# Mechanisms of Contextual Plasticity in Sound Localization

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### Intro: Contextual Plasticity



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Contextual plasticity: no-distractor bias in Front Dist run – no-distractor bias in Lat Dist run

Mechanism?

**Factors?** 



Kopco et al. (2007)

### Intro: Contextual Plasticity

Contextual plasticity (CP): no-distractor bias in Front dist run – no-distractor bias Lat dist run

#### **Mechanism? Factors?**

- independent of azimuth
- in anech and reverb rooms
- grows on timescale of seconds to minutes
- (- no baseline)





## Non-auditory factors (Kopco, 2015)

Measure baseline – no-distractor runs

Exp 1:

compare responses with/without vision, with/without sensory-motor transformation

Exp 2:

compare performance when contextual task is difficult (short SOA) and easy (large SOA, target preceding distractor)

## Vision, motor ctrl, top-down factors



Target-only baseline run:
performance depends on vision and sensory-motor transformation

CP:

- Independent of vision, sensory-motor tr, task difficulty
- Strongest near distractor
- Even when targ precedes dist

Kopco et al. (2015)

## Temporal factors (Hladek, 2017)

Exp 1:

manipulate SOA and context presentation rate independently

#### Exp 2:

replace 1-click distractor by 8-click distractor (increase in context presentation rate) or by noise (to eliminate distractor-target similarity)

#### 1-click vs. 8-click vs. noise distr.







- Independent of SOA on context trials
- grows slightly with context rate 75% vs. 50%
- grows dramatically with 8-click distractors
- (almost) no effect for noise with equal energy

Hladek et al. (2017)

#### Buildup in Hladek et al. (2017)



Buildup:

- fast with 1-click dist
- Equally fast (slope at onset), but continues to grow longer with 8-click dist

#### Front & Lat dist, 1-cl & 8-cl dist mix



#### Front & Lat dist, 1-cl & 8-cl dist mix

Front-Dist and Lat-Dist data at higher temporal resolution

Buildup:Exclusively for the Lat Dist



# Summary

#### **Contextual plasticity**

- Depends on spatiotemporal density of distr. stimuli
- Is sensitive to similarity between stimuli

#### **CP Buildup**

- longer for lat. distr. than front distr.
- longer for 8-click than 1-click distr.
   → For lat 8-click dist, build-up continues after 5 mins

#### Possible mechanisms:

- low-level distribution-sensitive adaptation (Dahmen et al., 2010)
- precedence-buildup-like mechanism (Djelani and Blauert, 2001; Freyman et al., 1991)
- high-level factors like streaming or expectation (Boehnke and Phillips, 2005; Shamma et al., 2011; Weintraub et al., 2014)

#### Lab and collaborators



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## Current projects and workshop

## Adaptation, learning and training for spatial hearing in complex environments (Marie Curie, H2020)

-Collaborators Boston University (Barb Shinn-Cunningham, Gin Best), Harvard Medical School/MGH (Jyrki Ahvenien), UC Riverside (Aaron Seitz), VA Portland/OHSU (Erick Gallun), Austrian Academy of Science (Piotr Majdak, Bernhard Laback)

#### -PhD/postdoc position

-Workshop #4 May 2019

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