Psych 156A/ Ling 150: Acquisition of Language II

5/3/2012

Midterm Review

Marr's 3 Levels

Any problem can be decomposed into 3 levels:
- Computational level
  - What's the problem to be solved?
- Algorithmic level
  - What (abstract) set of rules solves the problem?
- Implementational level
  - How are those rules physically implemented?

Computational Level

Abstract Problem:
- How do we regulate traffic at an intersection?

Goal:
- Direct lanes of traffic to avoid congestion/accidents

Algorithmic Level

What kind of rules can we use?
- Let Lane go whenever X cars are waiting?
- Let Lane go every X minutes?
- Let 1 car at a time go through the intersection?
- Make one direction always yield to the other?

Implementational Level

How do we physically implement the rule?

- Set up a stop light
- Set up a blinking stop light
- Put up a stop sign
- Have someone direct traffic
- Put up nothing and have drivers implement the rules themselves!

Transitional Probability

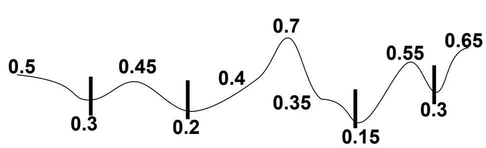
TP(AB) = P(AB|A) = # of times you saw AB / # of times you saw A

ka/ko/si
ko/li/ja
ja/ko
li/je/vo

TP(ko/si) = # of times ko/si / # of times ko

TP(ja/vo) = # of times ja/vo / # of times ja

TP Minima



TP can be though of like a tide

Every time the TP is at “low tide” we put a boundary

Precision & Recall

I wonder how well I can segment this sentence today

Iwonder how well Ican seg ment this sen tencetoday

Precision & Recall

I wonder how well I can segment this sentence today

Iwonder how well Ican seg ment this sen tencetoday

Precision:
# of correct / # guessed

3 correct / 9 guessed

Precision & Recall

I wonder how well I can segment this sentence today

Iwonder how well Ican seg ment this sen tencetoday

Recall:
# of correct / # true words

3 correct / 10 true

Stress-based Segmentation

how **WELL** can a **STRESS** based **LEARNER SEG**ment **THIS**?

If we assume Stress-INITIAL syllables:

How **WELL**cana **STRESS**based **LEARNER SEG**ment **THIS**?

Precision = 3/6 Recall = 3/9

Stress-based Segmentation

how **WELL** can a **STRESS** based **LEARNER SEG**ment **THIS**?

If we assume Stress-FINAL syllables:

How**WELL** cana**STRESS** based**LEARNER SEG** ment**THIS**?

Precision = 0/5 Recall = 0/9

Bayesian Learning

All (statistical) learning is a form of **INFERENCE**

We have data…

But which hypothesis is true?

P(H|D) ?

P(H | D) = P(D | H) * P(H) / P(D)

posterior likelihood prior prob. of data

Cross-Situational Learning

Use information across trials to identify a word/meaning mapping

Scene 1:	"dugme"	"lutka"	"prozor"
	Object 1	Object 2	Object 3
Scene 2:	"lutka"	"zid"	"prozor"
	Object 1	Object 3	Object 4

Cross-Situational Learning

Scene 1:	"dugme"	"lutka"	"prozor"
	Object 1	Object 2	Object 3
Scene 2:	"lutka"	"zid"	"prozor"
	Object 1	Object 3	Object 4

P(H|D) = P(D|H) * P(H) / P(D)

Posterior = likelihood * prior / prob. of data

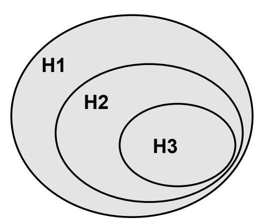
P(lutka == 1) = ¼ Prior (let's call this H1)

P(D | H1) = 1 Likelihood

P(D) = P(H1)*P(D|H1) + P(H2)*P(D|H2) + P(H3)*P(D|H3)…

P(H1 | D) = P(D | H1) * P(H1) / P(D)

Suspicious Coincedence



Three hypotheses:
- Superordinate: "mammal"
- Basic: "dog"
- Subordinate: "beagle"

Given a picture of a beagle:

P(data|H3) = 1/# of beagles

> P(data|H2) = 1/# of dogs

> P(data|H1) = 1/# of mammals

Contrastive Sounds

A pair of sounds are contrastive if:
Switching the sounds changes the **MEANING**

In English:

"food":	[f u d]	← Contrastive
"rude":	[r u d]	

In German:

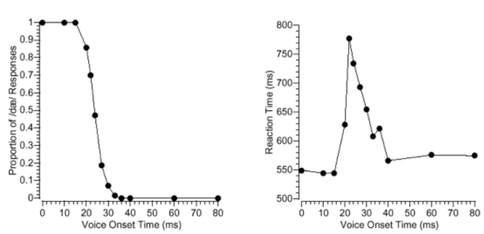
"street":	[s t R a s ə]	← Not contrastive
"street":	[s t r a s ə]	

Learning Sounds

Maintenance & Loss Theory:
- If you use a distinction in your language
  - Keep it
- If you don't use it
  - Ignore the distinction

Functional Reorganization:
- Create a filter between acoustics and phonemes
- If you hear a language sound
  - Impose filter to ignore non-native distinctions
- If you hear a non-language sound
  - Don't impose the filter

Sound Identification



Sound Discrimination

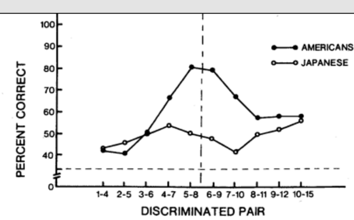


Figure 12.2. Test of the categorical perception of /ra/ and /la/ by American and Japanese adults. American listeners show the characteristic peak in discrimination at the phonetic boundary; Japanese listeners do not. (From Miyawaki et al., 1975.)