On Cognition and Inference of Spatial Dimension in Korean

Byong-Rae Ryu

Department of Linguistics, Chungnam National University
Gung-dong 220, Yuseong-gu, Daejeon, Korea
ryu@cnu.ac.kr

1 Introduction

Korean, arguably like all other languages ([Lang, 2002, p.1]), has a set of expressions to make reference to spatial dimensions such as height, length, width, depth, etc.: killa (long), cicalta (short); nelpta (wide), copta (narrow); nophta (high), nacta (low); melta (far); kakkapta (near); kipta (deep), yathta (shallow), nelpta (wide), copta (narrow); twukkpta (thick), yalpta (thin); khuta (big), caktta (small); kwulkta (thick) and calta (slender).¹ One of the peculiarities noticed in Korean is that the terms kalo (crosswise, side-to-side) and seylo (lengthwise, front-to-back) are additionally used, which seem to lack in other languages, e.g. English and German.

Most of the works on the spatial cognition in Korean are restricted to the spatial deixis based on the frames of reference (cf. Levinson (2003)); Zabin and Choi (1984), Yang (1985), Im (1984), Park (1985), among others. This paper examines the aspects of the inferences of the dimensional terms in Korean, which have not been delved into in the previous works. The set of examples which clearly show the points at issue is given in (1) and (2).

1. a. The pole is 10m high/tall.
   ⇒ The pole is 10m long.
   b. The pagoda is 10m high/tall.
   \[\not\Rightarrow \] *The pagoda is 10m long.

2. a. The milk pot is 30cm deep.
   ⇒ The milk pot is 30cm high.
   b. The cave is 10m deep.
   \[\not\Rightarrow \] The cave is 10m high.

In (1a), the dimensional terms high and long can be used for specifying the same maximal axis of pole. In (1b), however, only the term high is compatible with pagoda for the specification of its maximal axis. The examples in (2) show that the inference between depth and height is possible for specifying spatial objects like milk pot, but not cave.

Starting from the observations sketched above, I try to answer the question what determines the (im)possibility of the inferences of the dimensional terms on spatial objects, and give an principled explanation of the inference patterns.

2 The Semantics of Dimensional Designation

The inferences noted above are not anchored simply in the word meanings of the dimensional terms. We assume therefore an additional level called Conceptual Structure (CS). CS is a level representing language-independent, inter-modally accessible elements and complexes of conceptually determined everyday and encyclopedic knowledge about the world.

2.1 Dimension Assignment

According to Lang (1989) and Lang et al. (1991), Dimension Assignment (DA) to spatial objects works by designating certain axis extensions of a given object as spatial dimension by picking out some axis extension d of the object x. Dimension Assignment is basically organized not by a single body-schema but by two interacting categorization grids called 'Inherent Proportion Schema' (IPS) and 'Primary Perceptual Space' (PPS), both being independently traceable to human perceptual endowment.

IPS defines the gestalt properties of a spatial object. Following Lang (1989), we assume the following parameters for PPS:

- **MAX(imal) axis:** MAX identifies the maximal extent of some object x, provided there is exactly one maximal extent available.
- **SUBST(ance) axis:** SUBST identifies a non-maximal disintegrated third axis (assigned subst1 as value) or an integrated axis forming the diameter of circular section (assigned subst0 as value).
- **DIAM(eter) axis:** DIAM identifies an object axis perceived as inside diameter of a hollow body.
3 Dimensional Inferences

3.1 Identification and Specification

Basically following Lang (1989), I advance the idea that the inference is a systematic process to change the contextually induced positional specifications. Inferences are the relationship between the identified normal situation and the contextually-induced specified situation. For this purpose, we define Identification and Specification as follows:

(5) Identification: \( P \Rightarrow p \), where \( P \in \{ \text{MAX}, \text{SUBST}, \text{DIAM}, \text{VERT}, \text{OBS}, \text{ACRO}, \text{FLACH} \} \), \( p \in \{ \text{MAX}, \text{SUBST0}, \text{SUBST1}, \text{DIAM}, \text{VERT}, \text{OBS} \} \) and \( p \) is the last entry in an OS-section.

(6) Specification: \( Q \Rightarrow p \), where \( Q \in \{ \text{VERT}, \text{OBS}, \text{ACRO}, \text{FLACH} \} \), \( q \in \{ \text{MAX}, \text{NIL}, \text{VERT} \} \) and \( p \) is licensed as a landing site for \( Q \) in OS.

Based on the compatibility of the axial properties, we can define some set of admissible and inadmissible combinations (see Lang et al. (1991, 59ff.) for details).

3.2 Inferences as De-specification

Lang (1989) proposes the inference rule in (7). The main idea here is that the possibility of the inference in (8) (cf. (1)a in English), we can neatly explain the possibility of the inference in (8).

(7) Inf. 1: For any OS for object \( x \) with an os-section entry \( \frac{p}{q} \), there is an OS' for \( x \) with an os-section entry \( \frac{p}{p'} \), where \( p \neq q \neq \text{NIL} \).

Applying this mechanism to the Korean examples in (8) (cf. (1)a in English), we can neatly explain the possibility of the inference in (8).

(8) i. cangtae-nun nophi-ka/kili-ka 10m i-ta.
   this pole-TOP h.-NOM/l.-NOM 10m be-DL
   ‘This pole is 10m high/long.’

Cangtæ (pole) is compatible with both the specifications \( \text{MAX}_{\text{VERT}} \) (lexicalized as high) and \( \text{MAX}_{\text{FLACH}} \) (lexicalized as long). The former entails that the pole is standing, whereas the latter is unspecified as to the pole’s position. The inference in (9)(cf. (1)b for the English example) is impossible.

(9) ku sekhap-un nophi-ka/*kili-ka 10m i-ta.
    that pagoda-TOP h.-NOM/l.-NOM 10m be-DL
    ‘That tower is 10m high/*long.’

Unlike cangtæ, sekhap (pagoda) has the canonical standing property. This means that tower is not compatible with the specification \( \text{MAX}_{\text{VERT}} \) (lexicalized as long), but only with the specification \( \text{MAX}_{\text{FLACH}} \) (lexicalized as high). The crucial difference is explicitly represented in OS in (4).

---

2 We will not discuss the parameters FLACH and SIZE in this paper. See Lang et al. (1991, p.67) for details.
Lang (1989) and Lang et al. (1991, p.68) further propose another rule underpinning the possibility of the inference of dimensional terms as follows:

(10) Inf. 2: For any os for object $x$ with an os-section entry $\overline{\text{nil}}_{\text{q}}$, there is an os' for $x$ with an os-section entry $\overline{\text{nil}}_{\text{acro}}$.

Given the inference rule (10), we can explain the entailment relation that (11a) implies (11a).

(11) ku thakca-un kiphi-ka/nepi-ka 1m i-ta. that table-top d.-NOM/w.-NOM 1m be-DL

‘That table is 1m deep/wide.’

The relevant os for thakca (table) is given in (12).

(12) $< 1 \ 2 \ 3 >$ $< 1 \ 2 \ 3 >$

\[
\begin{array}{ccccc}
\text{vert} & \text{max nil vert} & \Rightarrow & \text{vert} & \text{max nil vert} \\
\text{vert} & \text{max nil vert} & \Rightarrow & \text{obs vert} & \text{max acro vert} \\
\end{array}
\]

In (12), the initial specification $\overline{\text{nil}}_{\text{q}}$, which is lexicalized as deep, is converted to $\overline{\text{nil}}_{\text{acro}}$, which is in turn lexicalized as wide.

The two inference rules in (7) and (10) together are responsible for the entailment relations in (13).

(13) The board is 2m wide, 30cm deep, and 3cm thick. ⇒ The board is 2m long, 30cm wide, and 3cm thick.

The the relevant os for board is given (14). We find that $\overline{\text{max}}_{\text{vert}}$ is converted to $\text{max}_{\text{vert}}$ (according to (20)), and $\overline{\text{nil}}_{\text{Obs}}$ to $\text{nil}_{\text{Obs}}$ (according to (10)). Hence, we have here the entailment relations wide ⇒ long and deep ⇒ wide.

(14) $< 1 \ 2 \ 3 >$ $< 1 \ 2 \ 3 >$

\[
\begin{array}{cccc}
\text{vert} & \text{max nil subst1} & \Rightarrow & \text{vert} & \text{max nil subst1} \\
\text{acbio subst0} & \text{max acro subst0} & \Rightarrow & \text{obs vert} & \text{max acro vert} \\
\end{array}
\]

In this way, the (im)possibility of the entailment relations with the object kewul (mirror) can be explained (cf. (15)). Each relevant os is given in (16).

(15) a. ku kewul-nun phoki 2m i-ko that mirror-top width-NOM 2m be-CONJ

\[
\begin{array}{cccc}
\text{height-NOM} & 1m & \text{be-DL} \\
\end{array}
\]

‘The mirror is 2m wide and 1m high.’

b. ku kewul-nun kili-ka 2m i-ko that mirror-top length-NOM 2m be-CONJ

\[
\begin{array}{cccc}
\text{width-NOM} & 1m & \text{be-DL} \\
\end{array}
\]

‘The mirror is 2m long and 1m wide.’

(16) $< 1 \ 2 \ 3 >$ $< 1 \ 2 \ 3 >$

\[
\begin{array}{ccc}
\text{max nil subst1} & \text{max nil subst1} & \Rightarrow \\
\text{max acro vert} & \text{max acro subst0} & \Rightarrow \\
\end{array}
\]

In case of a wall, a high wall does not imply a long wall. This is because the wall must be inherently in a standing position, as explicitly represented in (17).

3.3 Some Modifications and Extensions

The maximal axe of a hollow cylindrical container, like a barrel, cask, oildrum or bucket, can be referred to as height (cf. [Fig. 1)a and e] or depth (cf. [Fig. 1]b-d).

(17) $< 1 \ 2 \ 3 >$ $< 1 \ 2 \ 3 >$

\[
\begin{array}{cccc}
\text{max vert subst1} & \text{max vert subst1} & \Rightarrow \\
\text{vert} & \text{max vert subst1} & \Rightarrow \\
\end{array}
\]

It seems to be reasonable to assume that we recognize the hollow cylindrical containers differently from the non-hollow solid objects. We propose a new inference rule, Inf. 3, and slightly modify the the inference rule 1 as follows.

(18) ku tulemthong-un nophi-ka/kiphi-ka/ that oildrum-top height-NOM/depth-NOM/

\[
\begin{array}{cccc}
*\text{kili-ka} & 120cm & \text{i-ta.} \\
\text{length-NOM} & 120cm & \text{be-DL} \\
\end{array}
\]

‘That oildrum is 120cm high/deep/*long.’

The rules proposed by Lang (1989) and Lang et al. (1991, p.68) seems to fail correctly to predict the inference patterns: *long barrel (contra Inf. 1) vs. deep barrel (contra Inf. 2).

(19) high ⇒ deep vs. *long barrel

\[
\begin{array}{cccc}
< 1 \ (2 \ 3) > & < 1 \ (2 \ 3) > & < 1 \ (2 \ 3) > \\
\text{max subst0} & \text{max subst0} & \text{max subst0} \\
\text{vert} & \text{obs} & \text{max} \\
\end{array}
\]

Given Inf. 1’ and Inf. 3, we can explain the (im)possibility of the inferences in (19). The specification $\overline{\text{max}}_{\text{vert}}$ may be de-specified, because Inf. 1’ may not be applied to a hollow body. Inf. 3 allows the specification $\overline{\text{max}}_{\text{obs}}$ (→ deep).

A point to be noted is that the cognition of a hollow cylindrical container is controlled by an economy principle: One may identify the most salient axes of an object first. For this reason, we hardly
express the maximal axis of a pipe with a stopper using deep [compare the spatial situation c with a (for frying pan) and b (for bucket)].

We can predict that speakers who accept deep pipe (maxobs) will also accept long pipe (maxobs, based on Inf 1'), but vice versa.

(22) \[ \text{long vs. ?? deep pipe with a stopper} \]
\[ \begin{array}{c|c|c}
\text{max diam} & \text{max diam} \\
\hline
\text{max obs} & \text{max obs} \\
\end{array} \]

In the same vein, we normally express the maximal axis of a cave [cf. Fig. 3] using the term deep, not long. This is because, we assume, a cave has a for canonical feature for obs. In this case, inference between deep and long is impossible. The relevant obs are given in (23).

(23) \[ \text{*long cave} \neq \text{?? deep cave} \]
\[ \begin{array}{c|c|c}
\text{max diam} & \text{max diam} \\
\hline
\text{obs} & \text{obs} \\
\end{array} \]

4 Conclusion

In this paper, we examine the aspect of inferences between the dimensional terms in Korean, and tries to give an account of the inference patterns based on the interaction of gestalt and positional properties of spatial objects. Basically following Lang (1989), I advance the idea that the inference is a systematic process to change the contextually induced positional specifications, and propose some modifications and extensions. Finally, we tried to generalized the inference patterns of the dimensional terms kalo (side-to-side) and seylo (front-to-back) in Korean.

3.4 Lexicalization of kalo and seylo

As alluded to above, one of the peculiarities noticed in Korean is that the terms kalo (crosswise, side-to-side) and seylo (lengthwise, front-to-back) are additionally used, which seem to lack in other languages, e.g. English and German. Observe the data in (24) and (26).

(24) ku chayksang-un T₁-i/ka 2m i-ko
that desk-TOP term₁-NOM 2m be-CONJ
T₂-ka/i 1m i-ta.
term₂-NOM 1m be-DL
‘That desk is 2m term₁ e and 1m term₂.’

(25) \[ \begin{array}{c|c|c}
\text{max nil vert} & \text{max nil vert} \\
\hline
\text{acro obs vert} & \text{acro vert} \\
\end{array} \]

We can generalizations the use of the dimensional terms kalo and seylo in Korean as follows: First, kalo (side-to-side) and seylo (front-to-back) may be used for an object with at least two dimensions. Second, the use of kalo and seylo is a matter of the lexicalization of DAVs. Third, the DAVs subst and diam may not be lexicalized as kalo or seylo. Fourth, if one DAV is lexicalized as kalo, (one of) the remaining DAVs can be lexicalized as seylo. Fifth, because of the axial compatibility, the DAV obs can be lexicalized at best as seylo, say, not as kalo. Sixth, obs is never lexicalized as seylo.

References

Im, J.-R. (1984), A Semantic Structure of Spatial Perceptual Terms (written in Korean), Paytalmal 9, 119–137.


