An example of what you don't know you know—a syntactic equivalence class

Equivalence classes in Phonology

Allophones

Turkish Vowel Harmony

Equivalence classes in semantics

# *I-language*
# Chapter 6 Data Sets: Equivalence Classes a gogo

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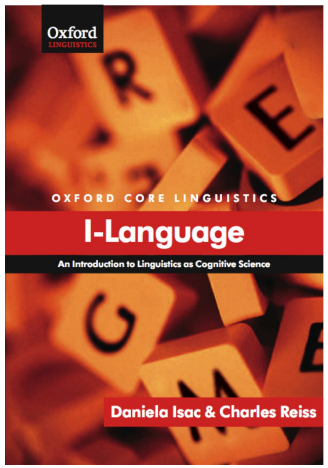
Concordia University, Montreal



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*"The beginning of science is the recognition that the simplest phenomena of ordinary life raise quite serious problems: Why are they as they are, instead of some different way?" [Noam Chomsky, Language and Problems of Knowledge:43].*

# Outline

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- *Do you know if anyone is here yet?*
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We can't say that the string *I know Mary's* is illformed. It depends on abstract analysis of the morphemes: possessive *-s* behaves differently from the so-called 'contraction' of *is*. And even the contraction of *is* is sometimes fine.

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- **Unconscious**: Most or all of us were unaware of such facts about our grammars. We never produce these weird sounding contractions and we know they are weird without knowing why.

- **Rule governed**: The weirdness we experience is based on a rule or pattern, not on a list of exceptions. For example, the weird case is not fine if we replace *Mary* with *Hank*. We haven't provided a full analysis of this phenomenon, but we have started to look at it in the way that linguists do.

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- Can functionalism help?
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- And we have seen lots of structural ambiguity:
  - *I saw the man with the telescope*

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# An important point

I saw the man with the hat.

is also structurally ambiguous!

# Some more simple phenomena:

- *Do you know if anyone is here yet?*
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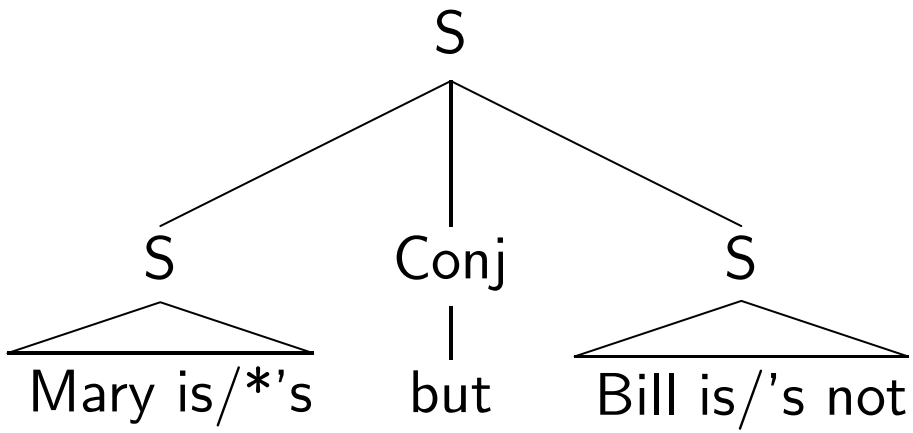

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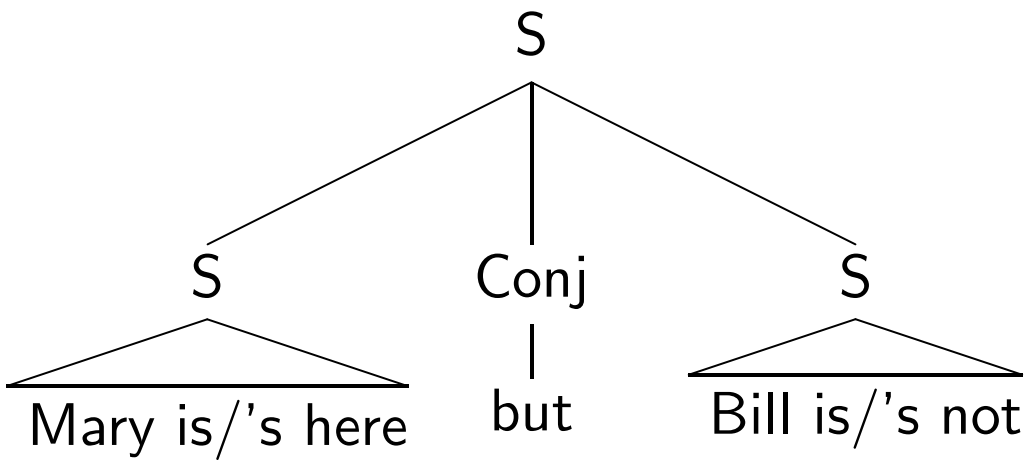

# Why are we looking at this?

- To develop some humility
- To return, once again, to the Fundamental Arguments
  - Mental Grammar . . .
  - Innate Knowledge . . .
  - Construction of Experience . . .

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## Mental Grammar

See above—this is obviously rule governed (grammar), and part of what it means to know English (mental).

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## Innate Knowledge

- Universality Argument
  - The correct analysis is dependent on the notion of sentences as structures—this seems to be universally true of syntactic patterns, as we will see.
- Acquisition Argument
  - There is no evidence that children ever posit other kinds of analyses—they are constrained to consider only structure dependent grammars.

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## Construction of Experience

These patterns do not inhere in the physical signal; they are pure mental constructs, examples of how the mind processes information

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- Abstract, rule-governed, unconscious nature of linguistic knowledge
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- Our developing critique of functionalism in favor of formalism

# Summary

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# Categories / Equivalence Classes we just discovered

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- S is a category
- Connector / Conjunction is a category
- Possessive is a category
- *'s* is a category — compare [s] and [z] pronunciations

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## How many *ts*?

That cat, Atom, didn't want to stare at the two thin rats at ease atop the atomic pot.

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- *I saw a cat* —a glottal stop [ʔ], the sound in the middle of *uh-uh* 'no'.
- *The cat is on the mat*-–a flap, [ɾ], the sound in the middle of *butter* and *ladder*.
- *I saw three cats*–plain old *t*, [t], without a puff of air

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- *My tie is clean*—an aspirated *t*, [$t^h$] followed by a puff of air
- *My sty is clean*—another plain old [t], although it actually sounds like a *d* if you cut off the *s*, something you can do with a simple, free computer program like *Praat*, mentioned in Chapter 2.

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## Why is this Construction of Experience?

- Things that are different physically perceived as the same
  - $\mathrm{t}/\mathrm{t}^{\mathrm{h}}/\mathrm{ʔ}/\mathrm{ɾ}/\emptyset$
- Things that are physically the same perceived as different:
  - *wetting* $\rightsquigarrow$ [wɛɾɪŋ]
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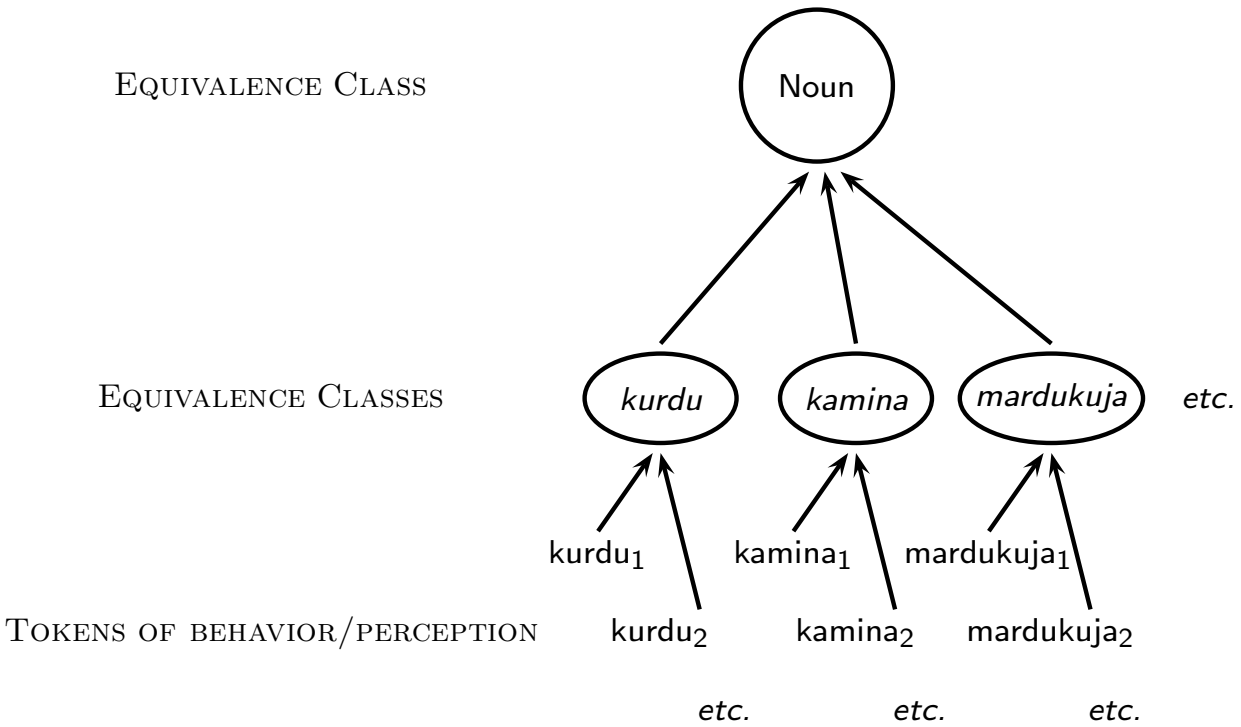


Figure: The equivalence class of Nouns is itself an abstraction from equivalence classes abstracted from sets of tokens of individual nouns.

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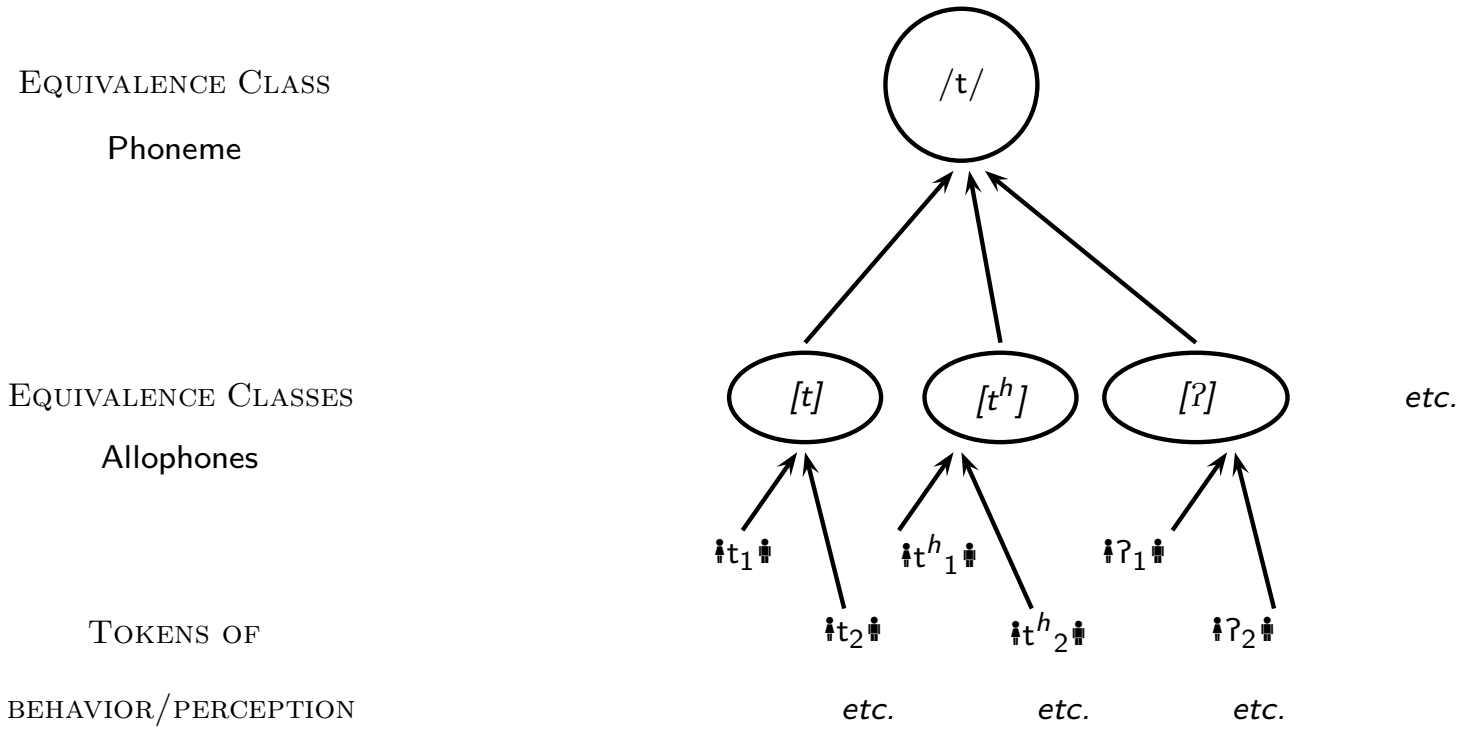


Figure: The equivalence class of the phoneme /t/ is itself an abstraction from equivalence classes of allophones abstracted from individual utterances.

# Turkish vowel harmony data

| | *nom. pl.* | *gen. sg.* | *gen. pl.* | |
|---|---|---|---|---|
| a. | ip-ler | ip-in | ip-ler-in | 'rope' |
| b. | kıl-lar | kıl- ın | kıl-lar- ın | 'hair' |
| c. | sap-lar | sap-ın | sap-lar-ın | 'stalk' |
| d. | uç-lar | uç-un | uç-lar-ın | 'tip' |
| e. | son-lar | son-un | son-lar-ın | 'end' |
| f. | öç-ler | öç-ün | öç-ler-in | 'revenge" |
| g. | gül-ler | gül-ün | sül-ler-in | 'rose' |
| h. | ek-ler | ek-in | ek-ler-in | 'joint' |

# Some questions

- What determines the choice of vowel in each suffix?
- How can we represent the suffixes?
- Do we have to say that the genitive suffix in the plural is different than the genitive suffix in the singular, since the former has only two forms and the latter has four?

# Describing Vowels

| | Front | | Non-Front | |
|---|---|---|---|---|
| | Non-Round | Round | Non-Round | Round |
| High | i | ü | ı | u |
| Non-High | e | ö | a | o |

# See and hear Turkish vowels on companion site

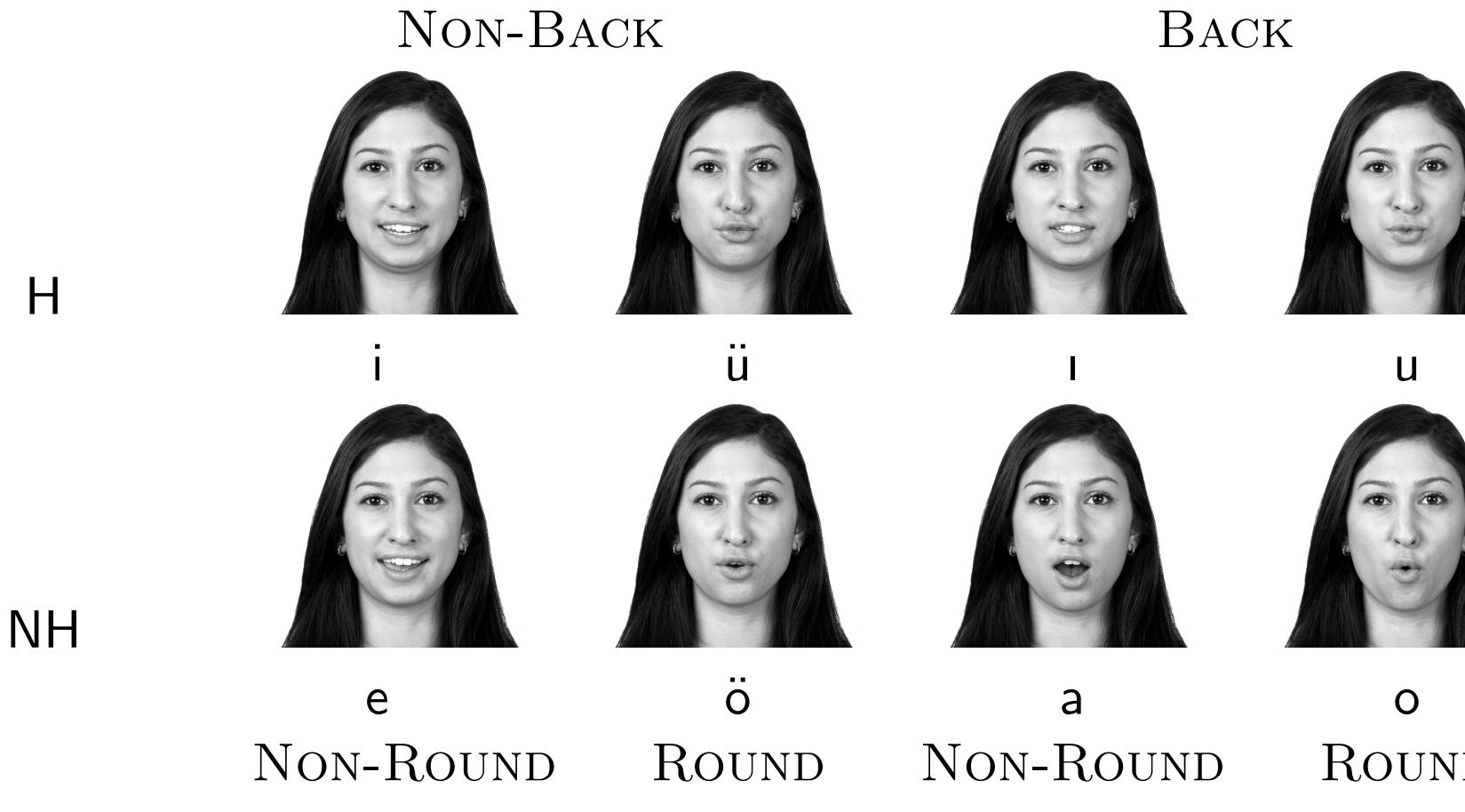


Figure: Photographer, Sabina Matyiku and model, Ezgi Özdemir are both Concordia undergraduate linguistics students.

# Turkish singular / plural pairs

| singular | plural | meaning |
|---|---|---|
| dev | devler | giant |
| kek | kekler | cake |
| can | canlar | soul |
| cep | cepler | pocket |
| tarz | tarzlar | type |
| kap | kaplar | recipient |
| çek | çekler | check |
| saç | saçlar | hair |
| şey | şeyler | thing |
| ters | tersler | contrary |
| aşk | aşklar | love |

- What are the two forms of the plural suffix?
- What determines where you find each suffiix?
  - Suffix (1) occurs . . .
  - Suffix (2) occurs . . .

# More Turkish singular / plural pairs

| singular | plural | meaning |
|---|---|---|
| ip | ipler | rope |
| kıl | kıllar | body hair |
| sap | saplar | stalk |
| uç | uçlar | edge |
| son | sonlar | end |
| öç | öçler | vengeance |
| gül | güller | rose |
| ek | ekler | junction |

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# Vowel of plural suffix

$$\begin{bmatrix} \text{V} \\ \text{Non-Round} \\ \text{Non-High} \end{bmatrix}$$

# Input representation of *öçler*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç l} \begin{bmatrix} \text{V} \\ \textsc{Non-Round} \\ \textsc{Non-High} \end{bmatrix} \text{r}$$

# Output representation of *öçler*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç} \begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Non-Round} \\ \textsc{Non-High} \end{bmatrix} \text{l} \quad \text{r}$$

# Turkish nominative and genitive singular pairs

| nom. singular | genitive singular | meaning |
|---|---|---|
| ip | ipin | rope |
| kıl | kılın | body hair |
| sap | sapın | stalk |
| uç | uçun | edge |
| son | sonun | end |
| öç | öçün | vengeance |
| gül | gülün | rose |
| ek | ekin | junction |

- What are the four forms of the genitive suffix?
- What determines where you find each suffiix?
  - Suffix (i) occurs . . .
  - Suffix (ii) occurs . . .
  - Suffix (iii) occurs . . .
  - Suffix (iv) occurs . . .

An example of what you don't know you know—a syntactic equivalence class

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# Genitive suffix

$$\begin{bmatrix} \text{V} \\ \textsc{High} \end{bmatrix} \; \text{n}$$

# Input representation of *öçün*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç} \begin{bmatrix} \text{V} \\ \textsc{High} \end{bmatrix} \text{n}$$

# Output representation of *öçün*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç} \begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{High} \end{bmatrix} \text{n}$$

# Turkish nominative singular / genitive plural pairs

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| nom. singular | genitive plural | meaning |
|---|---|---|
| ip | iplerin | rope |
| kıl | kılların | body hair |
| sap | sapların | cue |
| uç | uçların | edge |
| son | sonların | end |
| öç | öçlerin | vengeance |
| gül | güllerin | rose |
| ek | eklerin | junction |

- What are the two forms of the genitive suffix in this data?
  1. 2.
- What determines where you find each suffiix?
  - Suffix (1) occurs . . .
  - Suffix (2) occurs . . .

# Input representation of *öçlerin*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç l} \begin{bmatrix} \text{V} \\ \textsc{Non-Round} \\ \textsc{Non-High} \end{bmatrix} \text{r} \begin{bmatrix} \text{V} \\ \textsc{High} \end{bmatrix} \textit{n}$$

# Output representation of *öçlerin*

$$\begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Round} \\ \textsc{Non-High} \end{bmatrix} \text{ç} \begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Non-Round} \\ \textsc{Non-High} \end{bmatrix} \text{l} \begin{bmatrix} \text{V} \\ \textsc{Front} \\ \textsc{Non-Round} \\ \textsc{High} \end{bmatrix} \text{r}$$

# Outline

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# Downward entailment

## Semantics of *any*

- John wasn't wearing clothes
- John wasn't wearing footwear
- John wasn't wearing socks
- John wasn't wearing white socks

The negative *n't* creates a downward entailing environment where *any* can appear.

# Downward entailment

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The negative *n't* creates a downward entailing environment where *any* can appear.

# Downward entailment

## Semantics of *any*

- John wasn't wearing any clothes
- John wasn't wearing any footwear
- John wasn't wearing any socks
- John wasn't wearing any white socks

The negative *n't* creates a downward entailing environment where *any* can appear.

# Downward entailment

## Semantics of *any*

- John wasn't wearing any clothes ⇒
- John wasn't wearing any footwear ⇒
- John wasn't wearing any socks ⇒
- John wasn't wearing any white socks

The negative *n't* creates a downward entailing environment where *any* can appear.

# Downward entailment

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- John wasn't wearing any footwear
- John wasn't wearing any socks
- John wasn't wearing any white socks

The negative *n't* creates a downward entailing environment where *any* can appear.

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## Semantics of *any*

- John was wearing clothes
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Without negation we have an upward entailing environment and *any* cannot appear.

# Upward entailment

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- John was wearing socks
- John was wearing white socks

Without negation we have an upward entailing environment and *any* cannot appear.

# Upward entailment

## Semantics of *any*

- John was wearing *any clothes
- John was wearing *any footwear
- John was wearing *any socks
- John was wearing *any white socks

Without negation we have an upward entailing environment and *any* cannot appear.

# Upward entailment

## Semantics of *any*

- John was wearing clothes $\Leftarrow$
- John was wearing footwear $\Leftarrow$
- John was wearing socks $\Leftarrow$
- John was wearing white socks

Without negation we have an upward entailing environment and *any* cannot appear.

# Upward entailment

## Semantics of *any*

- John was wearing clothes $\Leftarrow$
- John was wearing footwear $\Leftarrow$
- John was wearing socks $\Leftarrow$
- John was wearing white socks

Without negation we have an upward entailing environment and *any* cannot appear.

# Entailment environments

| *Any | Any |
|---|---|
| John often wears *any socks | John hardly wears any socks |
| John left with *any socks | John left without any socks |
| John always wears *any socks | John never wears any socks |
| Many cats love *any dog | Few cats love any dogs |
| After you eat *anything, call me | Before you eat anything, call m |

# More examples

- *I see any boys in the room
- I ever go there
- He got a red cent out of me

An example of what you don't know you know—a syntactic equivalence class

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# More examples

- *I see any boys in the room
- *I ever go there
- He got a red cent out of me

# More examples

- *I see any boys in the room
- *I ever go there
- *He got a red cent out of me

# More examples

- I can't see any boys in the room
- I don't ever go there
- He never got a red cent out of me

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## Conclusion: Negative Polarity Items

- *any*, *ever*, *anything*, *a red cent*, *at all*: Negative Polarity Items (NPIs)
- Only occur in environments that are downward entailing (imply a subset)
- If you know some logic, these are environments that obey de Morgan's Law:
  - Not (P *or* Q) $\Rightarrow$ Not P *and* Not Q
  - John didn't drink any wine *or* beer $\Rightarrow$ John didn't drink any wine *and* John didn't drink any beer

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# Two semantic equivalence classes have been discovered

- Negative Polarity Items
- Downward entailing operators

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# Two semantic equivalence classes have been discovered

- Negative Polarity Items
- Downward entailing operators