Visual Word Recognition

Reading is a cultural invention

- Emerged recently in human history

- Is not universal (not all cultures have it)

- Must be explicitly taught

- Invented a number of times in different civilizations

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

- Morphemes?

- Syllables?   Connect to language

- Sounds?

If you were going to invent a writing system, what would your symbols represent?

- **Concepts/ideas?**

  -That's just Pictionary; not that powerful.

- Emotions?

- Morphemes?

- Syllables?

- Sounds?

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- **Emotions?**

- Morphemes?

- Syllables?

- Sounds?

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

- **Morphemes?**

  -"Logographic" system: symbols = units of meaning

  -Taps into the productive power of language

  -But lots to remember!

- Syllables?

- Sounds?

Slide 1

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

- Morphemes?

- **Syllables?**

  -"Syllabary" system

  Works great for languages with ~few syllables (e.g., Japanese = ~100+ due to phonotactic constraints)

  -Not so good for languages with lots of syllables (e.g., English = thousands of possible syllables)

- Sounds?

わらやまはなたさかあ
WA RA YA MA HA NA TA SA KA A
ゐりみひにちしきい
WI RI MI HI NI CHI SHI KI I
るゆむふぬつくう
RU YU MU FU NU TSU KU U
ゑれめへねてせげえ
WE RE ME HE NE TE SE GE E
をろよもほのとそこお
WO RO YO MO HO NO TO SO KO O
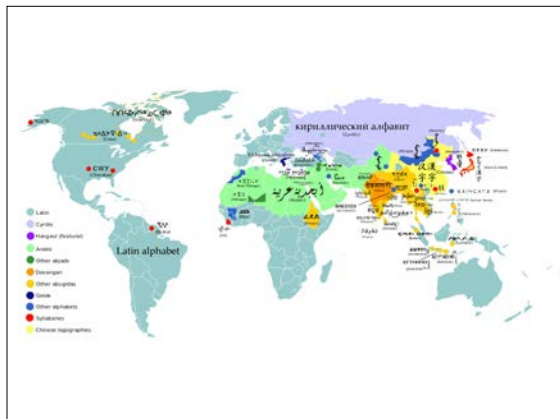
Japanese Hiragana

Slide 2

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

- Morphemes?

- Syllables?

- **Sounds?**

  -Various forms (see next slide)

  -Taps into language at a low level (takes advantage of full power)

  -Lot's of flexibility

  -Kind of unnatural (we aren't naturally aware of speech sounds)

العربية

Latin

עברית

кириллица

Slide 3

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

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- Syllables?

- **Sounds?**

  -Alphabetic — separate symbols for consonants and vowels — e.g., Latin

  -Abjad — symbols for consonants only w/diacritic marking — e.g., Arabic, Hebrew

  -Abugida — symbols for consonants w/secondary vowel notation — e.g., Devanagari

Slide 4

Slide 5

If you were going to invent a writing system, what would your symbols represent?

- Concepts/ideas?

- Emotions?

- Morphemes?

- Syllables?

- Sounds?

In fact, while writing systems may emphasize one approach, most writing systems use a mix.

- 1 2 3 4 5
- Mr. & Mrs.
- lb
- &, etc.

Slide 6

Most research on reading focuses on alphabetic systems

So how do we read?

- "Sound out" words (e.g., c-a-t —> cat)

- AKA: Grapheme to phoneme conversion

- Allows us to read new words or non-words

Jabberwocky

`Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,
And the mome raths outgrabe.'

-Lewis Carroll

But grapheme to phoneme conversion doesn't work perfectly in English

- hint, mint, pint

- gave, save, have

- tic, click, clique

- shun, nation, fashion

- gruff, enough, though

- pare, pair, pear

- yacht, soldier, listen

In fact…

Aoccdrnig to rseearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae.

But sneuqesbut etnemirepxs sseggut osiwrehte.

Letter position must be coded to some extent


So how do we read?

1. Grapheme to phoneme route

2. Whole word pattern matching

Slide 1

What information must we represent in word recognition?

- Letter features (/ - \)

- Abstract letters (A a 𝕒 *a* 𝗮 𝐀 𝒂 𝗮 = 'A')

- Abstract word forms (*cake*, CAKE, *cake* = "CAKE")

- Phonological form (e.g., we can pronounce words)

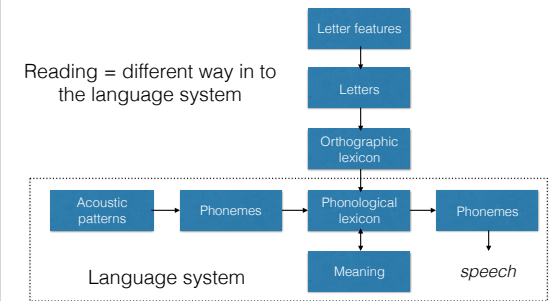- Meaning (e.g., can understand words)

Slide 2

What information might we represent in word recognition?

- Letter features

- Abstract letters

- Abstract orthographic word forms

- Phonological word forms

- Meaning

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Slide 3
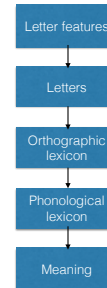
What information must we represent in word recognition?

Reading = different way in to the language system

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Acoustic patterns → Phonemes → Phonological lexicon → Phonemes → speech

Language system

Slide 4

What information must we represent in word recognition?

But what about PLUB or KLEMP or YUG?

We can pronounce nonwords so there must be a route that skips the "lexicons"?

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Phonemes → speech; Phonological lexicon → Meaning

Slide 5

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Letter features → Letters → Orthographic lexicon → Phonological lexicon → Phonemes → speech; Letters → Phonemes

Slide 6
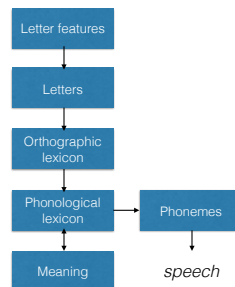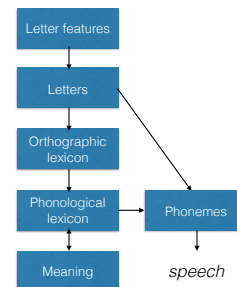
What information must we represent in word recognition?

But what about

Chiwetel Ejiofor

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Phonemes → speech; Letters → Phonemes

Slide 1
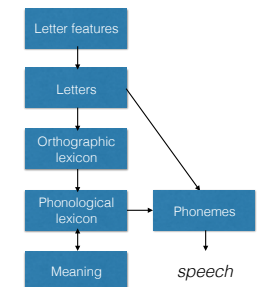
What information must we represent in word recognition?

Or

Caucasus Mountains

The Caucasus Eco-Region

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Letters → Phonemes

Phonological lexicon → Phonemes

Phonemes → *speech*

Slide 2
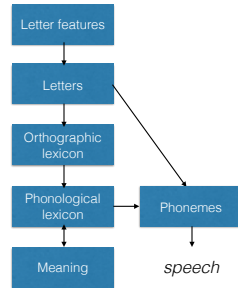
What information must we represent in word recognition?

Or

Otolaryngology

Or

Tetrahydrocannabinol

Or

Givenchy

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Letters → Phonemes

Phonological lexicon → Phonemes

Phonemes → *speech*

Slide 3
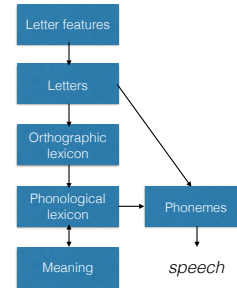
What information must we represent in word recognition?

Or

Zzzzzzzz

Or

$%#&!

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Letters → Phonemes

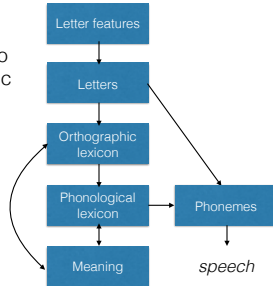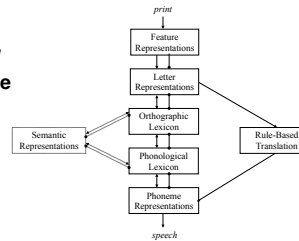Phonological lexicon → Phonemes

Phonemes → *speech*

Slide 4
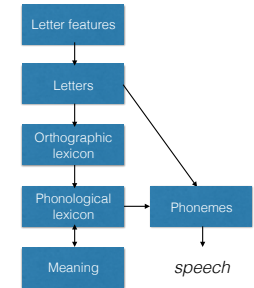
What information must we represent in word recognition?

There must also be a way to go from familiar orthographic forms directly to meaning

Letter features → Letters → Orthographic lexicon → Phonological lexicon → Meaning

Letters → Phonemes

Phonological lexicon → Phonemes

Phonemes → *speech*

Slide 5

The DRC ("Dual" Route Cascaded) Model

1. **Lexical semantic route**
   - good for Chiwetel Ejiofor
2. **Lexical non-semantic route**
   - good for yacht—>/**jɑt**/
3. **Grapheme-to-phoneme conversion route**
   - good for reading nonwords

print

Feature Representations

Letter Representations

Semantic Representations — Orthographic Lexicon — Rule-Based Translation

Phonological Lexicon

Phoneme Representations

speech

Slide 6

The DRC ("Dual" Route Cascaded) Model

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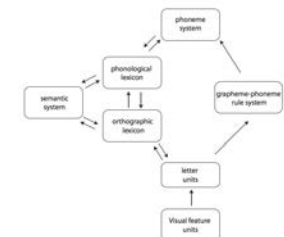   - good for reading nonwords

Figure 1. The dual-route cascaded model of reading aloud (Coltheart et al., 2001).

Slide 1

Data from Brain Injury

Some patients…

1. Can read real words (regular and irregular) but not nonwords
   - "phonological dyslexia"
2. Can read regular words and nonwords but not irregular real words (*listen* read as "lis-ton")
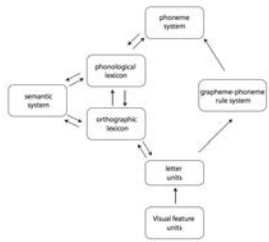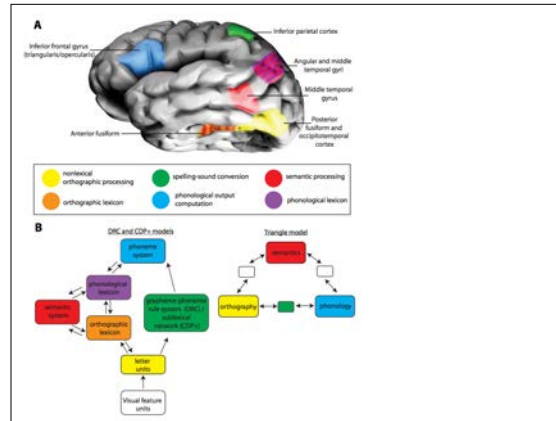   - "surface dyslexia"

Figure 1. The dual-route cascaded model of reading aloud (Coltheart et al., 2001).

Slide 2

Slide 3

Acquired vs. Developmental Dyslexia

- Acquired dyslexia (often called "alexia"): reading difficulty due to brain damage

  - "Agraphia": Acquired writing difficulty

- Developmental dyslexia: reading and writing difficulty disproportionate to the rest of cognition and assuming adequate instruction

Slide 4

Developmental Dyslexia

Difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction.

10% of population affected
Tends to run in families (genetic component)

Slide 5

Developmental Dyslexia

How do you measure "phonological deficit"?

- Tests of "phonemic awareness"

  - Awareness of and ability to manipulate the phonological structure of words
  - E.g., deletion ("say 'stop' without the 's')", segmentation ("what's the first sound in 'stop'), etc.

- "metalinguistic" tests (not natural use of language)
- Does not imply natural language deficit