

## Voice onset time (VOT)

- Primary cue for distinguishing voiced and voiceless stop consonants
- Delay between release and vocal fold vibration
- Much longer in voiceless stops
  - 0 - 20 ms = voiced
  - 40 - 100 ms = voiceless

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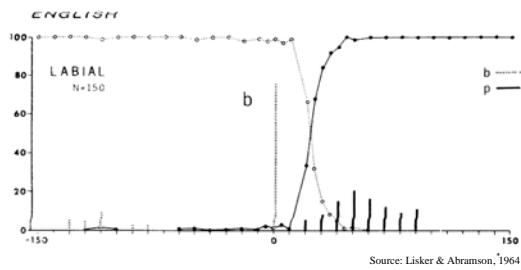
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## English speakers



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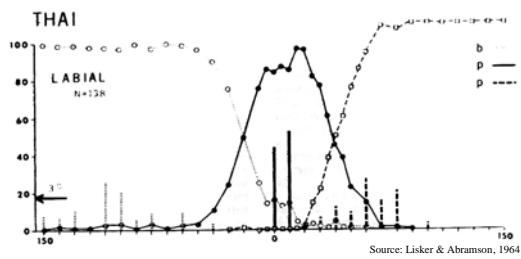
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## Thai speakers



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## Categorical Perception

- Continuum from blue to green

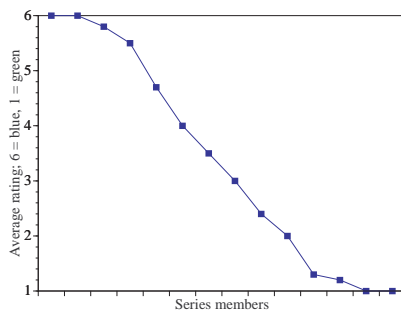


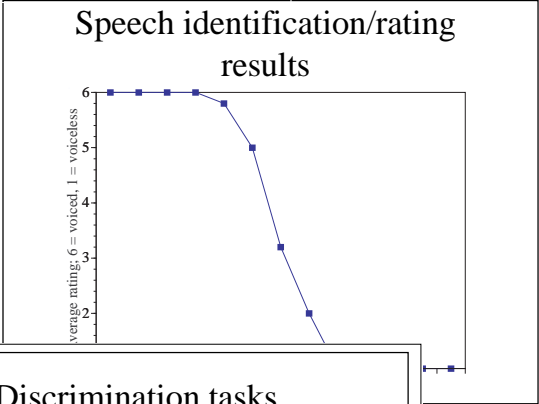
- Continuum from /g/ to /k/
  - VOT ranging from 0 ms to 80 ms in steps

## Identification/rating task

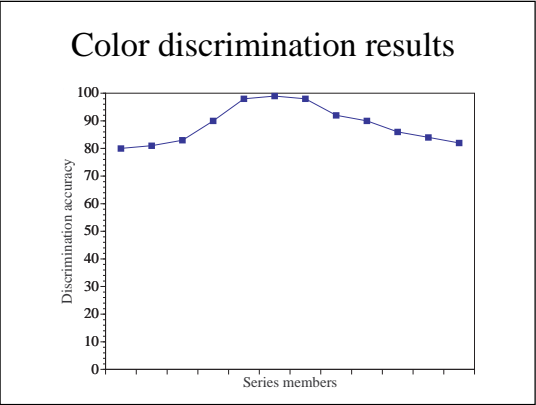
- Label each item as being a member of one category or the other
- Sometimes add in “goodness rating”
- For example, a 6-item rating going from a good clear blue (1) to a good clear green (6)
  - 2 = mostly blue
  - 3 = borderline, but more blue than green
  - 4 = borderline, but more green than blue
  - 5 = mostly green

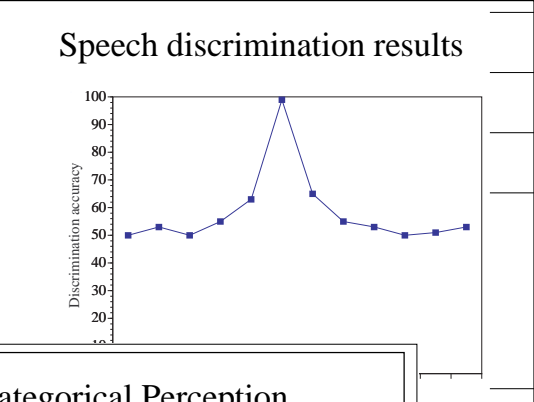
## Color identification/rating results





- ### Discrimination tasks
- AX
  - ABX
    - 1 step: 1-2-2, 4-3-3, 7-8-7, 6-5-6
    - 2 step: 1-3-3, 4-2-2, 6-8-6, 7-5-7






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### Categorical Perception

- As if people can only perceive category information
- Found for many different consonant distinctions
- Not found for vowels

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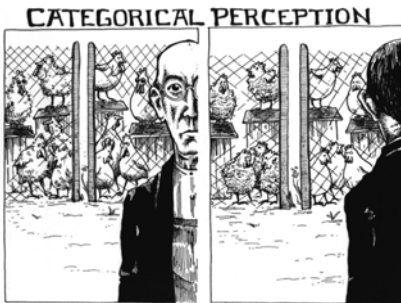
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Differences among items that fall into different categories are exaggerated, and differences among items that fall into the same category are minimized.

Source: [cognitn.psych.indiana.edu/rgoldsto/projects/categorical.html](http://cognitn.psych.indiana.edu/rgoldsto/projects/categorical.html)

### Example stimuli

- Series 1 
- Series 2 
- Series 3 
- Series 4 
  
- Same/different task 

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### Same-Different Answers

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|--------------|---------------|
| 1. Different | 11. Same      |
| 2. Same      | 12. Different |
| 3. Different | 13. Different |
| 4. Same      | 14. Different |
| 5. Same      | 15. Different |
| 6. Different | 16. Different |
| 7. Different | 17. Same      |
| 8. Same      | 18. Different |
| 9. Different | 19. Different |
| 10. Same     | 20. Different |

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### Same-Different Answers, cont.

- Compare your results across the continuum:
  - /g/ end of the continuum = numbers 1, 2, 7, 8, 10, 13, 16, 20
  - /k/ end of the continuum = numbers 3, 4, 11, 12, 14, 18
  - Middle of the continuum = numbers 5, 6, 9, 15, 17, 19

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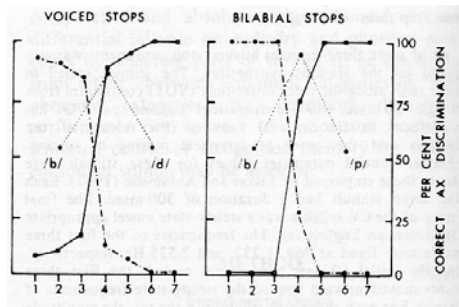
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## Consonant results




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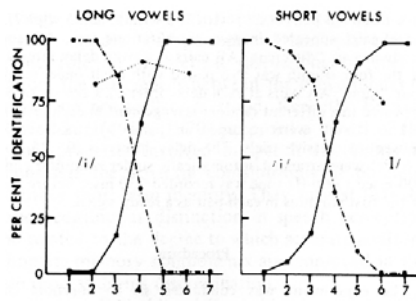
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## Vowel results




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## Interpretations

- Is speech special?

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## Animals show categorical perception

- Pat Kuhl trained chinchillas to label endpoints of a speech continuum
- Tested on other members of series




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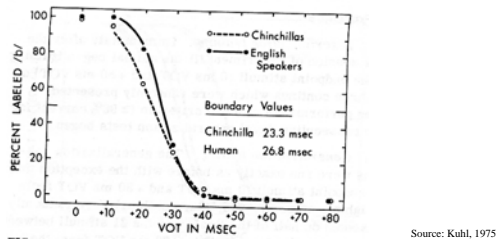
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## Chinchilla results

- Chinchillas showed the same categories, although slightly less steep




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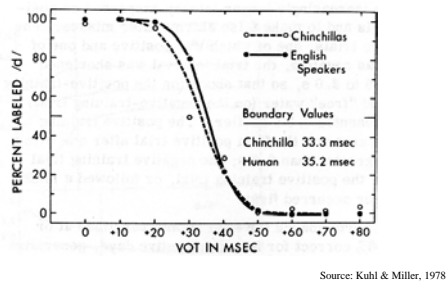
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## Chinchilla results, cont.




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**Who cares about categorical perception?**

- Because phonemes are heard categorically, distinctions that do not occur in your language are not heard, even though they may occur in other languages.
- This poses a problem for second language learning & accent reduction.

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