Reference Resolution #1

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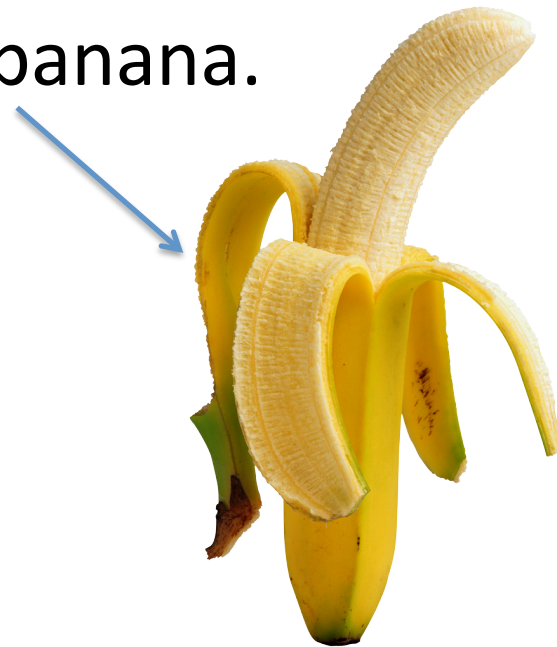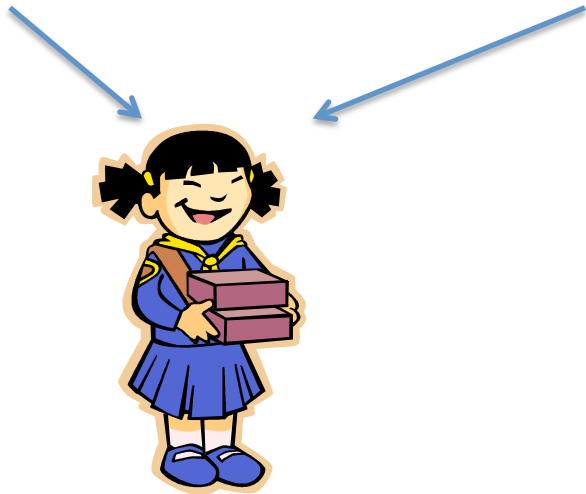# Reference Resolution: Objective

- Identify all phrases which refer to the same real-word entity
  - first, within a single document
  - later, also across multiple documents

Terminology

referent: real-world object referred to

referring expression [mention]: a phrase
  referring to that object

Mary was hungry; she ate a banana.

Terminology

- *coreference*: two expressions referring to the same thing

Mary was hungry; she ate a banana.

antecedent   anaphor

(prior expression)   (following expression)

- So we also refer to process as *anaphora resolution*

Types of referring expressions

- definite pronouns (he, she, it, …)
- indefinite pronouns (one)
- definite NPs (the car)
- indefinite NPs (a car)
- names

Referring Expressions: pronouns

Definite pronouns: he, she, it, …

- generally anaphoric
  - Mary was hungry; she ate a banana
- pleonastic (non-referring) pronouns
  - It is raining.
  - It is unlikely that he will come.
- pronouns can represent bound variables in quantified contexts:
  - Every lion finished its meal.

Referring Expressions: pronouns

Indefinite pronouns (one)

- refers to another entity with the same properties as the antecedent
  - Mary bought an IPhone6.
  - Fred bought one too.
  - *Fred bought it too.
- can be modified
  - Mary bought a new red convertible.
  - Fred bought a used one.
    = a used red convertible

  (retain modifiers on antecedent which are compatible with those on anaphor)

Referring Expressions: pronouns

Reflexive pronouns (himself, herself, itself)

- used if antecedent is in same clause
    - I saw myself in the mirror.

Referring expressions: NPs

NPs with definite determiners ("the")

- reference to uniquely identifiable entity
- generally anaphoric
    - I bought a Ford Fiesta. <u>The car</u> is terrific.
- but may refer to a uniquely identifiable common noun
    - I looked at <u>the moon</u>
    - <u>The president</u> announced …
- or a functional result
    - <u>The sum of 4 and 5</u> is 9.
    - <u>The price of gold</u> rose by $4.

Referring expressions: NPs

NPs with indefinite determiners ("a")

- generally introduces a new 'discourse entity'
- may also be generic:
  - A giraffe has a long neck.

Referring expressions: names

- subsequent references can use portions of name:
  - Fred Frumble and his wife Mary bought a house. <u>Fred</u> put up a hammock.

Complications

- Cataphora
- Bridging anaphora
- Zero anaphora
- Non-NP anaphora

Cataphora

- Pronoun referring to a following mention:
  - When <u>she</u> entered the room, Mary looked around.

Bridging Anaphora

- Reference to related object
  - Entering the room, Mary looked at <u>the ceiling</u>.

Zero Anaphora

- many languages allow subject omission, and some allow omission of other arguments (e.g., Japanese)
  - these can be treated as zero (implicit) anaphors
    - similar resolution procedures
  - some cases of bridging anaphora can be described in terms of PPs with zero anaphors:
    - "IBM announced the appointment of Fred as president [of IBM]."

Non-NP Anaphora

- Pronouns can also refer to events or propositions:

  – Fred claimed that no one programs in Lisp. <u>That</u> is ridiculous.