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# CS4025: Microplanning

# Microplanning

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- Second stage of NLG
  - » Choosing language to express content
- Several subtasks
  - » Lexical choice: Which words to use
  - » Reference: How to refer to objects
  - » Aggregation: How/when combine phrases into sentences

# Microplanning

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- Problem: There are zillions of ways of expressing a message in words
  - » *John sold the book to Mary*
  - » *Mary bought the book from John*
  - » *John sold the book. Mary bought it*
  - » Etc, etc
- Which one should we use?

# Example

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- Lexical choice: *sold* vs *bought*
- Reference: *the book* vs *it*
- Aggregation: one sentence vs two
  
- How do we make such choices?
- Which text is best?
  - » Easiest to read? Most likely to be remembered? Most persuasive? ...

# Approaches

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- Theoretical

- » Define what “best” means, make microplanning choices that optimise it
- » Hard to do in practice because we don’t have good models of the effects of choices

- Pragmatic

- » Imitate corpus
  - Use statistical learning if corpus large enough
- » Problem: corpus texts may not be very good from a microplanning perspective

# Lexical choice

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- Which word should be used to communicate a concept?
  - » *Buy vs sell*
  - » *Ascended vs rose vs surfaced*
  - » *Too fast vs too rapidly*
  - » *Recommend vs suggest*
  - » etc

# What affects lexical choice?

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- Edmonds and Hirst (2002)
  - » *Error, mistake, blunder, slip, lapse, faux pas, howler*
  - » *Lie, fib, misrepresentation, untruth, prevarication, falsehood*
  - » *Correct, correctly, right*
- Class's opinions on choosing between these?

# Issues that affect lexical choice

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- Frequency (affects readability)
  - » *lie vs prevarication*
- Formality:
  - » *Error vs howler*
- Connotation
  - » *Error vs mistake*
- Focus, expectations
  - » *not many, few, a few, only a few [students failed the exam]*



# Other factors

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- Technical terms
  - » (statistics) *standard error*, not
  - » *standard mistake*
- Linguistic context
  - » *Answered questions correctly vs*
  - » *Answers are correct*

# More Context

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- Convention
  - » Temperature falls, Wind speed eases
- Variation between users
  - » Grammar *mistake* includes spelling?
  - » By evening means 6PM or midnight?
  - » Blue *baby* means skin is blue or O2 low
    - Eg, Green *banana* means colour or not ripe?
- Vary words to make texts interesting?

# Techniques

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- Corpus-based

- » Find which words human authors use in corpus texts, use these in NLG texts

- Theoretical

- » Find words which can be used to express a meaning, choose one which best fits context and is easiest to read

# Corpus-Based

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- Works OK, not ideal
  - » Problem: many domain experts use words that readers may not interpret correctly
    - Readers don't know word (eg, *grammar*)
    - Writers use words idiosyncratically (eg, *later*)
    - Experts/public interpret word diff (*migraine*)
  - » Reiter et al (2005), Choosing Words in Computer-Generated Weather Forecasts
- Need to check if readers understand

# Corpus frequency

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- Choose most common synonym which works in current context?
- Doesn't always work:
  - » *You got 15 questions right* vs
  - » *You got 15 questions correct*
  - » We thought right better (13x more common)
  - » 90% of users preferred correct

# Theory Based

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- Choose word which best fits situation based on deep models of meaning, connotation, context, formality, user, etc
  - » Often associate words with ontology concepts
  - » Eg, Unmarried Adult Male -> *bachelor*
- Hard to get to work in practice
  - » Hard to get good data about above
  - » Ontologies don't have nearly enough info
    - The pope is not usually called a *bachelor*

# Variation

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- Should we vary words
  - » Standard writing advice
  - » *I met John and then I ran into Joan*
  - » *I met John and then I met Joan*
- Our experience
  - » Vary cue phrases (don't overuse *but*, *for example*, *because*, etc)
  - » Variation in other words depends on genre
    - Technical vs everyday vs management vs ...

# Our approach


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- Initially imitate words in corpus
- Look for problem cases
  - » Words that users may not understand
  - » Words that different corpus writers use differently
- Check these with users, change if appropriate
- Vary connectives, nothing else (initially)



# Advanced Topic: Word Meaning

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- What do words “mean” in terms of data?
  - » Example: when is a book red?
    - Which RGB values are red?
      - Different for red books and red hair?
    - How much of book needs to have “red” RGB?
      - How much do people differ?
        -  Blue or Green?
  - » Roy and Reiter (2005), Connecting Language to the World

# Reference

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- Which phrase should be used to identify an object?
  - » Look at the big dog
  - » Look at Fido
  - » Look at it

# Types of reference

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- Pronoun – *it, them, him, you, ...*
- Name – *Dr Ehud Reiter, Ehud Reiter, Ehud, Dr Reiter*
- Definite NP – *the big black dog, the big dog, the black dog, the dog*

# Terminology

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- Referent – the thing we are trying to identify
  - » Eg, Fido the dog
- Distractor – something else which is salient, which we don't want to refer to
  - » Eg, Spot the dog

# Pronouns

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- Most efficient way to refer to something
- Generally only use when
  - » Referent is something mentioned very recently (eg, previous sentence)
  - » No ambiguity; ie, no distractors mentioned recently which fit the pronoun
- Sometimes syntactically required
- More elaborate theories as well

# Examples

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- The dog saw me. It ran away.
- It saw me. The dog ran away.
- The dog saw me. The dog ran away.
- The dog and the cat saw me. It ran away.
- The dog saw me. I looked at my friend and she smiled. It ran away.

# Names

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- Good referring expression if object has a name.
- Can shorten if no distractors match the shortened name
  - » Genre, formality constraints on which short forms allowed
    - Informal: OK to use John for John Smith
    - Formal: OK to use Mr Smith for John Smith

# Examples

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- John Smith and Sam Brown came to see me.  
I told John to come back on Friday.
  - » OK, John doesn't match distractor (Sam Brown)
- John Smith and John Brown came to see me.  
I told John to come back on Friday.
  - » no, John does match distractor (John Brown)
- John Smith and John Brown came to see me.  
I told John Smith to come back on Friday.
  - » OK, only one John Smith



# Definite NPs

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- Refer to an object by its attributes
  - » The dog
  - » The big dog
  - » The black dog
  - » The big black dog
  - » The big poodle

# Definite NPs

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- Must decide which attributes to mention
  - » Size, colour, ... (ordinal, time)
- Must decide on level of detail
  - » *Animal vs dog vs poodle*
- Description should match referent but not any of the distractors
  - » Should also be short
  - » Prefer basic-level (default) level of detail

# Example: distractors

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- Two ascents

- » *The first ascent was risky, but the second ascent was fine*
- » *The ascent was risky, but the ascent was fine*

- One ascent

- » *The first ascent was risky*
- » *The ascent was risky*

# Example: properties, detail

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- *The ascent from 30m ...*
- *The ascent at 3 minutes ...*
  - » *The movement at 3 minutes*
  - » *The ascent at 3.023 minutes*
- *The first ascent ...*

# How Choose

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## ● Principles

- » Referring expression should match referent
- » Ref-exp should not match any distractor
- » Ref-exp should conform to genre
  - Eg, don't use John in formal context
  - Examine corpus to see what forms used
- » Ref-exp should be short, easy to understand

# Suggestion

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- Use pronoun if possible
  - » Referent mentioned recently
  - » Pronoun is not ambiguous
- Else use name if possible
  - » Shortest form which is unambiguous and stylistically allowed
- Else use definite NP
  - » Shortest one, prefer basic-level words
- Only use forms seen in corpus
  - » Eg, Don't use pronouns if not in corpus

# Example

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- I am taking the Caledonian Express tomorrow. It is a much better train than the Grampian Express. The Caledonian has a real restaurant car, while the Grampian just has a snack bar. The restaurant car serves wonderful fish, while the snack bar serves microwaved mush.

# Advanced topic: Sets

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- How to refer to sets?
  - » *John, George, Susan, ...* (list of names)
  - » *The UK and French students...* (define NP)
    - Not *The UK and female students* (coherence)
  - » *All the UK students except George... ?*
- Aberdeen TUNA project



# Advanced Topic: Regions

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- How to refer to regions
  - » Eg, road-gritting forecasts
- False positive/negative tradeoff
  - » Assume no points below 100m freeze, some points between 100m-200m freeze, all points above 200m freeze
  - » “Roads will freeze above 100m” ??
  - » “Roads will freeze above 200m” ??

# Reference and domain knowledge

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- Unemployment is high in areas above 100m
- Unemployment is high in rural areas
- Freezing rain in areas above 100m
- Freezing rain in rural areas

# Aggregation

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- When/how should we combine phrases?
  - » Your first ascent was fine. Your second ascent was fine.
  - » Your first ascent was fine, and your second ascent was fine.
  - » Your first ascent and your second ascent were fine.
  - » Your first and second ascents were fine.

# Ellipsis

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- Leaving out repeated information in an aggregated sentence
  - » John went to Sainsbury's. John bought some groceries.
  - » John went to Sainsbury's and John bought some groceries.
  - » John went to Sainsbury's and bought some groceries.

# When can we aggregate?

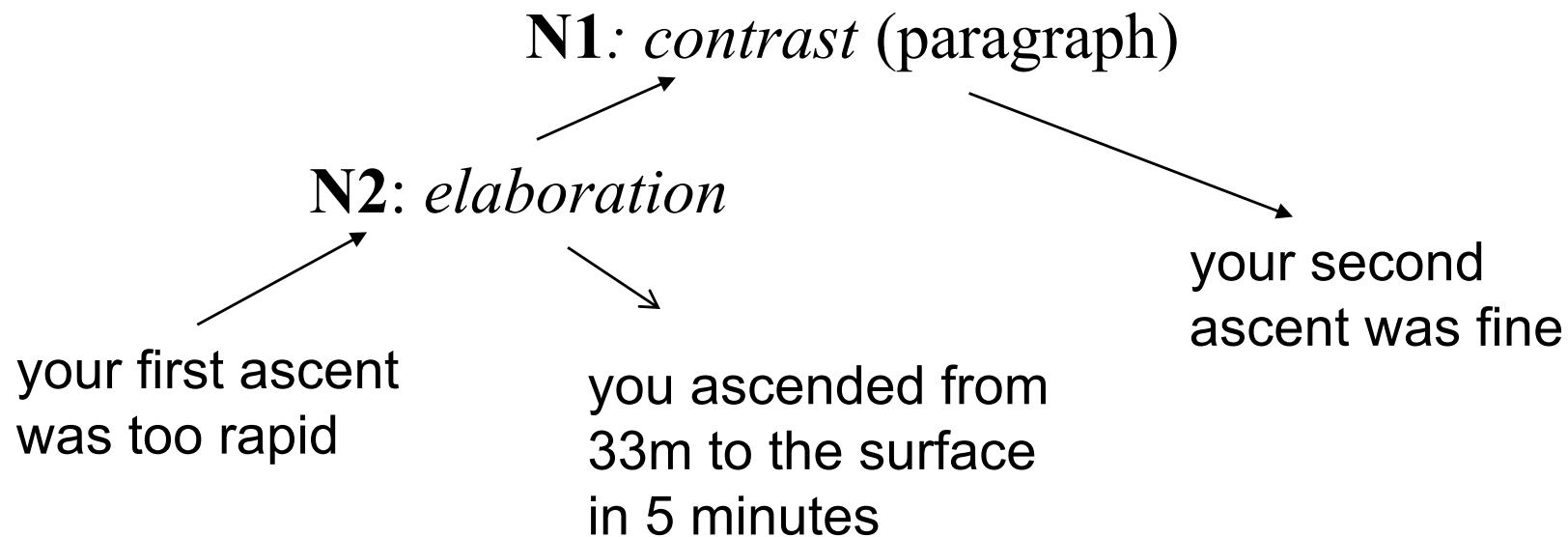
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- When can we aggregate phrases?
- Constraint – only when phrases being aggregated are sisters in document plan or text spec
  - » too simplistic, many exceptions

# Example tree

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- Your first ascent was too rapid, you ascended from 33m to the surface in 5 minutes. However, your second ascent was fine.



# Why tree?

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- Tree shows where constituents can be merged (children of same parent)

- » Your first ascent was a bit rapid. You ascended from 33m to the surface in 5 minutes. However, your second ascent was fine. (not aggregated, OK)
- » Your first ascent was a bit rapid, you ascended from 33m to the surface in 5 minutes. However, your second ascent was fine. (aggregate children of N2, OK)
- » Your first ascent was a bit rapid. You ascended from 33m to the surface in 5 minutes, however, your second ascent was fine. (aggregate N1 child and N2 child, not OK)

# Genre issues

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- Aggregation depends on genre
- Check corpus, see
  - » What kinds of aggregation occur?
  - » How long sentences usually are
    - Eg, if sentences are typically 20 words long,
    - Good idea to aggregate two 10-word phrases into a 20-word sentence
    - Bad idea to aggregate two 20-word phrases into a 40-word sentence



# What type of aggregation to use?

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- Generally use the deepest one we can
  - » Your first ascent was safe, and your second ascent was safe.
  - » Your first ascent and your second ascent were safe.
  - » Your first and second ascents were safe.
- Depends on how similar phrases are.
- Depends on genre (corpus)

# How to aggregate

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- See simplenlg tutorial
  - » Section 10
  - » Section 13

# Advanced Topic: Aggregation and Readability

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- How does aggregation impact the readability of a text?
  - » Longer sentences could make texts harder to read?
  - » But reducing overall word count could make texts easier to read?
  - » Depends on user, context, things being aggregated
- *Started* investigating in SkillSum project

# Other Microplanning Issues

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- Syntactic choice based on “focus”
  - *I hit Mary* vs *Mary was hit by me*
  - Text is more coherent if you keep the focus the same for as long as possible
- Paragraph formation
- Ordering of phrases, sentences, paras

# Microplanning

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- Decide how to best express a message in language
  - » Essential for producing “nice” texts
- Imitating corpus works to some degree, but not perfectly
  - » Currently more of an art than a science
- Key is better understanding of how linguistic choices affected readers
  - » Our SumTime weather-forecast generator microplans better than human forecasters