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# **Gradience in morphophonology**

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- Part of this talk is based on the following works:

Jun, Jongho (forthcoming) Morpho-phonological processes in Korean. In Mark Aronoff (ed.) *Oxford Research Encyclopedia of Linguistics*. New York: Oxford University Press.

-- (2015) Korean n-insertion: a mismatch between data and learning. In *Phonology* 32.3.

# Roadmap

1. what is morphophonology?
2. morphophonology in Korean
  - 2.1 sai-siot
  - 2.2 vowel harmony
  - 2.3 n-insertion
3. gradience in n-insertion
  - 3.1 empirical investigation
  - 3.2 theoretical/computational investigation

# 1. what is morphophonology?

- Morphophonological processes refer to phonological processes with the following characteristic properties:
  - (a) may be subject to **morphological and lexical conditions**;
  - (b) may have **exceptions**;
  - (c) are **not sensitive to speech rate and style**;
  - (d) may be phonetically/phonologically **unnatural**.

## Example: English velar softening

electri[**k**] vs. electri[**s**]-ity

- (a) it applies only before a certain limited set of derivational suffixes, mainly **–ity**, **–ism**, and **–ist**.
- (b) it has exceptions (e.g. **Yor[k]-ist**).
- (c) it applies **regardless of speech rate and style**.
- (d) it cannot simply be characterized as the result of **coarticulation** or **articulatory reduction**.

(Pierrehumbert 2006)

## **Analysis of morphophonological processes**

- It has been an issue for a long time how to properly analyze morphophonological processes within generative linguistics.
- It is usually more difficult to analyze morphophonological patterns than truly phonological patterns.

## Analysis of morphophonological processes

- **Productive** processes are plausibly formulated as **grammatical rules or constraints**.
- ▶ Morphophonological processes typically have **exceptions**, which means at least “not fully productive”.

## Analysis of morphophonological processes

- For **unproductive** processes, it is usually difficult to justify linguistic rules, especially when the processes are phonetically unnatural.
- ▶ Listing suppletive allomorphs in the lexicon

## Analysis of morphophonological processes

- Many morphophonological processes show **gradient productivity**.

### □ Wug test (Pierrehumbert 2006)

Halley's comet is a very **interponic** comet.

Its orbital period varies because of its \_\_\_\_\_.

### ▶ Responses:

interponic-ness, **interponic**<sup>c</sup>-ity

k or s

## Analysis of morphophonological processes

- Many morphophonological processes show **gradient productivity**.
  - Thus, simple **lexical listing of suppletive forms** would not be sufficient to capture such gradient productivity.
  - It is necessary to posit **grammatical rules or constraints** even for exceptional processes.

## Analysis of morphophonological processes

- ❑ How do morphophonological rules with gradient productivity differ from fully-productive ones?
  - They do not apply all the time.
  - They have their own probability of application.
- ❑ What determines the probability of application of a rule which can eventually explain its productivity?

## Analysis of morphophonological processes

- The productivity of a process may arguably reflect the relative **frequency** of the relevant pattern in the **lexicon**.
- ➔ stochastic grammatical models which can capture the frequency distribution
  - ▶ probabilistic Optimality-Theoretic (OT) approaches (See Coetzee & Pater 2011 for a review.)
  - ▶ Among them, **Maximum Entropy (maxent) OT** (Goldwater & Johnson 2003) is the most popular.

## Analysis of morphophonological processes

- The stochastic grammar models are usually a lot more complicated to construct than traditional grammar models.
- In order to capture a probability distribution over a set of attested allomorphic forms, ...

The grammar may be specified with a probability distribution of ...

- ✓ rule application
- ✓ constraint rankings

➤ **A maxent OT grammar uses weighted constraints.**

## standard OT

- Final t/d deletion in English

e.g. [lɒs~~Ø~~] ‘lost (books)’

/lɒst/	*CT#	MAX
a.  lɒs <del>Ø</del>		*
b. lɒst	*	

- \*CT# ‘No final clusters ending in /t d/.’
- MAX ‘No segment deletion.’

## maxent OT

- variable final t/d deletion in English

e.g.  $\text{ɫɔs} \emptyset$  or  $\text{ɫɔst}$  'lost'

weight

probability

	<b>1</b>	<b>1</b>	H	$e^H$	<b>P</b>
$/\text{ɫɔst}/$	*CT#	MAX			
a. $\text{ɫɔs} \emptyset$		-1	-1	0.36	<b>0.5</b>
b. $\text{ɫɔst}$	-1		-1	0.36	<b>0.5</b>

## maxent OT

- variable final t/d deletion in English

e.g.  $\text{ɫɔs} \emptyset$  or  $\text{ɫɔst}$  'lost'

	<b>2</b>	<b>1</b>	H	$e^H$	P
<i>/ɫɔst/</i>	<b>*Ct#</b>	<b>MAX</b>			
a. $\text{ɫɔs} \emptyset$		-1	-1	0.36	<b>0.73</b>
b. $\text{ɫɔst}$	-1		-2	0.13	<b>0.27</b>

## Analysis of morphophonological processes

- In order to find out the **correct constraint weights**, we need to **estimate the exact productivity** of the process.
- The productivity can correctly be estimated only when the **domain** and **conditions** of rule application are correctly identified.

## Analysis of morphophonological processes

- The most common previous approach to exceptions in morphophonology is to **revise the domain or conditions** of rule application so as to make the rule obligatory.
  - Many such attempts to propose an exceptionless rule have failed.
- ▶ Note: If the process is gradient, there would be no way to find a categorical rule for it.

## Empirical data description is always important.

- However, it is always most important in the analysis of a process to figure out what and how factors affect its application, regardless of whether it is categorical or gradient.
- ***incorrect* data description**  
**=/= > *correct* analysis**

# Steps in the study of gradient morphophonology

- **empirical** data description
  - ▶ **corpus/experiment/survey** on existing (& novel) words
  - ▶ **statistical**: e.g. mixed effects regression analysis of the experiment results
- **theoretical** grammar model construction
  - ▶ **computational**
    - ✓ learning simulation
      - input data: results of the experiment
      - output: maxent OT grammar
    - ✓ testing

# Roadmap

- 1. what is morphophonology?
- 2. morphophonology in Korean
- 3. gradience in n-insertion

## 2. Morphophonology in Korean

- sai-siot
  - vowel harmony
  - n-insertion
  - (palatalization)
- All these processes are **much discussed** in the literature on Korean phonology and morphology.
  - They have a **large number of exceptions**, but on the other hand they have at least a certain degree of productivity.
  - For each of the three processes, issues involving the application conditions, the productivity and the optimal formal analysis need to be addressed.

## 2.1 sai-siot

- In traditional Korean phonology and morphology, sai-siot refers to morphophonological processes **marking the juncture of a compound** consisting of two nouns, called here  $N_1$  and  $N_2$ .
  - ✓ **obstruent tensing**
  - ✓ **nasal gemination**

## sai-siot: obstruent tensing

- Examples

<u>N1 final</u>	<u>N1</u>	<u>N2</u>	<u>phonetic form</u>
vowel	해	빛	[hɛpʰit]
liquid	가을	비	[kaiɭpʰi]
nasal	봄	비	[pompʰi]
(obstruent	복	주머니	[pokɕʰumʌni])

- Compound obstruent tensing rule** (N<sub>1,2</sub> = noun)

$$\left[ \begin{array}{l} -\text{sonorant} \\ +\text{lenis} \end{array} \right] \rightarrow [+tense] / ]_{N_1+N_2} [ \_\_\_$$

## sai-siot: nasal gemination

- Examples

<u>N1 final</u>	<u>N1</u>	<u>N2</u>	<u>phonetic form</u>
vowel	머리	말	[mʌl <b>imm</b> al]
	이	몸	[i <b>mm</b> om]

- Compound nasal gemination**

$$\emptyset \rightarrow \left[ \begin{array}{c} C_i \\ +\text{nasal} \end{array} \right] / V \text{---} ]_{N_1+N_2} \left[ \begin{array}{c} C_i \\ +\text{nasal} \end{array} \right]$$

## Exceptions: sai-siot

- Not all noun-noun compounds undergo sai-siot even when they meet the basic application conditions.
- The occurrence or non-occurrence of sai-siot is **not phonologically predictable**.

<u>N1 final</u>	<u>sai-siot</u>	<u>non-sai-siot</u>
vowel	나무배 [배]	나무배
liquid	물고기 [꼬]	불고기
nasal	봄비 [베]	봄가을

## Conditioning factors: sai-siot

- Most previous studies attempt to characterize the set of Korean compounds undergoing sai-siot and those not undergoing it in terms of their **morpho-syntactic, semantic, etymological, and processing** properties.

## Conditioning factors: sai-siot

	<b>sai-siot</b>	<b>non-sai-siot</b>
a. degree of cohesion of parts	intermediate	either high or low
b. compound type	genitive (w/ inanimate N <sub>1</sub> ), sub-compound (modifier-head)	genitive (w/ animate N <sub>1</sub> ), non-genitive, coordinative or co-compound, argument-predication
c. N <sub>1</sub> denotation	time, location, origin, purpose of use	shape, material, ingredient
d. etymology	native Korean	Sino-Korean (in particular, with multisyllabic N <sub>2</sub> )

## **Conditioning factors: sai-siot**

- Descriptive categories are often impressionistically defined, and thus category membership is not always clear-cut for some words.
- Moreover, each of the proposed conditions has exceptions.

## Variation in sai-siot across words with no crucial differences in conditioning factors

<b>sai-siot</b>	<b>non-sai-siot</b>
비빔밥 [뽽]	비빔국수
콩국수 [꾹]	콩밥
안방 [뽡]	사랑방
돈방석 [뽡]	바늘방석
판자집 [짹]	기와집
벌집 [짹]	새집
돈벌이 [뽨]	논갈이

## Variation in sai-siot within a word

- According to the Standard Korean Dictionary (Kwuklip kwuke yenkwuwen 1999) and most previous studies, the following words do not undergo sai-siot, but their variants with sai-siot can often be observed in natural speech.
  - 사랑방
  - 기와집
  - 사이시옷

## Unpredictability in sai-siot

- Thus, it is obvious that none of the factors, just mentioned, can clearly separate words undergoing sai-siot from those not undergoing it.
- Many previous studies conclude ...  
**sai-siot is extremely irregular and largely unpredictable.**

## **sai-siot is not totally random.**

- However, although the probability of sai-siot varies across words and speakers, there exist **tendencies** which may be explained by the interaction of phonological, morpho-syntactic, etymological and processing factors.
- These factors might contribute to the overall probability of the occurrence of sai-siot.

## **sai-siot is not totally random.**

- This possibility was explored initially by **Zuraw (2011)** and subsequently by Ito (2014) and Kim (2016), both of whom focus on phonological factors.
- ▶ See Ito and Kim for the **maxent** OT analyses of compound obstruent tensing.

## 2.2 vowel harmony

- Vowel harmony in Seoul Korean and many other dialects of Korean
  - **verbal inflection** → focus of this talk  
막-아 vs. 먹-어
  - ideophones

# Basic patterns: vowel harmony

- The initial vowel of V-initial suffixes is [a] if the last stem vowel is /a/ or /o/; otherwise, [ʌ].

<u>stem V</u>	<u>suffix V</u>	<u>stem</u>	<u>suffixed form</u>	
ʌ	ʌ	/mʌk/	mʌk-ʌ	‘eat’
e		/se/	se-ʌ	‘count’
ɛ		/mɛc/	mɛc-ʌ	‘bear’
i		/mil/	mil-ʌ	‘push’
ɪ		/tɪl/	tɪl-ʌ	‘lift’
u		/sum/	sum-ʌ	‘hide’
∅		/t∅/	t∅-ʌ	‘become’
y		/hy/	hy-ʌ	‘bend’
<b>o</b>		a	/c’oc <sup>h</sup> /	c’oc <sup>h</sup> -a
<b>a</b>	/mak/		mak-a	‘block’

## variations and exceptions in vowel harmony

- Factors (mostly discussed by Kang 2012)
  - a. **The quality of the last stem V**
    - variation: 막-아 ~ 막-어      cf. 쫓-아
  - b. **The presence or absence of the stem-final C**
    - no variation: 가      (also, 날-아, 낫-아)
  - c. **The stem class: p-irregular**
    - exception & variation: ‘괴롭-’ 괴로워 ~ 괴로와  
cf. ‘돕-’ 도와 → an exception to an exception!!  
→ The **stem length** play a role???
  - d. **The suffix type**
    - variation: 막-      막어, 막어라(?), 막었다(?)

## **variations and exceptions in vowel harmony**

- The application of Korean VH is subject to a number of complicated factors.
- It seems that the probability of gradient VH is determined by their interactions.

## 2.3 n-insertion

- Examples

	M1	M2	phonetic form
compound	좀	약	[comnjak]
prefixed word	덧	양말	[tʌnnjaŋmal]
phrase	먹을	엿	[mʌkilljʌt]

- n-insertion rule:  $\emptyset \rightarrow \mathbf{n} / \mathbf{C1} ]_{\mathbf{M1}} \text{---} \mathbf{M2} [\mathbf{i/j}$**

(M1,2 = morpheme; C1 = M1-final consonant)

## conditioning factors: n-insertion

- The basic conditions for application of n-insertion are not enough to determine when to apply and when not to apply n-insertion.
- Many previous studies have attempted to properly restrict the domain of application of n-insertion.
- The crucial factors include **morphological category** of component morphemes, **syllabicity** of M2-initial vocoid, and **sonorancy** of M1-final consonant, C<sub>1</sub>.

## Morphology of M1: n-insertion

- n-insertion in words with different morphological compositions (O: n-insertion, X: non-n-insertion, based on Han 1994: 114-130)

M <sub>1</sub> -M <sub>2</sub>	Seoul	Kyungsang	Examples
stem-stem	O	O	부엌-일
stem-root/suffix	O	O	식용-유
prefix-stem	O	O	홀-이불
root-root	X	O	민-요
root-stem	X	O	안-약

## Morphology of M2: n-insertion

- n-insertion occurs only before a **free morpheme**, at least in native Korean words.

집-일 [닐]

vs.

집-이 (좋다)

## **syllabicity of M2-initial vocoid: n-insertion**

- /j/ is a stronger trigger of n-insertion than /i/, although it is controversial whether the difference in strength is categorical or gradual.

## sonorancy of C1: n-insertion

좀-약 /com-jak/ vs. 독-약 /tok-jak/

- Korean n-insertion applies **obligatorily after a sonorant C1** and **optionally after an obstruent C1** (Cho 1995; Cho & Iverson 1997).
- In Sino-Korean words consisting of monosyllabic roots, n-insertion occurs **only after a sonorant**, not after an obstruent (Oh 2006).

e.g. 검-열 [녠] vs. 백-열

## Exceptions: n-insertion

- However, none of the conditions proposed thus far clearly separate words undergoing n-insertion from those not undergoing it since there are usually exceptions to each of the proposed conditions.

e.g. Certain (/j/-initial) **native Korean M2 suffixes** may trigger n-insertion (an exception to the restriction of M2 morphology):

e.g. 잠시만-요 [뇨].

## **variations: n-insertion**

- In addition, n-insertion is often **optional**.
- The probability of n-insertion may **vary across speakers and words**.
- It is possible that the above mentioned factors may have **gradient** effect, contributing to the overall probability of the occurrence of n-insertion.

# Roadmap

- 1. what is morphophonology?
- 2. morphophonology in Korean
- 3. gradience in n-insertion

## **3. gradience in n-insertion**

### **3.1 empirical investigation**

- In order to establish what factors affect n-insertion and whether they have categorical or gradient effects, I conducted surveys on n-insertion in existing and novel words.

## conditioning factors: n-insertion

- Factors investigated (existing word)
  - morphological category of M1 and M2
  - syllabicity of M2-initial vocoid
  - sonorancy of C1
  - dialect
  - etymology of component morphemes
  - length of component morphemes
  - quality of a vowel following M2-initial /j/ (V2)
  - word frequency

## n-insertion in existing words

- Test words: 304 multi-morphemic words with /j/-initial M2
- Survey form
  - Both inserted and non-inserted forms of each test word were presented in standard Korean orthography.
  - The participants were asked to choose what they think is their pronunciation, among the following three (or two) choices: e.g. **죤낙, 죤약, 조막.**

## **n-insertion in existing words**

- Participants
  - 22 Seoul speakers
  - 23 Kyungsang speakers

## Some tendencies found (existing words)

- (A > B = ‘n-insertion is more frequent under condition A than condition B’, \* = significant in **mixed effects** analysis, ✓ = not significant)

effect	relative frequency	existing words
C <sub>1</sub> sonorancy	<b>sonorant &gt; obstruent</b>	* (.53 > .44)
C <sub>1</sub> sonorant place	<b>/ m n l / &gt; ŋ</b>	* (.58 > .46)
V <sub>2</sub> height	<b>high &gt; non-high</b>	* (.62 > .49)
M <sub>1</sub> length	<b>poly-σ &gt; mono-σ</b>	* (.61 > .38)
M <sub>1</sub> morphology	<b>stem &amp; prefix &gt; root</b>	* (.57 & .41 > .33)
M <sub>2</sub> morphology	<b>stem &amp; suffix &gt; root</b>	* (.51 & .64 > .47)

## Some tendencies found (existing words)

- (A > B = 'n-insertion is more frequent under condition A than condition B', \* = significant in mixed-effects analysis, ✓ = not significant)

effect	<div style="border: 2px solid black; padding: 2px; display: inline-block;">                     줌약 com-jak                 </div> <div style="border: 2px solid black; padding: 2px; display: inline-block; margin-left: 20px;">                     독약 tok-jak                 </div> existing words	
C <sub>1</sub> sonorancy	sonorant > obstruent	* (.53 > .44)
C <sub>1</sub> sonorant place	/ m n l / > ŋ	* (.58 > .46)
V <sub>2</sub> height	high > non-high	* (.62 > .49)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)
M <sub>1</sub> morphology	stem & prefix > root	* (.57 & .41 > .33)
M <sub>2</sub> morphology	stem & suffix > root	* (.51 & .64 > .47)

## Some tendencies found (existing words)

- (A > B = ‘n-insertion is more frequent under condition A than condition B’, \* = significant in mixed effects analysis, ✓ = not significant)

effect	existing words	existing words
C <sub>1</sub> sonorancy	<div style="border: 1px solid black; padding: 5px; display: inline-block;">                     좀약 com-jak                 </div> sonorant > obstruent	<div style="border: 1px solid black; padding: 5px; display: inline-block;">                     탕약 taŋ-jak                 </div> (.53 > .44)
C <sub>1</sub> sonorant place	/ m n l / > ŋ	* (.58 > .46)
V <sub>2</sub> height	high > non-high	* (.62 > .49)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)
M <sub>1</sub> morphology	stem & prefix > root	* (.57 & .41 > .33)
M <sub>2</sub> morphology	stem & suffix > root	* (.51 & .64 > .47)



## Some tendencies found (existing words)

- (A > B = 'n-insertion is more frequent under condition A than condition B', \* = significant in mixed effects analysis, ✓ = not significant)

effect	relative frequency	existing words
C <sub>1</sub> sonorancy	sonorant > obstruent	* (.53 > .44)
C <sub>1</sub> vowel height	high > non-high	* (.52 > .46)
C <sub>1</sub> vowel length	long > short	* (.52 > .49)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)
M <sub>1</sub> morphology	stem & prefix > root	* (.57 & .41 > .33)
M <sub>2</sub> morphology	stem & suffix > root	* (.51 & .64 > .47)

무좀약 **mu.com-jak**

좀약 **com-jak**

## 3.2 theoretical/computational investigation

### ■ Learning simulation

- a maxent learner implemented in the maxent grammar tool (Hayes 2009)
- input: the results of the survey with existing words
- OT constraints (relatively descriptive) → next slide

# Constraints

INSERT-/n/	Insert /n/ at the juncture of two morphemes, if M1 ends with a consonant and M2 begins with /i j/.
DEP-n	Avoid insertion of /n/.
*INSERTION/RootM1	If M1 is a bound root, n-insertion is blocked.
*INSERTION/RootM2	If M2 is a bound root, n-insertion is blocked.
*INSERTION/SinoM1	If M1 is Sino-Korean, n-insertion is blocked.
*INSERTION/SinoM2	If M2 is Sino-Korean, n-insertion is blocked.
*INSERTION/MonoM1	If M1 is monosyllabic, n-insertion is blocked.
IDENT(son)/C1	Input and output correspondents of C1 have the same specification for [sonorant].
*INSERTION/ŋ_	If M1 ends with /ŋ/, n-insertion is blocked.
*INSERTION/_j[-high]	If M2 begins with /j[-high]/, n-insertion is blocked.

## Weights obtained

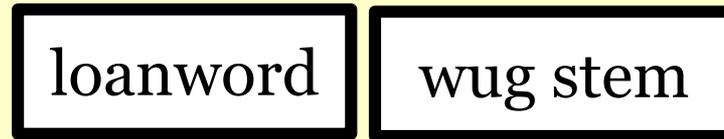
	Seoul	Kyungsang
INSERT-/n/	6.032	6.056
DEP-n	3.968	3.944
*INSERTION/RootM1	0.689	0.478
*INSERTION/RootM2	0.566	0.381
*INSERTION/SinoM1	0.457	0.201
*INSERTION/SinoM2	0.521	0.253
*INSERTION/MonoM1	1.203	0.921
IDENT(son)/C1	0.438	1.003
*INSERTION/η_	0.389	0.478
*INSERTION/_j[-high]	0.469	0.461

## correlations between observed and predicted rates

- relatively high and significant:
  - Seoul (r = **0.679**, p < 0.001, n = 293)
  - Kyungsang (r = **0.689**, p < 0.001, n = 293)

## n-insertion in novel words

- Test words:



[ ... C]<sub>M1</sub> + [j ...]<sub>M2</sub>

e.g. 킹-유제놀

- total number: 84
- Method: the same as the survey with existing words

## Tendencies found (novel words)

- (A > B = ‘n-insertion is more frequent under condition A than condition B’, \* = significant in mixed effects analysis, ✓ = not significant)

effect	relative frequency	existing words	novel words
C <sub>1</sub> sonorancy	sono > obstr	* (.53 > .44)	✓ (.35 > .26)
C <sub>1</sub> sono place	/ m n l / > η	* (.58 > .46)	* (.39 > .21)
V <sub>2</sub> height	high > non-high	* (.62 > .49)	* (.35 > .27)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)	✓ (.29 < .33)
M <sub>1</sub> morphology	stem & pref > root	* (.57 & .41 > .33)	not tested
M <sub>2</sub> morphology	stem & suf > root	* (.51 & .64 > .47)	not tested

## Tendencies found (novel words)

effect	relative frequency	existing words	novel words
C <sub>1</sub> sonorancy	sono > obstr	* (.53 > .44)	✓ (.35 > .26)
C <sub>1</sub> sono place	/ m n l / > ŋ	* (.58 > .46)	* (.39 > .21)
V <sub>2</sub> height	high > non-high	* (.62 > .49)	* (.35 > .27)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)	✓ (.29 < .33)

- ▶ Korean speakers are aware of these tendencies in the distribution of existing words, and use this knowledge when they apply n-insertion to novel words.

## Tendencies found (novel words)

effect	relative frequency	existing words	novel words
C <sub>1</sub> sonorancy	<b>sono &gt; obstr</b>	* (.53 > .44)	✓ (.35 > .26)
C <sub>1</sub> sono place	/ m n l / > η	* (.58 > .46)	* (.39 > .21)
V <sub>2</sub> height	high > non-high	* (.62 > .49)	* (.35 > .27)
M <sub>1</sub> length	poly-σ > mono-σ	* (.61 > .38)	✓ (.29 < .33)

- ▶ Korean speakers are *probably* aware of this tendency as well.

## Tendencies found (novel words)

effect	relative frequency	existing words	novel words
C <sub>1</sub> sonorancy	sono > obstr	* (.53 > .44)	✓ (.35 > .26)
C <sub>1</sub> sono place	/ m n l / > η	* (.58 > .46)	* (.39 > .21)
V <sub>2</sub> height	high > non-high	* (.62 > .49)	* (.35 > .27)
<b>M<sub>1</sub> length</b>	<b>poly-σ &gt; mono-σ</b>	<b>* (.61 &gt; .38)</b>	<b>✓ (.29 &lt; .33)</b>

- Speakers do not internalize all the statistically prominent patterns of a language.

## Tendencies: existing vs. novel words

□ Why do Korean speakers fail to learn the tendency about the length of M1?

▪ One possible answer

**The length of M1 is not a phonologically natural factor** which can condition the application of n-insertion or affect the probability that n-insertion applies (Jun 2015).

# Roadmap

- 1. what is morphophonology?
- 2. morphophonology in Korean
- 3. gradience in n-insertion

## Summary

- I have discussed three **gradient** morphophonological processes in Korean, sai-siot, vowel harmony and n-insertion.
- All of them have many **exceptions** and **variations**, which make them look quite irregular.
- Nonetheless, it seems that the variable application of each process is still **systematic** in that various factors, phonological, morpho-syntactic, socio-linguistic, processing, etc., contribute to the overall probability of rule application.

# Summary

- For the proper analysis of such gradient processes, **experimental, statistical and computational** research methods are necessary.
- I've briefly presented my own research on Korean n-insertion, while illustrating how to investigate and analyze gradient morphophonological processes.

감사합니다.

# References

- Cho, Young-mee Yu (1995). In defense of juncture rules/constraints. *Language Research*, 31.4: 589–614.
- Cho, Young-mee Yu & Gregory K. Iverson. (1997) Korean phonology in the late twentieth century. *Language Research* 33.4, 687-735.
- Coetzee, Andries & Joe Pater (2011) The place of variation in phonological theory. In J. Goldsmith, J. Riggle & A. Yu (eds.) *The Handbook of Phonological Theory*, 2nd edition, 401-434. Malden, MA and Oxford, UK: Blackwell.
- Goldwater, Sharon & Mark Johnson (2003). Learning OT constraint rankings using a Maximum Entropy model. In Jennifer Spenador, Andres Eriksson & Östen Dahl (eds.) *Proceedings of the Workshop on Variation within Optimality Theory*, 111-120. Stockholm: Stockholm University.
- Han, Eunjoo (1994) *Prosodic structure in compounds*. PhD dissertation, Stanford University.
- Ito, Chiyuki (2014). Compound tensification and laryngeal co-occurrence restrictions in Yanbian Korean. *Phonology* 31.3, 349-398.
- Jun, Jongho. (2015) Korean n-insertion: A mismatch between data and learning. *Phonology* 32(3), 417–458.

# References

- Jun, Jongho (forthcoming) Morpho-phonological processes in Korean. In Mark Aronoff (ed.) *Oxford Research Encyclopedia of Linguistics*. New York: Oxford University Press.
- Kang, Hijo (2012) *Diachrony in synchrony: Korean vowel harmony in verbal conjugation*. Ph.D. dissertation, Stony Brook University.
- Kim, Seoyoung (2016) *Phonological trends in Seoul Korean compound tensification*. MA thesis, Seoul National University, Korea.
- Oh, Mira (2006). Reexamination of environments for /n/-insertion. [Niun-sapip hwankyenguy caykemtho] *The Linguistic Association of Korea Journal* 14.3, 117-135.
- Pierrehumbert, Janet B. (2006) The statistical basis of an unnatural alternation. In Louis Goldstein, Douglas H. Whalen and Catherine T. Best (eds.), *Laboratory Phonology VIII, Varieties of phonological competence*, 81–107. Berlin: Mouton de Gruyter.
- Zuraw, Kie. (2011) Predicting sai-siot in Korean compound nouns: Phonological and non-phonological factors. Handout presented at the 21st Japanese/Korean Linguistic Conference, Seoul National University.