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## Background

- Do we have innate preferences for or aversions to sounds?
- Cross-cultural research can help us determine whether preferences for or aversions to different types of sounds are biologically determined or culturally contingent



## Hypotheses

- Certain sounds may be aversive because they can damage our auditory system**
  - Loud sounds and sounds in the 2-5kHz range, which are amplified by the ear canal
  - Example: Posited that 2-5kHz sounds are unpleasant because that is the same pitch range as macaque alarm calls (Halpern, Blake, Hillenbrand, 1986)
- Sounds may be aversive because of context/outside information or cultural expectations**
  - Example: Preferences for musical consonance are culturally contingent (McDermott et al., 2016, McPherson et al., 2020)

## Methods and Participants

### Tested Preferences for:

- High vs. Low Tones (125-6000 Hz)
- Loud vs. Soft Tones (50-90 dB)
- Amplitude Modulated Tones
- Environmental Sounds
- Laughter vs. Gasps

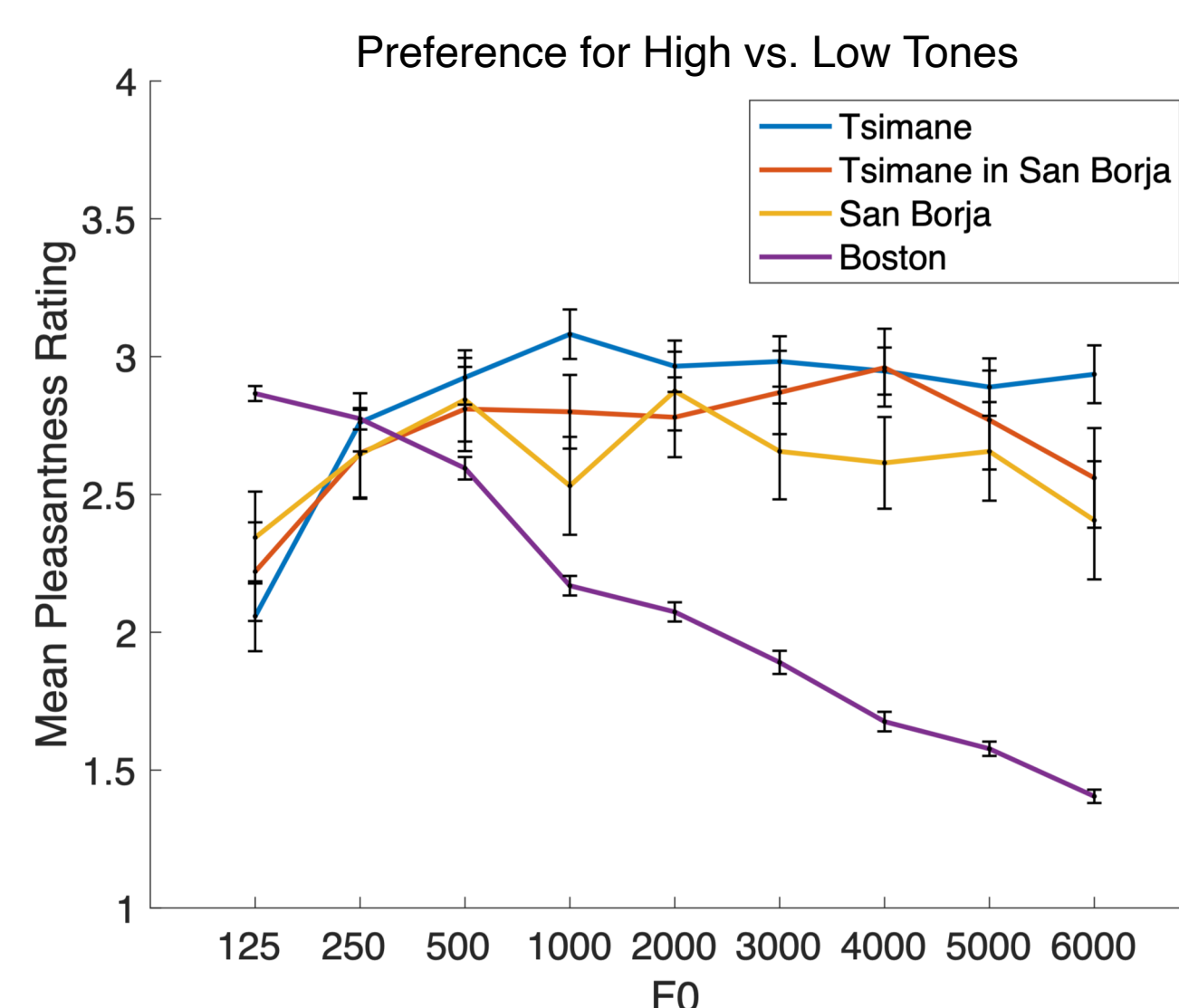
### Identical Sets of Experiments in

- Tsimane'
- Mostly monolingual Tsimane' speakers, live in the Bolivian Amazon
- N=43
- Tsimane' who live in San Borja
- N=25
- Small town in rural Bolivia, in the region where Tsimane' live
- Non-Tsimane' Residents of San Borja
- Non-indigenous Spanish speakers with electricity and cell phone service
- N=24
- USA residents
- In-person (N = 14) and online (N=71 – High vs. Low Tones and Environmental Sounds)



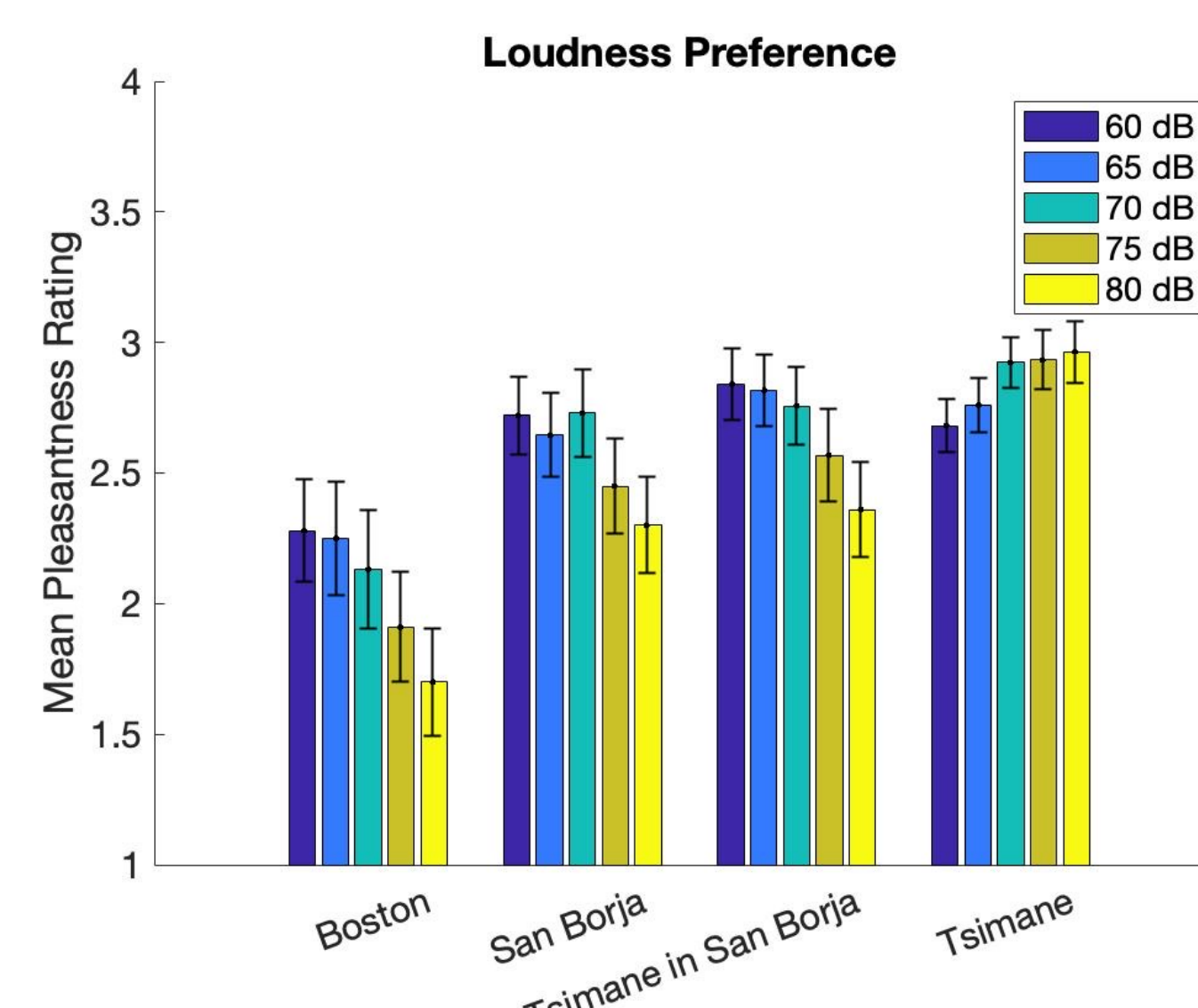
Experimenter on left, participant center, translator right. Participant wears over-ear headphones and experimenter enters responses.

## Preference for Pitch Height Varies Across Cultures

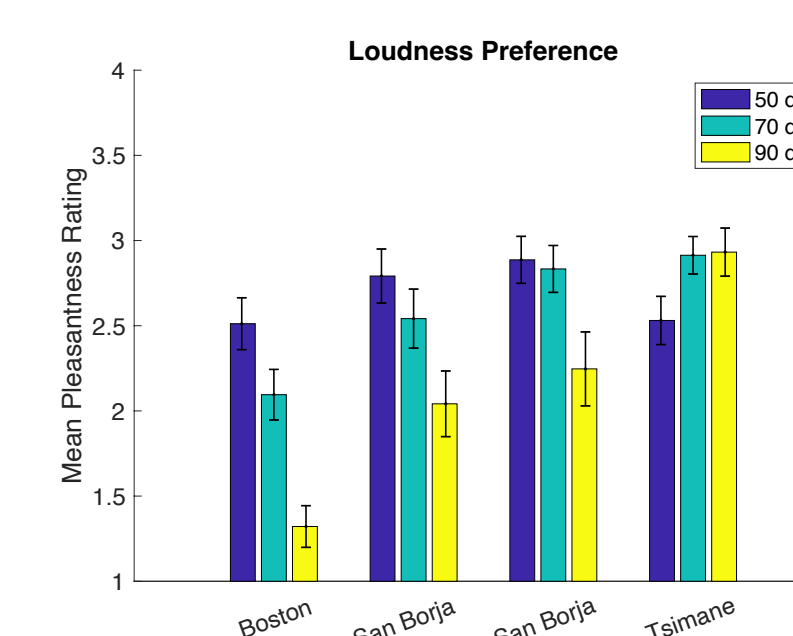


- Significant difference between Tsimane' who live in town and in traditional villages ( $F(1,66)=5.89, p=.017$ )
- Results suggest that the aversiveness of 2000-5000 Hz tones is acquired, rather than biologically determined
- Aversiveness of high or low tones is driven by some factor that varies continuously between Tsimane', San Borja (a small rural town), and the US

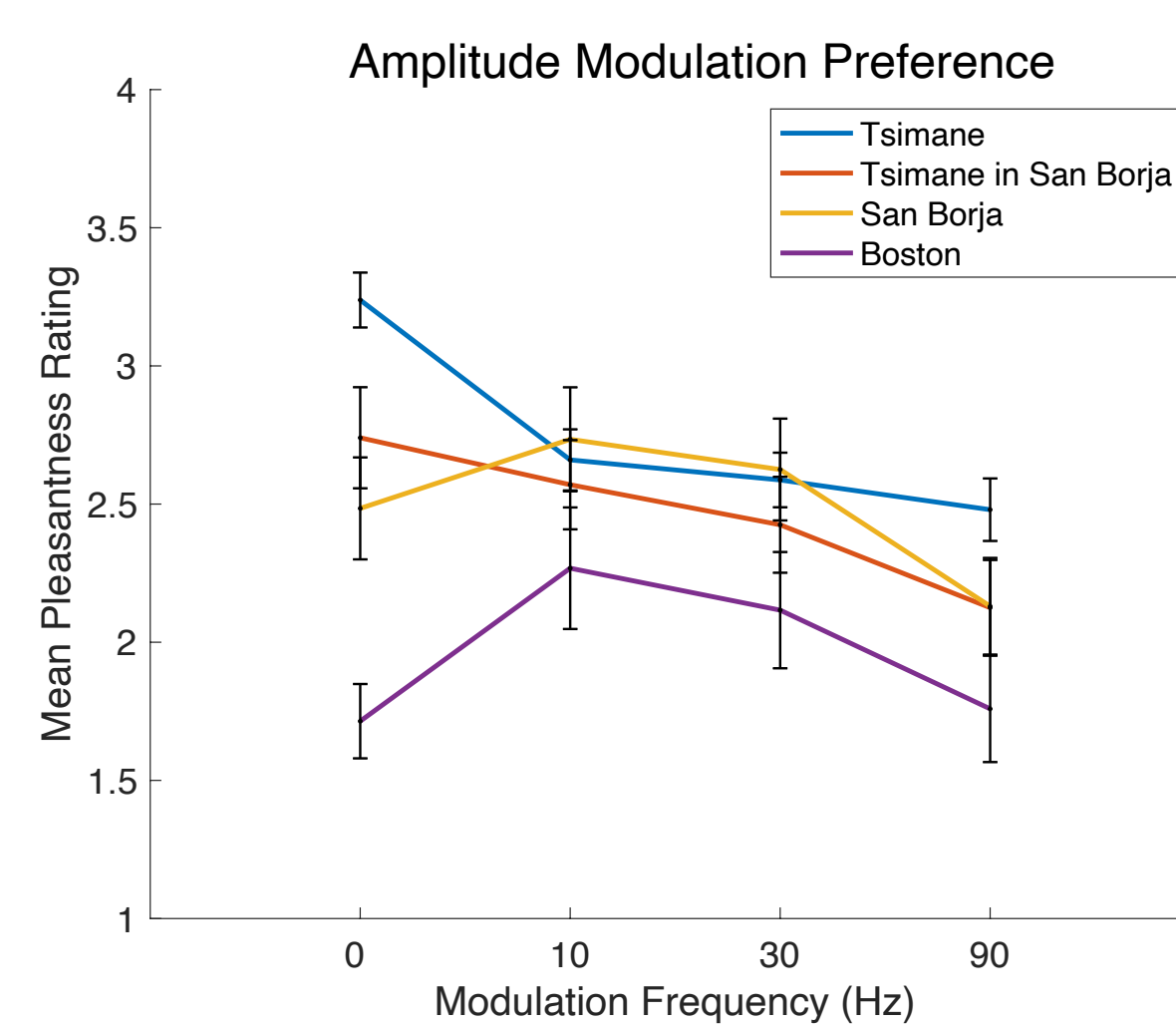
## Tsimane' Prefer Loud to Soft Tones



Replication: Preference for loud sounds may plateau above 70 dB for Tsimane'



## Preferences for Amplitude Modulations Vary Across Cultures



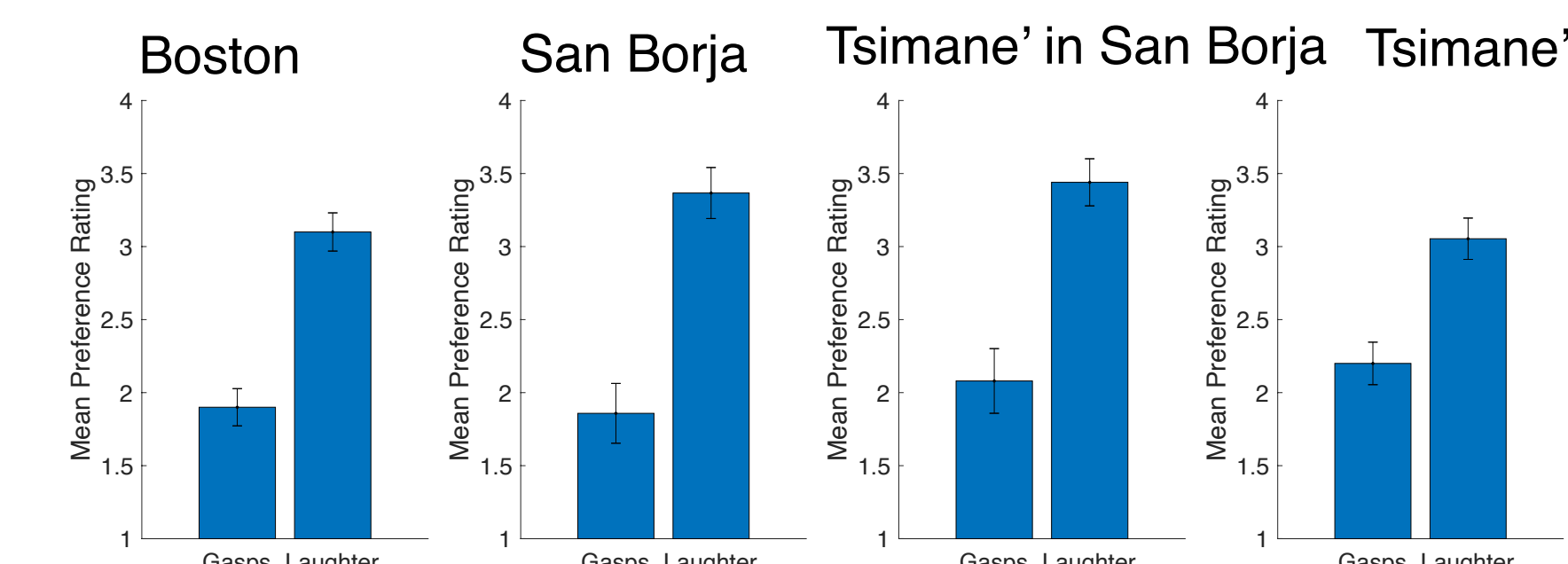
- All participants prefer lower modulation frequencies to higher modulation frequencies
- Boston participants prefer low levels of amplitude modulation to unmodulated tones, while Tsimane' strongly prefer unmodulated tones

## Summary and Conclusions

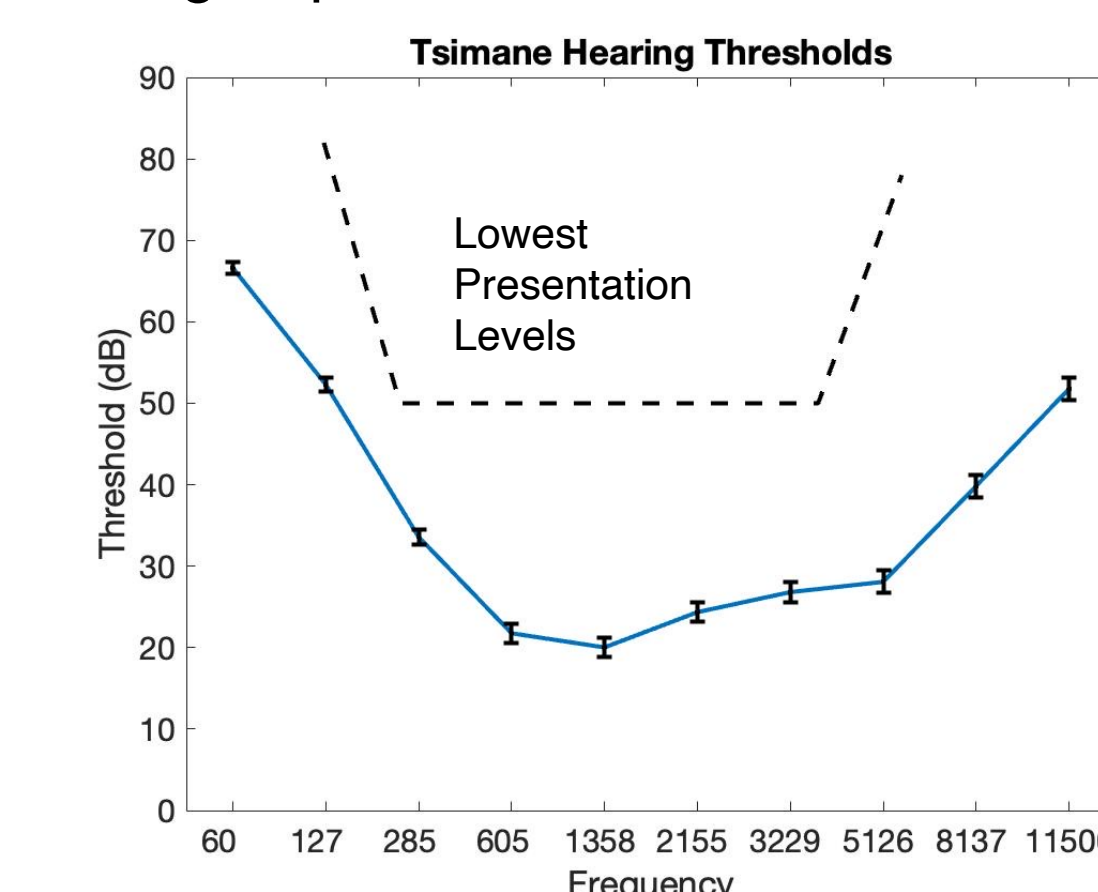
- Preferences for frequency and loudness appear to be learned
- Given the gradients in responses from Tsimane' to USA participants, aversion to high frequencies and loud noises is plausibly related to industrialization
- Preferences for environmental sounds appear to be at least partially driven by the frequency content of sounds

## Possible Concerns & Alternative Explanations

**People don't understand the task?** → Control conditions confirm task comprehension, and anecdotal evidence from translators confirms that high-pitched sounds are preferred to low-pitch sounds

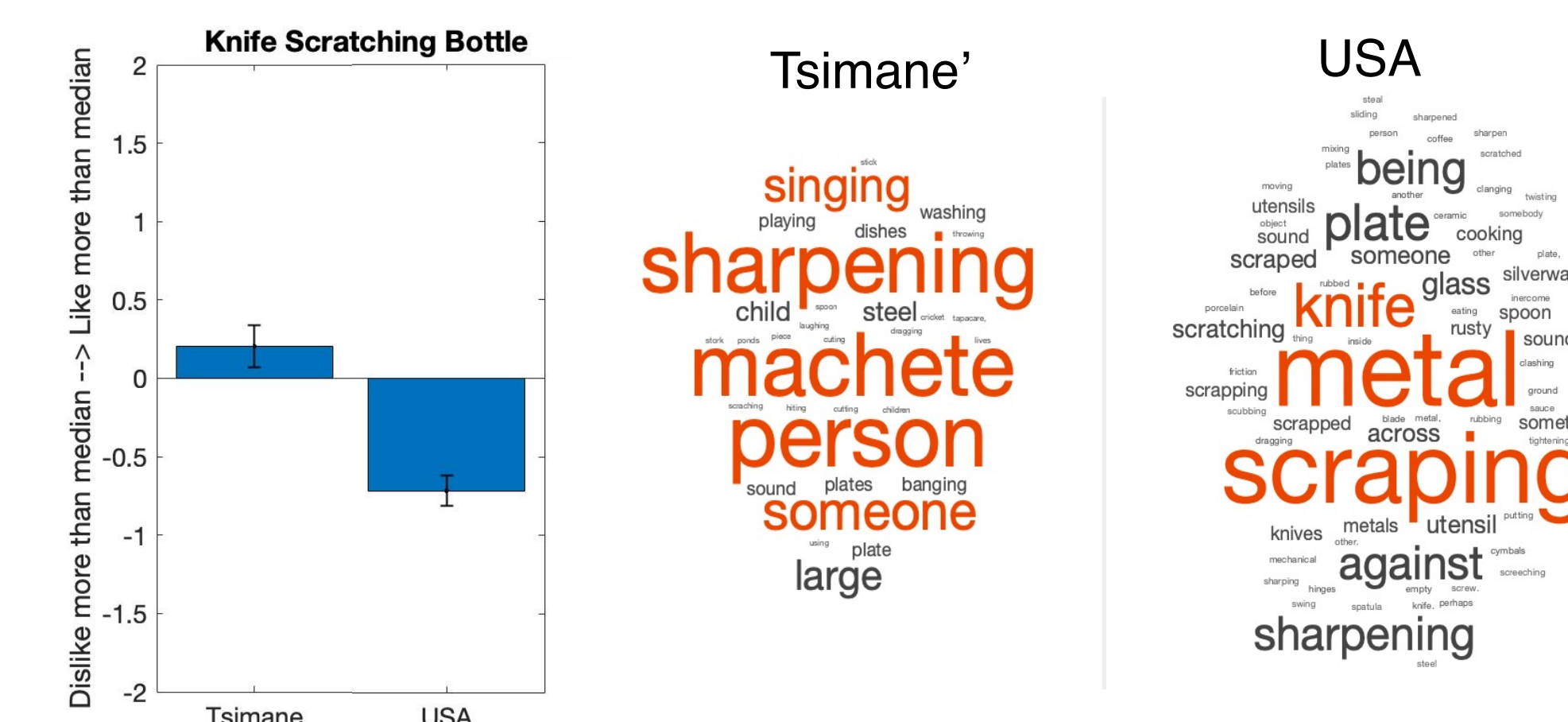


**Hearing differences between populations?** → Hearing test confirmed all sounds were audible to all groups

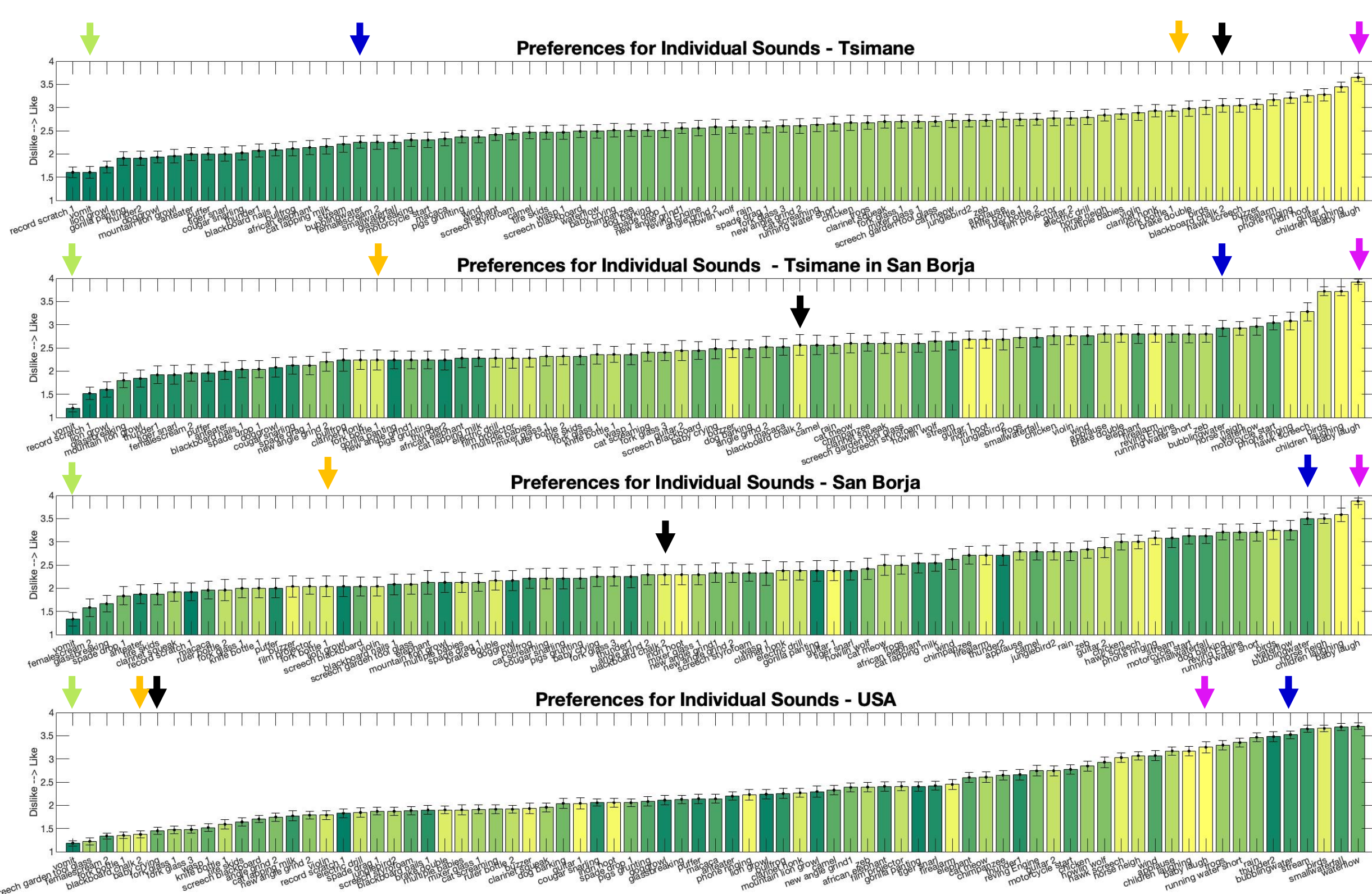


**Genetics?** → Differences between Tsimane' and Tsimane' who have moved into San Borja suggest that preferences are not genetically driven

**People interpret the sounds differently** → When asked to identify sounds, participants from Bolivia and the USA give similar responses



## Preferences for Environmental Sounds vary widely...

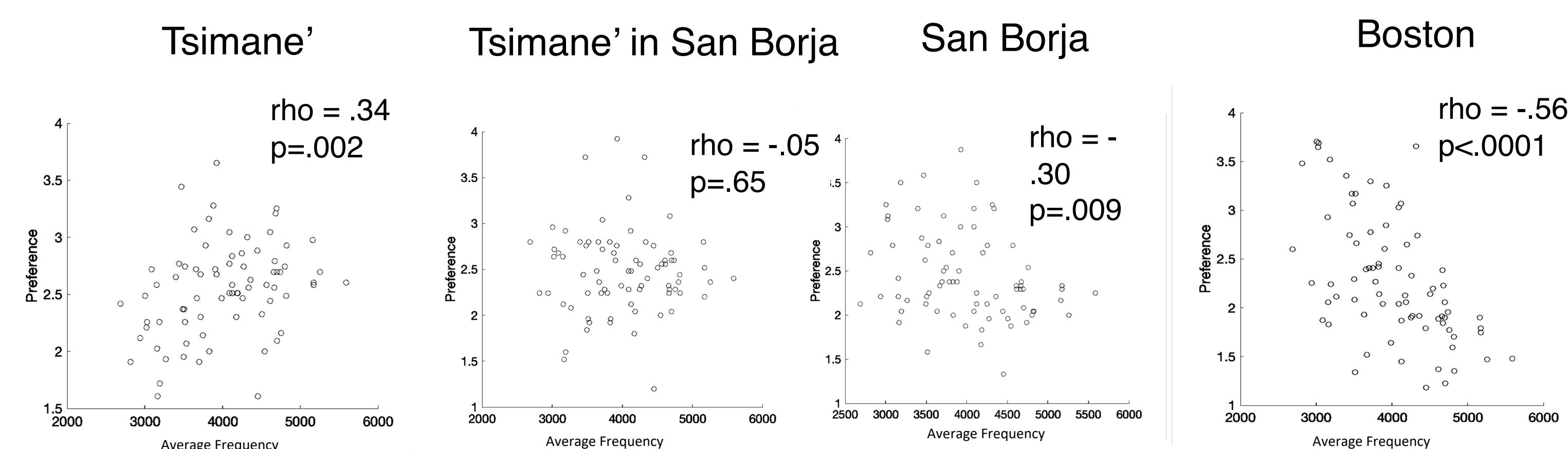


Color legend from Tsimane' held constant for other groups

- Some preferences are shared:
- Vomit
  - Baby Laughter
- Some preferences are not shared:
- Bubbling Water
  - Chalk on Blackboard
  - Fork Scratching Bottle

## ...but can be partially explained by different preferences for pitch height

Post-Hoc Analysis: Correlation between preference ratings and average frequency content for individual sounds



Data from all groups had split-half reliability of at least  $\rho = .72$

- While Tsimane' participants prefer low to high sounds, we observed the opposite pattern in San Borja and Boston

## References

- Halpern, D. Lynn, Randolph Blake, and James Hillenbrand. "Psychoacoustics of a chilling sound." *Perception & Psychophysics* 39 (1986).
- McDermott, Josh H., et al. "Indifference to dissonance in native Amazonians reveals cultural variation in music perception." *Nature* 535.7613 (2016).
- McPherson, Malinda J., et al. "Perceptual fusion of musical notes by native Amazonians suggests universal representations of musical intervals." *Nature communications* 11.1 (2020).