



Overview

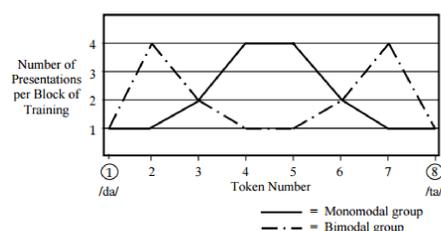
- **Distributional learning mechanism** involved in the acquisition of phonemes (Maye, Werker, and Gerken, 2002)
- **Amazon Mechanical Turk (MTurk)**: online crowdsourcing service gaining in popularity among psychologists as a subject pool
- **Goal**: Replicate distributional learning studies on MTurk
- **Findings**: If anything, I find the opposite of previous studies when testing participants on MTurk

Background: Distributional learning in the lab

- Maye and Gerken (2000)

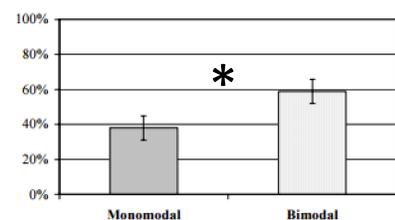
- Two conditions: Monomodal group and Bimodal group
- Stimuli: 3 8-point continua ranging between prevoiced [d] to voiceless unaspirated [t]
 - da – ta, dæ – ta, dɪ – tɪ

- Training: Hear monomodal or bimodal distribution of phones



- Testing: “Are these the same or different words?” (da vs. ta)

- Results: Bimodal group more likely to answer that the endpoints of the continua were “different” words



Figures from Maye and Gerken (2000)

- This has been replicated...

- With infants (Maye et al. 2002)
- With [i] – [ɪ] (Gulian et al. 2007)
- With [a] – [ɑ] (Gulian et al. 2007)
- With [k] – [g] (Hayes-Harb 2007)
- With [ç] – [ç̥] (Cristià et al. 2011)
- Thai tone pairs [33] and [241] (Ong et al., 2015)

Background: Psychological studies performed through Mechanical Turk

- Online crowdsourcing service provided through Amazon
- Being used more and more by experimental psychologists to gather data quickly
- A number of psychology studies have been successfully replicated on MTurk (Crump et al., 2013)

Experiment 1:

Attempted replication of distributional learning on MTurk shows significant effect in *opposite* direction of previous studies

- **Stimuli**: 3 8-point continua ranging between prevoiced [g] (“gill”) and voiceless unaspirated [k] (“skill”)

- ga – ka, gæ – ka, gɪ – kɪ

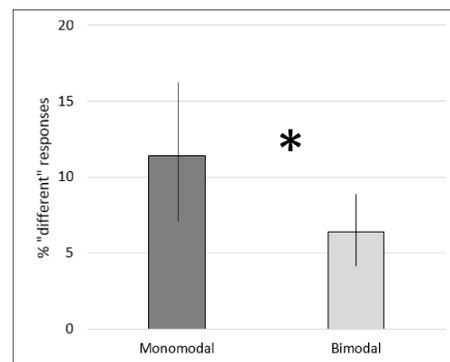
- **Procedure** (following Maye and Gerken (2000)):

1. **Practice Testing Phase with English words**: “Are these the same or different words?” (lock vs. rock)
2. **Training Phase**: Hear monomodal or bimodal distribution of phones
3. **Testing Phase**: “Are these the same or different words?” (ga vs. ka)
4. **Questionnaire**: Questions regarding language background

- **Adapting to MTurk platform**:

1. Computer location set to United States to increase chances that participant would be a native English speaker
2. One or two low-toned beeps (50 Hz) were interspersed throughout the Training Phase
 - Asked to press “1” or “2” to indicate how many beeps they had heard
 - Included to ensure participants were wearing headphones (most speakers will not pick up a 50 Hz sound) and were paying attention throughout
3. During Testing Phase, participants would randomly hear a buzzer sound
 - Told not to press any key when they heard the buzzer sound
 - Included to ensure participants were not just clicking through the testing phase

- **Results**: Monomodal group significantly more likely to answer that [ga] and [ka] were “different” words

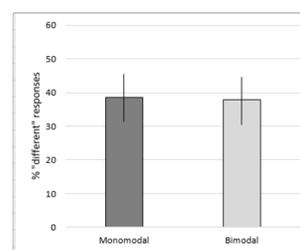


$p = 0.039$
 $N_{\text{monomodal}} = 31$
 $N_{\text{bimodal}} = 39$
 10 participants rejected from analysis

Experiment 2:

Different stimuli, no difference between groups

- **Stimuli**: 3 8-point continua ranging between [u] and [y]
- Procedure identical to Experiment 1
- **Results**: No significant difference between Monomodal and Bimodal groups

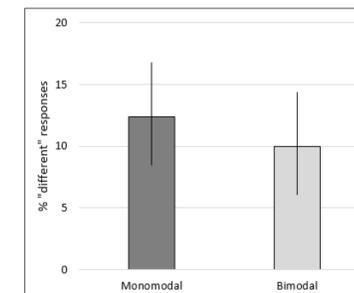


$p = 0.89$
 $N_{\text{monomodal}} = 18$
 $N_{\text{bimodal}} = 15$
 17 participants rejected from analysis

Experiment 3:

Is age a factor? Test 18-25 year olds only

- Most participants in Experiment 1 reported being 46-65 years old
- Experiment 3: Identical to Experiment 1, but asked only 18-25 year olds to participate
- No significant results



$p = 0.35$
 $N_{\text{monomodal}} = 23$
 $N_{\text{bimodal}} = 27$
 19 participants rejected from analysis

Conclusion and Discussion

- Experiment 1: Monomodal group significantly *more* likely to answer that endpoints of the continua were “different”
 - *Opposite of what previous studies have found*
- There have been previous studies which fail to find evidence for distributional learning, but as far as I am aware, no previous study found the opposite effect

- **Possible reasons for findings**:

- Age difference?
 - Most participants in Experiment 1: 46-65 years old
 - Likely that many of the previous replications were done with undergraduate students
 - Different age groups may be using different strategies for phoneme acquisition
 - Difficult to say since Experiment 3 was inconclusive
 - If so, may be using a variation of lexical learning (Feldman et al. 2013)

Lexical learning = learners assume two phones belong to the same phoneme if they hear them in two similar-sounding wordshapes
 Bimodal group had their attention drawn more to the endpoints of the continuum

This, plus lexical learning, may account for findings in Experiment 1

- Or, may be due to a difference in setting
 - MTurk participants may be paying less attention (distracted, not in a lab setting)
 - ... or possibly more attention (believe payment may be withheld if they do not follow all instructions)
 - Either may have had an effect on learning strategies

Selected References

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