The intensity of prior stimuli affects subjective ratings of loudness (Dange et al., 1993). However, prior ERP research with adults suggests responses to sounds of varying intensity are not modulated by intensity of prior stimuli (Ninomiya et al., 2000). The present study aims to use intensity-dependent auditory ERPs from typically-developing children enrolled in the Autism Phenome Project (APP) at the UC Davis MIND Institute to explore whether intensity adaptation effects can be observed in a larger sample of young children.

## RESULTS

### 50 DB

- **Figure 2**: Raw (not difference) P1 waveforms over each hemisphere evoked by 50 dB stimulus preceded by either 60 dB (green), 70 dB (orange), or 80 dB (red) stimulus.
- **Figure 3**: Differences by hemisphere between P1 responses evoked by 50 dB stimulus following each prior stimulus intensity and an overall 50 dB average.
- **Figure 4**: Topographies of differences between P1 responses evoked by 50 dB stimulus following each prior stimulus intensity and an overall 50 dB average.

There was a main effect of prior stimulus intensity on responses to 50 dB tones, F(2,160) = 4.23, p = .02. P1 responses to 50 dB tones were significantly larger after 60 dB than 70 dB tones, F(1,80) = 6.04, corrected p = .05. P1 responses to 50 dB tones were significantly larger after 60 dB than 80 dB tones, F(1,80) = 5.42, corrected p = .05.

However, P1 responses to 50 dB tones following 70 and 80 dB tones did not differ, F(1,80) = 0.08, p = .77.

### 60 DB

- **Figure 5**: Raw (not difference) P1 waveforms over each hemisphere evoked by 60 dB stimulus preceded by either 50 dB (blue), 70 dB (orange), or 80 dB (red) stimulus.
- **Figure 6**: Differences by hemisphere between P1 responses evoked by 60 dB stimulus following each prior stimulus intensity and an overall 60 dB average.
- **Figure 7**: Topographies of differences between P1 responses evoked by 60 dB stimulus following each prior stimulus intensity and an overall 60 dB average.

There was an interaction among prior stimulus intensity and hemisphere, F(2,160) = 4.17, p = .02. Responses were significantly modulated by preceding stimulus intensity over the left hemisphere, F(2,160) = 3.81, corrected p < .05, but not the right hemisphere, F(2,160) = 2.49, p = .09.

Left hemisphere responses after 50 dB trended towards being smaller than after 70 dB, t(80) = −2.54, corrected p = .08. Left hemisphere responses after 50 dB trended towards being smaller than after 80 dB, t(80) = −2.37, corrected p = .10.

### 70 DB

- **Figure 8**: Raw (not difference) P1 waveforms over each hemisphere evoked by 70 dB stimulus preceded by either 50 dB (blue), 60 dB (orange), or 80 dB (red) stimulus.
- **Figure 9**: Differences by hemisphere between P1 responses evoked by 70 dB stimulus following each prior stimulus intensity and an overall 70 dB average.
- **Figure 10**: Topographies of differences between P1 responses evoked by 70 dB stimulus following each prior stimulus intensity and an overall 70 dB average.

There was a main effect of prior stimulus intensity on responses to 70 dB tones, F(2,160) = 6.20, p = .02. P1 responses to 70 dB tones were significantly larger after 60 dB than 80 dB tones, F(1,80) = 5.85, corrected p = .05.

However, P1 responses to 70 dB tones following 60 and 80 dB sounds did not differ, F(1,80) = 0.06, p = .94.

### 80 DB

- **Figure 11**: Raw (not difference) P1 waveforms over each hemisphere evoked by 80 dB stimulus preceded by either 50 dB (blue), 60 dB (orange), or 70 dB (red) stimulus.
- **Figure 12**: Differences by hemisphere between P1 responses evoked by 80 dB stimulus following each prior stimulus intensity and an overall 80 dB average.
- **Figure 13**: Topographies of differences between P1 responses evoked by 80 dB stimulus following each prior stimulus intensity and an overall 80 dB average.

There was a main effect of prior stimulus intensity on responses to 80 dB tones, F(2,160) = 0.63, p = .54. No interaction of preceding stimulus loudness and hemisphere, F(2,160) = 0.06, p = .94.

No main effect of preceding stimulus loudness, F(2,160) = 0.82, p = .44. No interaction of preceding stimulus loudness and hemisphere, F(2,160) = 0.57, p = .57.

## DISCUSSION

The present study suggests neural responses, not just subjective loudness estimates, are shaped by the context offered by prior stimuli of varying intensity.

Prior stimulus intensity appeared to impact responses to low-intensity sounds (50 dB, 60 dB), whereas high-intensity sounds appeared relatively unaffected by this context.

Neural refractoriness, or adaptation to high-intensity sounds, may account for weaker responses to 50 dB stimuli after 70 dB or 80 dB sounds, relative to 60 dB sounds.

However, over the left hemisphere, responses to 60 dB sounds strongly trended towards being stronger when they followed 70 dB or 80 dB sounds, relative to 50 dB sounds—an effectively opposite pattern.

The mechanism of this opposing effect is unclear, but might reflect attention capture by 80 dB sounds.

It is also possible that lingering cortical excitability following high intensity stimuli might differentially interact with subsequent low-intensity 50 dB and 60 dB inputs.

Further research is required to replicate findings in various age groups and to clarify mechanisms.

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