Korean Honorification in Answer Set Programming

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1. Problem statement

Korean language reflects the important observance of a speaker's relationships with the subject of the sentence, the third person of the sentence, or the audience. Indeed, honorifics in Korean language mirror social factors such as age, intimacy, formality, gender, social rank or kinship. Korean honorification is classified to three ways on the basis of whom a speaker respects and is expressed by nouns, honorific case particles, verb suffixes, or special honorific forms of verbs. In this paper, I focus on honorification to listener. In the accordance with the honorification, the main goal of this project is to develop software components which are the automated system to provide users with information about social factors between a speaker and a listener.

As mentioned above, Korean honorification has deep connection with sociolinguistics. This connection brings the need of a language that describes non-monotonic or defeasible reasonings so as to explain about why a speaker could choose particular speech levels and, ultimately, to achieve the purpose of the project. AnsProlog is the knowledge representation language that is able to express the characteristics in Korean honorification. We will construct a knowledge base in Answer Set Programming (ASP) for six speech levels in Korean honorification. The answer sets to satisfy the knowledge base will finally represent the relationship between a speaker and a listener with respect to social factors and will tell what speech level should be used for them.

2. Background

Honorification to listener is the method for representation of a speaker who respects a listener. It is mainly expressed by various final endings at the end of a sentence. This honorification makes a speaker treat a listener with high or low level of respect. In some cases, a speaker lowers himself/herself. The grade system of honorification to listener is differently classified by researchers and linguistic communities as research subjects. However, the grade system is generally divided to six speech levels [3].

2.1 Speech level
2.1.1 HapSho

HapSho is the speech level to treat a listener with the highest level of respect [3]. It is used between strangers and used to customers in a distant relationship. In addition, it is used to public audiences in formal places such as a speech, lecture, or news coverage. The formats of final endings for HapSho speech level are '-습니다(-sumnida)[3], 합니다(hamnida)[1], or ㅂ니다 (nida)[2]' in a declarative sentence, '습니까(sumnika)[3], 합니까(hamnika)[1], -ㅂ니까(-nika)' in an interrogative sentence, '으십시오(ûsipsio), -으소서(ûsoseo)[3], 하십시오(hasipsio)[1], ㅂ시오(sio)[2]' in an imperative sentence, and '-(으)시지요(-(û)sijiyo)[3]', '하십시다(hasipsida)[1]' in a propositive sentence.

2.1.2 HaO

HaO speech level is mainly used among some older male people in a distant relationship. It is used where a speaker is older than a listener or they are of the same age. The speaker conveys high respect for the listener. There is no case that the listener's rank for degree of kinship or position is higher than or equal to the speaker's rank [4]. In addition, HaO speech level is used among older female people in a kindred relationship. A speaker's rank for degree of kinship is lower than a listener's rank. The possible cases are the followings: between sister-in-laws, between sisters, or between mother and daughter [3]. The formats of final endings for HaO speech level are '-오(-o), -소(-so)[3], 하오(hao)[1] in a declarative and an interrogative sentence, '-오(-o), -구려 (-guryu)[3], 하(시)오(ha(si)o)[1]' in an imperative sentence, and '-(으)ㅂ시다(-(û)sida)[2][3], 합시다(hapsida)[1]' in a propositive sentence. HaO speech level is rarely used in everyday conversation except for the imperative format [1]. The respect level of HaO is higher than the respect level of HaGe [3].

2.1.3 HaGe

HaGe speech level is mainly used among older male people in a close relationship. Like HaO speech level, it is used where a speaker is older than a listener or they are of the same age. However, the speaker conveys low respect for the listener. The listener's rank for degree of kinship or position is lower than the speaker's rank [4]. Besides, it is used between mother-in-law (father-in-law) and son-in-law, between sister-in-laws [2][3], and between older teacher and student [1]. The formats of final endings for HaGe speech level are '-네(-ne), -을세(-eulse), -데(-de), -구먼(-gumeon)[3], 하네(hane)[1]' in a declarative sentence, '-는가(-nunga), -나(-na)[3], 하나(hana), 하는가

(hanunga)[1]' in an interrogative sentence, '-게(-ge)[3], -하게(-hage)[1]' in an imperative sentence, and '-세(-se)[2][3], 하세(hase)[1]' in a propositive sentence. The use of HaGe speech level decreases at the present [3].

2.1.4 HaeRa

HaeRa is the speech level to treat a listener with the lowest level of respect [3]. It is not only used between close friends of the same age, but also used between a much older speaker and a listener. In another case, a speaker's rank for degree of kinship or position is much higher than a listener's rank. The formats of final endings for HaeRa speech level are '-ㄴ다(-da)[3], 한다(handa)[1]' in a declarative sentence, '-느냐(-nunya), -니(-ni)[3], 하느냐(hanunya)[1]' in an interrogative sentence, '-어라(-ôra)[3], 해라(haera)[1], -아라(-ara)/너라(-neora)[2]' in an imperative sentence, and '-자(-ja)[3], 하자(haja)[1]' in a propositive sentence.

2.1.5 HaeYo

The value of respect level for HaeYo is between HaO's and HapSho's. HaeYo speech level as well as Hae speech level is commonly used in daily conversation. HaeYo is used where a listener's rank for degree of kinship or position is higher than a speaker's rank regardless of age. It is also used to customers or bosses with higher respect [4]. The formats of final endings for HaeYo speech level are '-아요(-ayo), -어요(-ôyo)[3]' in a declarative sentence, '-어요(-ôyo)[1]' in an interrogative and imperative sentence, and '-지요(-jiyo)[3]' in a propostive sentence.

2.1.6 Hae

Hae speech level is called a crude language. The value of its respect level is between HaGe's and HaeRa's, and Hae is able to be used for HaGe and HaeRa [3]. This speech level is used where a listener's rank for age, degree of kinship or position is lower than a speaker's rank in a close relationship between them. For example, it is widely used between senior and junior students, between sisters and brothers, between parents and children, between husbands and wives, between teachers and students, and between friends [4]. The formats of final endings for Hae are '-어(-ô), 지(ji)' in all types of sentences [3].

2.2 Order of precedence among social factors

So far, we have seen social factors between a speaker and a listener in each speech level. For example, HaO and HaGe are used where a speaker is older than a listener or they are of the same age. The social factor in this example is age.

Social factors in Korean honorification are divided into rank and intimacy. Rank is ramified to degree of kinship, social rank, and age [5]. Moreover, there exists the order of precedence among social factors. It is about how they are powerful to Korean honorification. For instance, which factor between social rank and age is more powerful where there are a younger employer and an older employee at work? The answer is social rank. The following is the summary of the order of precedence among social factors [5].

kindred rank(kinship) > social rank(job) > age (difference) > intimacy

We will also add formality to the front of the order. The meaning of formality is not a formal speech level but a formal place. In a formal place under Korean honorification, a speaker treats a listener with the highest level of respect regardless of age, social rank, and degree of kinship.

It is not easy to formalize Korean honorification because of the order of precedence among social factors. The reason is that a lot of exceptions/cases happen in comparisons among social factors. Imagine how many if-else condition statements would we have in order to handle the exceptions in imperative programming languages such as Java and C++? On the other hand, answer set programming (ASP) is able to formalize the exceptions succinctly and expressively. It will be shown on the next section.

3. Formalizing in ASP
3.1 Social factors
All kinds of social factors and their levels are shown in **Appendix A** (level.lp).

3.1.1. Respect level (RL)
The value of each level represents how a speaker respects a listener. The range of values is from 0 to 5. The highest value is for HapSho speech level.

3.1.2 Formality level (FL)
This level is simply divided into **formal** and **informal**.

3.1.3 Intimacy level (IL)

This level is simply divided into **distant** and **close**.

3.1.4 Social rank (position) level (PL)

This level is divided into three units. **p_higher** represents that one's social rank is higher than the other's social rank. **p_equal** represents that social ranks are the same. **p_noRel** represents that a speaker and a listener have no relationship of social rank.

3.1.5 Kindred level (KL)

This level is divided into three units. **k_higher** represents that the degree of one's kinship is higher than the degree of the other's kinship. **k_equal** represents that degrees of kinship are the same. **k_noRel** represents that a speaker and a listener have no kindred relationship.

3.1.6 Age difference level

This level is divided into three units. **much_older** represents that one is much older than the other. **older** represents that one is older than the other. **equal** represents that a speaker and a listener are of the same age.

3.1.7 Age level

This level is divided into five units. **elder** represents above 60 years old. **adult** represents from 40 to 60 years old. **young_adult** represents from 20 to 40 years old. **teenager** represents from 10 to 20 years old. **child** represents from 0 to 10 years old.

3.2 Speech levels

All speech levels are shown in **Appendix B** (honorification.lp).

3.2.1 HapSho speech level

We assume that a child does not use this speech level. HapSho speech level is used where a speaker conveys the highest respect for a listener in a formal place. It is described by the expression:

hapSho(S,L) :- formality(S,L,formal), age(S,V), V>child, respect(S,L,r_highest).   (1)

HapSho speech level is also used where a listener's rank is higher than a speaker's rank. This rank is relation to kinship, position, or age. It is described by the expression:

hapSho(S,L) :- older(L,S,G), G>equal, age(S,V), V>child, respect(S,L,r_highest),

$$\text{not ab1(L,S), not ab2(L,S).} \tag{2}$$

The rule (2) introduces two abnormal predicates.

$$\text{ab1(S,L) :- position(L,S,p\_higher), kindred(S,L,k\_noRel).} \tag{3}$$

$$\text{ab1(S,L) :- kindred(L,S,k\_higher).} \tag{4}$$

$$\text{ab2(S,L) :- position(L,S,p\_equal), kindred(S,L,k\_noRel).} \tag{5}$$

$$\text{ab2(S,L) :- kindred(L,S,k\_equal).} \tag{6}$$

ab1(S,L) expresses that a speaker's rank for degree of kinship or position is higher than a listener's rank. ab2(S,L) expresses that a speaker's rank for degree of kinship or position is equal to a listener's rank. kindred(S,L,k_noRel) in the rule (3) and (5) makes position the most powerful among social factors.

3.2.2 HaO speech level

HaO speech level is mainly used by male-middle-aged or elder adults without close relationship. This speech level is not only used where a speaker is older than a listener, but also used where they are of the same age. The speaker treats the listener with high level of respect even though the listener's rank for degree of kinship or position is lower than or equal to the speaker's rank. It is described by the expression:

$$\text{haO(S,L) :- intimacy(S,L,distant), age(S,V), age(L,V2), V>=adult, V2>=adult,}$$
$$\text{older(S,L,G), G>=equal, respect(S,L,r\_high), not ab1(S,L).} \tag{7}$$

3.2.3 HaGe speech level

HaGe speech level is mainly used by male-middle-aged or elder adults with close relationship. This speech level is not only used where a speaker is older than a listener, but also used where they are of the same age. The speaker treats the listener with low level of respect where the listener's rank for degree of kinship or position is lower than the speaker's rank. It is described by the expression:

$$\text{haGe(S,L) :- intimacy(S,L,close), age(S,V), age(L,V2), V>=adult, V2>=adult,}$$
$$\text{older(S,L,G), G>=equal, respect(S,L,r\_low), not ab1(S,L), not ab2(S,L).} \tag{8}$$

Compared to Hao speech level, two abnormal predicates are added because the speaker's rank is higher than the listener's rank.

3.2.4 HaeRa speech level

HaeRa speech level is used between close friends. We assume that close friends are of the same age. This speech level is not able to be used where a listener's rank for degree of kinship or position is higher than a speaker's rank because the speaker treats the listener with the lowest level of respect. It is described by the expression:

haeRa(S,L) :- intimacy(S,L,close), older(S,L,equal), respect(S,L,r_lowest),
    not ab1(S,L).   (9)

HaeRa is also used where a speaker is much older than a listener like the relationship between father and son.

haeRa(S,L) :- older(S,L,much_older), respect(S,L,r_lowest), not ab1(S,L).   (10)

3.2.5 HaeYo speech level

HaeYo speech level is used where a listener's rank for degree of kinship or position is higher than a speaker's rank. In that case, age difference does not matter. The value of the respect level is **r_higher** since HaeYo is able to be used for HaO and HaSho. It is described by the expression:

haeYo(S,L) :- respect(S,L,r_higher), ab1(S,L).   (11)

3.2.6 Hae speech level

Hae speech level is used where a listener's rank for age, degree of kinship or position is lower than a speaker's rank. This speech level involves a close relationship. The value of the respect level is **r_lower** since Hae is able to be used for HaGe and HaeRa. It is described by the expression:

hae(S,L) :- intimacy(S,L,close), older(S,L,G), G>=equal,
   respect(S,L,r_lower), not ab1(S,L).   (12)

3.3 Symmetric relations

If one is in a formal place, then the other is also in the formal place because they are in the same location. The symmetric relationship is also applied to intimacy, kindred, position, and older. They are described by the following expressions:

formality(L,S,F) :- formality(S,L,F)

kindred(L,S,k_equal) :- kindred(S,L,k_equal)
position (L,S,p_noRel) :- position (S,L,p_noRel)   (13)

The other remaining rules are in **Appendix B**.

3.4 Constraints

There exist several constraints among social factors.

3.4.1 Between older and age

The Degrees of age difference between a speaker and a listener are described by the following expressions:

:- older(S,L,much_older), age(S,V), age(L,V2), V-V2<2.

:- older(S,L,older), age(S,V), age(L,V2), V-V2!=1, V-V2!=0.

:- older(S,L,equal), age(S,V), age(L,V2), V!=V2.   (14)

3.4.2 Between age and position

We assume that there are only two possible cases where one is much older than the other whose age is under 20 years old. First, a much older one's position is higher than the other's position. Second, they have no relationship of social rank. They are described by the following expressions:

:- position(S,L,p_equal), age(S,V), V>=young_adult, age(L,V2), V2<=teenager.

:- position(L,S,P), age(S,V), V>=young_adult, age(L,V2),

   V2<=teenager, P!=p_noRel.   (15)

3.4.3 Between respect and other factors

If a speaker is older than or much older than a listener and age is the most powerful among social factors, then the listener has to use HapSho or HaeYo. It is described by the expression:

:- older(S,L,G), G>=older, respect(L,S,R), R<=r_high, not ab1(S,L).   (16)

Only middle aged or elder adults are able to use HaO and HaGe. A listener must not be older than a speaker in this case. They are described by the following expressions:

:- respect(S,L,R), R>=2, R<=3, age(S,V), V<adult.

:- respect(S,L,R), R>=2, R<=3, age(L,V), V<adult.

:- respect(S,L,R), R>=2, R<=3, older(L,S,older).   (17)

3.4.4 In a social factor

If a speaker is older than a listener, then the listener is not able to be older than

the speaker. It is also applied to position and kindred. They are described by the following expressions:

:- older(S,L,G), G>equal, older(L,S,G2), G2>equal.

:- position(S,L,p_higher), position(L,S,p_higher).

:- kindred(S,L,k_higher), kindred (L,S,k_higher).   (18)

3.5 Simple example: Input file

Suppose that a father said to his son, "Did you eat lunch, son?" and that the father

used a final ending '∟(Ni)' in HaeRa speech level. In this sentence, we are able to

extract the following information:

kindred(speaker, listener, k_higher).   % because the speaker is a father

older(speaker, listener, much_older). % because the speaker is a father

intimacy(speaker,listener,close).   % because of the relationship between father and son

:- not haeRa(speaker, listener).   % because the father used HaeRa

Later, the information will be automatically extracted by an interface from a Korean Morphological Analyzer (KMA). The screen shot of a KMA is in **Appendix E.** The last rule is a constraint. It is relation to an abduction approach.

We still need to add the following choice rules to compute answer sets:

1 {respect(S,L,RL) : rlevel(RL)} 1 :- S!=L.

1 {formality(S,L,FL) : flevel(FL)} 1 :- S!=L.

1 {age(Person,AL) : ageLevel(AL)} 1.

1 {position(S,L,PL) : plevel(PL)} 1 :- S!=L.

The choice rules in relation to the other remaining social factors except for kindred, older and intimacy are added. All the rules above are shown in **Appendix C** (input.lp).

3.6 Output of the simple example

As we see in **Appendix D**, the speaker uses HaeRa and the listener can use either HaeYo or HapSho.

Stable Model 1) haeRa(speaker,listener) respect(speaker,listener,0)

haeYo(listener,speaker) respect(listener,speaker,4)

Stable Model 2) haeRa(speaker,listener) respect(speaker,listener,0)

hapSho(listener,speaker) respect(listener,speaker,5)

It depends on how the listener respects the speaker. Under the same circumstance, the listener has a chance to choose a speech level. **respect** predicate and its levels set up preference among speech levels for the listener. For example, the listener uses HapSho with the highest respect to the speaker.

4. Future works

(1) To represent kindred relationships:

Using only the kindred predicate is not enough to represent the relationship between a mother-in-law and a son-in-law. A KMA might support this work.

(2) To give clear meanings of formality and intimacy:

- Is the meaning of intimacy(S,L,close) different in each speech level?

- Is the concept of intimacy relation to the concept of respect?

- Does formality(S,L,formal) only mean that a speaker and a listener are in the same formal place? Does not it mean that the speech level of a speaker is in a formal style?

(3) To develop the interface between a KMA and the knowledge base in ASP:

<Figure 1: Application Framework>
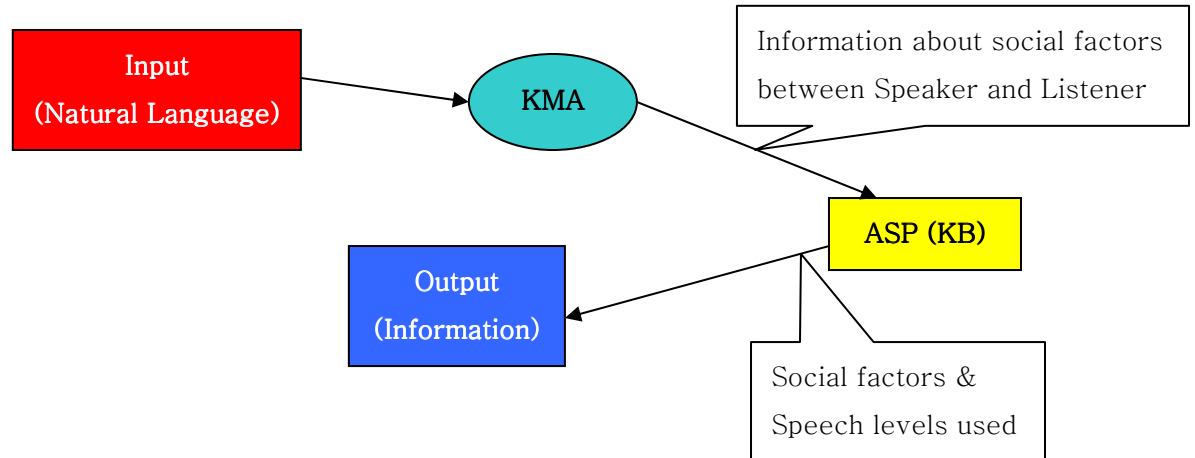
(4) To figure out more possible exceptions that the present knowledge base is not able to handle

Appendix

A. level.lp

% Respect Level(RL)

#const r_highest=5. % hapSho

#const r_higher=4.   % haeYo

#const r_high=3.   % haO

#const r_low=2.   % haGe

#const r_lower=1.   % hae

#const r_lowest=0.   % haeRa

rlevel(r_highest;r_higher;r_high;r_low;r_lower;r_lowest).

#domain rlevel(R).

% Formality Level(FL)

#const formal=1.

#const informal=0.

flevel(formal;informal).

#domain flevel(F;F2).

% Intimacy Level(IL)

#const close=1.

#const distant=0.

ilevel(close;distant).

#domain ilevel(I;I2).

% Position Level(PL)

%#const p_higher=1.   % one's rank is higher than the other's rank

%#const p_equal=0.   % one's rank is equal to the other's rank

%#const p_noRel=-1.   % No position relationship

plevel(p_higher;p_equal;p_noRel).

#domain plevel(P;P2).

% Kindred Level(KL)

%#const k_higher=1.   % Degree of one's kinship is higher than

                              % degree of the other's kinship

%#const k_equal=0.   % Degree of one's kinship is equal to

                              % degree of the other's kinship

%#const k_noRel=-1.   % No kindred relationship

klevel(k_higher;k_equal;k_noRel).

#domain klevel(K;K2).

% Age

#const much_older=2.   % One is much older than the other

#const older=1.   % One is older than the other

#const equal=0.   % One's age is equal to the other's age

ageDifference(much_older;older;equal).

#domain ageDifference(G;G2).

% Part II

#const elder=4.   % 60~   years old

#const adult=3.   % 40~60 years old

#const young_adult=2.   % 20~40 years old

#const teenager=1.   % 10~20 years old

#const child=0.   %   0~10 years old

ageLevel(elder;adult;young_adult;teenager;child).

#domain ageLevel(V;V2).

B. honorification.lp

person(speaker; listener).

#domain person(S;L;Person). % S: Speaker, L: Listener

%%% Symmetric Relationship

formality(L,S,F) :- formality(S,L,F).

intimacy(L,S,I) :- intimacy(S,L,I).

% Degree of kinship is the same to each other.

kindred(L,S,k_equal) :- kindred(S,L,k_equal).

% No kindred relationship between Speaker and Listener

kindred(L,S,k_noRel) :- kindred(S,L,k_noRel).

% Position(Social rank) is the same to each other

position(L,S,p_equal) :- position(S,L,p_equal).

% No relationship of social rank bewteen Speaker and Listener

position(L,S,p_noRel) :- position(S,L,p_noRel).

% The same age of each other

older(L,S,equal) :- older(S,L,equal).

%%% Constraints

% Between older and age

:- older(S,L,much_older), age(S,V), age(L,V2), V-V2<2.

:- older(S,L,older), age(S,V), age(L,V2), V-V2!=1, V-V2!=0.

:- older(S,L,equal), age(S,V), age(L,V2), V!=V2.

% Between age and position

:- position(S,L,p_equal), age(S,V), V>=young_adult, age(L,V2), V2<=teenager.

:- position(L,S,P), age(S,V), V>=young_adult, age(L,V2), V2<=teenager, P!=p_noRel.

%

:- older(S,L,G), G>equal, older(L,S,G2), G2>equal.

:- position(S,L,p_higher), position(L,S,p_higher).

:- kindred(S,L,k_higher), kindred(L,S,k_higher).

% Between respect and other factors

:- older(S,L,G), G>=older, respect(L,S,R), R<=r_high, not ab1(S,L).

:- respect(S,L,R), R>=2, R<=3, age(S,V), V<adult.

:- respect(S,L,R), R>=2, R<=3, age(L,V), V<adult.

:- respect(S,L,R), R>=2, R<=3, older(L,S,older).

% Need to add more constraints!!!! => later

%% hapSho

% Assume that a child doesn't use this speech level.

% case 1) Used in a public place

hapSho(S,L) :- formality(S,L,formal), age(S,V), V>child, respect(S,L,r_highest).

% case 2) Listener > Speaker: kinship, position, age

hapSho(S,L) :- older(L,S,G), G>equal,   age(S,V), V>child,   respect(S,L,r_highest),

          not ab1(L,S), not ab2(L,S).

ab1(S,L) :- position(L,S,p_higher), kindred(S,L,k_noRel).

ab1(S,L) :- kindred(L,S,k_higher).

ab2(S,L) :- position(L,S,p_equal), kindred(S,L,k_noRel).

ab2(S,L) :- kindred(L,S,k_equal).

%% haO

% case 1) Mainly used by male middle-aged or elder adults without close relationship.

haO(S,L) :- intimacy(S,L,distant), age(S,V), age(L,V2),

          V>=adult, V2>=adult, older(S,L,G), G>=equal,

          respect(S,L,r_high),

          not ab1(S,L).

%% haGe

% case 1) Mainly used by male middle-aged or elder adults with close relationship.

haGe(S,L) :- intimacy(S,L,close), age(S,V), age(L,V2), V>=adult, V2>=adult,

older(S,L,G), G>=equal, respect(S,L,r_low), not ab1(S,L), not ab2(S,L).

%% haeRa

% case 1) Used to close friends (Strong assumption: same age of each other)

haeRa(S,L) :- intimacy(S,L,close), older(S,L,equal), respect(S,L,r_lowest), not ab1(S,L).

% case 2) Used between a much older speaker and a listener/ example: father and son

haeRa(S,L) :- older(S,L,much_older), respect(S,L,r_lowest), not ab1(S,L).

%intimacy(S,L,close)?

%% hae

% case 1) Speaker >= Listener (age, kinship, position)

hae(S,L) :- intimacy(S,L,close), older(S,L,G), G>=equal, respect(S,L,r_lower),

not ab1(S,L).

%% haeYo

% case 1) Listener > Speaker: kinship, position

haeYo(S,L) :- respect(S,L,r_higher), ab1(S,L).

hide.

show hapSho(_,_), haeYo(_,_), haO(_,_), haGe(_,_), haeRa(_,_), hae(_,_),

    age(_,_), older(_,_,_), intimacy(_,_,_), formality(_,_,_),

    position(_,_,_), kindred(_,_,_), respect(_,_,_), ab1(_,_), ab2(_,_).

C. Simple example: input.lp

% Abduction approach

1 {respect(S,L,RL) :rlevel(RL)} 1 :- S!=L.

1 {formality(S,L,FL) :flevel(FL)} 1 :- S!=L.

1 {age(Person,AL) :ageLevel(AL)} 1.

1 {position(S,L,PL):plevel(PL)} 1 :- S!=L.

%1 {kindred(S,L,KL):klevel(KL)} 1 :- S!=L.

%1 {intimacy(S,L,IL):ilevel(IL)} 1 :- S!=L.

%1 {older(S,L,AD):ageDifference(AD)} 1 :- S!=L.

% The information extracted from KMA

%respect(speaker,listener,r_low).

%formality(speaker,listener,formal).

%age(speaker,adult).

%age(listener,adult).

%position(speaker,listener,p_higher).

intimacy(speaker,listener,close).

older(speaker,listener,much_older).

kindred(speaker,listener,k_higher).

:- not haeRa(speaker,listener). % from KMA

D. Output of the simple example

1) Command line: lparse level.lp honorification.lp input.lp | smodels 0

2) The following is the answer set of the simple example:

Stable Model: age(listener,2) age(speaker,4)

haeRa(speaker,listener) respect(speaker,listener,0)

haeYo(listener,speaker) respect(listener,speaker,4)

formality(speaker,listener,1) formality(listener,speaker,1)

position(speaker,listener,p_noRel) position(listener,speaker,p_noRel)

kindred(speaker,listener,k_higher) ab1(listener,speaker)

older(speaker,listener,2) intimacy(speaker,listener,1) intimacy(listener,speaker,1)

Another Stable Model: age(listener,2) age(speaker,4)
position(listener,speaker,p_equal) position(speaker,listener,p_equal)

haeRa(speaker,listener) respect(speaker,listener,0)

hapSho(listener,speaker) respect(listener,speaker,5)

formality(speaker,listener,1) formality(listener,speaker,1)

kindred(speaker,listener,k_higher) older(speaker,listener,2)

intimacy(speaker,listener,1) intimacy(listener,speaker,1) ab1(listener,speaker)

E. Screen shot of a Korean Morphological Analyzer

F. References

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