. * She sang any louder. (weak NPI)
b. * She lifted a finger to help her boyfriend. (strong NPI)

Second member of semantic operator, assumed here, is a rather tricky one – 'unveridical operator'. The environments that are created by unveridical operator including conditionals, (normal) questions, and imperatives, and can license weak types of NPIs.

(25) Nonveridical Ⅰ: unveridical
a. Can she sing any louder? (weak NPI)
b. * Why did she lift a finger to help her boyfriend? (strong NPI)

(26) a. Take any apples ! (weak NPI)
b. * Lift a finger to help me ! (strong NPI)

The distributions of weak and strong NPIs seem to be all correctly predicted in examples (25) and (26). However, I must also mention that strong NPI *lift a finger* are not always banned in questions or imperatives, which makes them a tricky part in predicting NPI–licensing. For a solution to these counterexamples, I will provide more detailed discussion in the following.

Finally, let me observe the behaviors of antiveridical operators, another subtype of nonveridical operators. Since antiveridical operators create typical negative environments, they can license all types of NPIs as the following examples in (27) proves.

(27) Nonveridical Ⅱ: antiveridical
  a. She cannot sing any louder. (weak NPI)
  b. She didn't lift a finger to help her boyfriend. (strong NPI)

Based on these facts, Tonhauser's Figure 2 on PSIs and their environments with relation to DE can be exchanged to the following Figure 6 with (non)veridicality:

PSI	constraint on licenser
weak NPI	unveridical
strong NPI	antiveridical
PPI	veridical

Figure 6 : Lexical Constraint on PSIs

Since the (non)veridicality, rather than strength, is verified as a determining factor of NPI-licensing, from now on I will take an approach to the solution for the extension of Tonhauser's constraint on lexicon to all contexts. First of all, I need to suggest how the lexical NPI-licenser - determiner and quantifier that Tonhauser illustrated, can be absorbed into the veridicality-based analysis proposed in this paper.

Every is unveridical operator, a subtype of nonveridical one. *Every* can be inferred to be a nonveridical operator first. Then, among the nonveridical operators, it is categorized into the unveridical one in the veridicality hierarchy in Figure 4, because *every* is not an antiveridical operator.

Based on this fact and the veridicality hierarchy proposed in 4.1, I will use the feature VERIDICALITY instead of the STR(ength) in my feature structure. This new feature will have three types as its value – *veridical, unveridical* and *antiveridical*. This gives us the following feature structure, a revised version of the former one by Tonhauser in (13), about the semantic constraint on *every* in example (14), repeated here.

(28) *every_rel*
HANDEL ☐
LISZT ⟨ [RESTR ☐
SCOPE ☐
[DOM ☐
LIC VERIDICALITY *unveridical*]] ⟩

(14) Every child who has ever eaten chocolate is addicted to it.

The modified feature structure in (28), initially proposed by Tonhauser, has an *unveridial* value for the feature VERIDICALITY as clarified above, and also indicates that the domain of the licenser *every* is correspond to its RESTR, not its SCOPE.

The constraint on PSI *ever* also need to be revised as follows:

(29) *ever_rel*
LISZT { [HANDEL ☐
LIC [DOM ☐]] }

<
LIC DOM ☐
H−CONS VERIDICALITY *nonveridical*
PSI ☐

As with Tonhauser's feature structure in (12), the constraint on the DOM(ain) in H−CONS is preserved in (29) as well, because each licenser has their own governing domain. The only part changed here is the feature from the STR(ength) to the VERIDICALITY. In the case of *ever*, the value of VERIDICALITY is nonveridical, because *ever* is a weak NPI which creates either unveridical or antiveridical environment according to the Figure 5.

In the same way, I propose that the veridicality can be extended to the constraint on specific semantic mode such as questions or directives. For the semantic constraint, I need the hypothesis that the MODE of the sentence predicts the veridicality of itself.

Discussions on semantic MODE are issued by Sag & Wasow (1999), who also adopt a simplified version of minimal recursion semantics. They classified the semantic objects of their grammar in terms of four semantic modes with respect to four basic kinds of meanings. Sag & Wasow are notable here because they analyse questions and directives alike. They consider question and directive similar in that they both are not themselves true or false. Concerning the meaning of normal questions, except for rhetorical questions, their truth value is not fixed because of all the possibilities of numerous answers. On the unfixed truth of imperatives, Sag & Wasow state that the hearer may or may not perform the action. So they use the feature MODE to note the difference between the meaning of question & directive and proposition in their semantic feature description.

Accordingly, the MODE types in English can be represented as in (30):

(30) mode

ref *proposition* *question* *directive* *(none)* . . .

(Sag & Wasow 1999)

Appling the veridicality on each types of MODE, only the question and directive mode are unable to predict their veridicality among four types. The questions and directives are not fixed either veridical or antiveridical because of their inherent characteristics, so they have to be analysed to be unveridical in the veridicality hierarchy in Figure 4.

Consequently, I can suggest the constraints on the questions in (31) and directions in (32), which designates their type to be 'unveridical' depending on the questional and directive MODE, respectively.

(31)MODE ques → LISZT LIC [VERI *unveridical*] , ...

(32)MODE dir → LISZT LIC [VERI *unveridical*] , ...

Above two constraints on semantic MODE guarantee that both of them are unveridical PSI-licensers. Then, how above two constraints are applied to each types of sentences need to be examined.

Two types of questions in English should be treated separatedly. According to Yoo (1997), the question mode of English are classified into two types of modes; *wh* and *polar*. Firstly, in a *wh*-question like (34), the *wh*-word is assumed to have information as a *wh*-question-operator within my analysis. This question operator is analysed to be an unveridical licenser itself and represented in *wh*-rel in the first list of the feature (33) and (35).

(33)
MODE *wh*
INDEX *s*
LISZT ⟨ [*wh-rel*
LIC [VERIDICALITY *unveridical*]],... ⟩

The *wh*-question in (34) can be presented in the following feature structure;

(34) Who wants any soup.

(35)
MODE *wh-interrog*
HANDEL ☐

INDEX *s*

want−rel *wh−rel* *person−rel*
HANDEL ☐ HANDEL☐ HANDEL☐
BV *i* INST *i* INDEX *s*
RESTR ☐ ACTOR *i*
SCOPE ☐ UND *u*
LISZT HD_ARG ☐ , , ,
LIC DOM ☐
VERI- DICALITY *unveridical*

any−rel *soup−rel*
HANDEL☐ HANDEL ☐
BV *u* , INST *u*
RESTR ☐
SCOPE ☐
LIC[DOM☐]

H−CONS < LIC DOM ☐
VERIDICALITY *nonveridical*
PSI ☐

Next, a constraint on matrix pol−interrogative is suggested as in (36). Apart from *wh*−int−cl, the question operator of (matrix) pol−int−cl is another unveridical licenser, and this information is represented at the inverted auxiliary verb in the first LISZT.

(36) [MODE *polar*
HANDEL ☐
INDEX *s*
LISZT ⟨ [*aux−v−rel*
INV +
LIC [DOM ☐
VERIDICALITY *unveridical*]] , . . . ⟩]

The matrix pol-interrogative in (37) can be presented in the following feature structure in (38).

(37) Have you ever smoke marihuana?

(38)

MODE *polar*
HANDEL □
INDEX *s*
LISZT ⟨ [*aux-v-rel* HANDEL □ INV [VERIDICALITY *unveridical*] LIC DOM □], [*hearer-rel* HANDEL□ INST *i*], [*ever-rel* HANDEL □ SCOPE □ LIC [DOM □]] ⟩,
{ [*smoke-rel* HANDEL □ INDEX *s* ACTOR *i* UND *u*], [*marihuana-rel* HANDEL □ INST *u*] }
H-CONS < LIC DOM □ VERIDICALITY *nonveridical* PSI □

When it comes to the embedded pol-interrogative like *I'm wondering if(whether) you ever smoke marihuana*, its MODE will be polar and the lexical entry of *if/whether* will be the interrogative licenser which owns the information for the veridicality of its licenser to be unveridical.

With above analyses applicable to every interrogative sentences in English, all the previous problems in questions with PSIs will completely extinct. For instance, the questions in (2) and (3), illustrated as problems before, now get the authority as a licenser of weak types of NPI and PPI. The *nonveridical* value for VERIDICALITY that the weak NPI *ever* claims for its licenser to be, is compatible with the value *unveridical* that the *question* MODE claims. Moreover, questions with other PSIs can be analysed alike.

Finally on directions, the constraint in (39) is suggested on the assumption that the infinitive verb, which is the first member in LISZT and shares the value of INDEX with the whole sentence, is an unveridical licenser.

(39) MODE *direction*
INDEX *s*
LISZT ⟨ INDEX *s*
LIC [VERIDICALITY *unveridical*] , ... ⟩

A directive sentence with weak NPI *any* in (4) is presented as in (40);

(4) Take any apples !

(40) MODE *direction*
HANDEL □
INDEX *s*

take−rel *any−rel*
apple−rel
HANDEL ☐ HANDEL ☐ HANDEL ☐
INDEX *s* , BV *u* , INST *u* ,
ACTOR *i* RESTR ☐
LISZT UND *u* SCOPE ☐
LIC DOM ☐ LIC[DOM☐]
VERIDI− *unver−*
CALITY *idical*

<
LIC DOM ☐
H−CONS VERIDICALITY *nonveridical*
PSI ☐

Along with the questions, the MODE *directive* gives the imperative sentence like (4) a reason to license weak types of PSIs within its domain which is the whole sentence in this case, according to Figure 5.

At last, a clearer description is provided to the phenomena of PSI−licensing in questions and even imperatives in English, both of which have constantly been trouble−causers in this area. Thanks to the invitation of the neutral notion 'unveridicality' in the veridicality hierarchy of Figure 4, the coherence in the theory of NPI−licensing is acquired.

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