Drivers of Incidental Category Learning

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Introduction

Incidental category learning

- Incidental tasks are neither passive, nor entirely unsupervised or feedback free (Gabay et al., 2015; Lim & Holt, 2011; Seitz & Watanabe, 2009; Vlahou et al., 2012)
- Sound categories are learned by virtue of their relationship to success in performing a task defined along other, largely visuomotor, dimensions
  - Does not involve overt category decisions or explicit feedback about categorization
- Incidental tasks capture some of the incidental nature of category learning in more natural environments

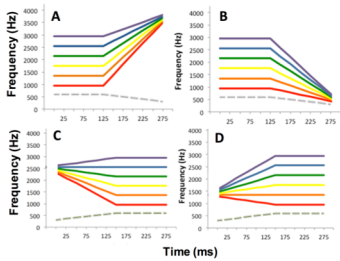
An example: the SMART task

- Systematic Multimodal Association Reaction Time (SMART) task (Gabay, Dick, Zevin, & Holt, 2015)
- Simple task in which participants rapidly detect a visual target and report its location with a keypress.
- A brief sequence of sounds precedes the visual target.
- Unknown to participants, the sounds are drawn from one of four distinct sound categories
- Multimodal correspondence from auditory-category to visual-location relates variable sound category exemplars to a consistent visual location

What drives incidental auditory category learning?

- In the current study, we explored two possible drivers of incidental learning
  - Sound category-to-location correspondence (Experiment 1)
  - Association of the sound categories with distinct response alternatives (Experiment 2)

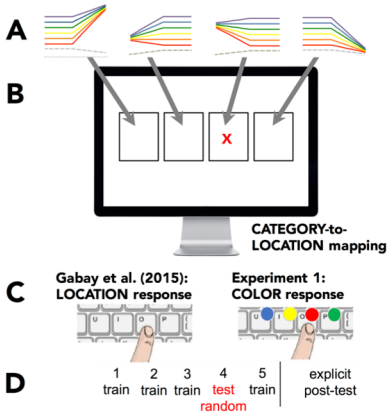
Auditory Categories



Auditory Categories. Each higher-frequency (colored) component is paired with the lower-frequency (grey) component to create 6 category exemplars for training. The 5 generalization exemplars are not pictured (from Wade & Holt, 2005).

Training Paradigms

Experiment 1



Overview of SMART Paradigm

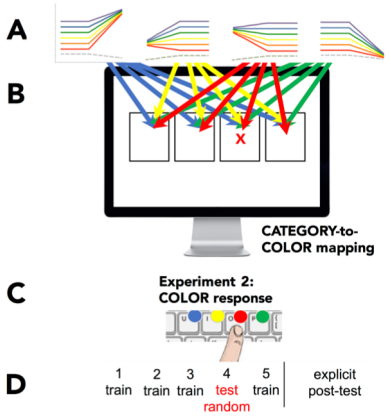
(A) Four auditory categories are defined by multiple exemplars.

(B) As in Gabay et al. (2015), each category is ***associated with a particular visual target location***.

(C) In Gabay et al. (2015), participants indicated the target location with a key press. In Experiment 1, participants indicate ***target color*** with a keypress. Target color does not predict category membership.

(D) Blocks include a Test Block in which the category-to-location association is destroyed, and an overt labeling post-test follows SMART training.

Experiment 2



Paradigm, Experiment 2

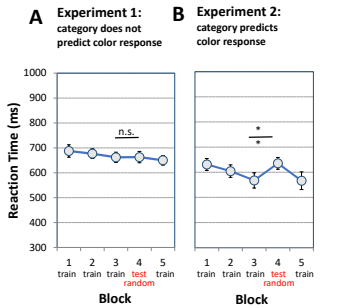
(A) Four auditory categories as in Gabay et al. (2015).

(B) Here, each category is ***associated with a particular visual target color*** (blue, yellow, red, green) appearing equally often at each location.

(C) In Experiment 2, participants ***indicate target color***.

(D) Training and testing as in Experiment 1.

Results



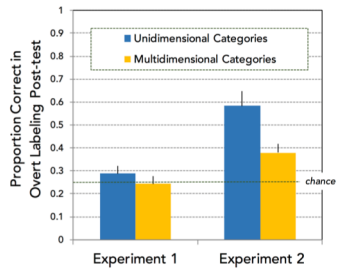
Target Detection RT in SMART

Incidental sound category learning is evident in online learning as RT Cost.

$$\text{RT Cost} = RT_{\text{Block 4}} - RT_{\text{Block 3}}$$

(A) Experiment 1, no RT Cost
($t(23) = 0.13$, $p = .90$, $M = 0.7$ ms)

(B) Experiment 2, RT Cost
($t(20) = 2.66$, $p = .015$, $M = 58.1$ ms)



Mean accuracy in the overt labeling post-test

(A) Experiment 1 performance was no different from chance
($t(23) = .53$, $p = .60$)

(B) Experiment 2 performance was above chance
($t(20) = 4.42$, $p = .00026$)

Error bars are standard error of the mean.

Conclusions

- Participants can *incidentally* learn perceptual categories as they undertake seemingly unrelated tasks, if the task demands of the primary task align with the structure of the categories
- When behavioral responses were decoupled from category-to-location association experienced in the primary visual detection task (Experiment 1), there was no learning. Reinstating this coupling by introducing category-to-color association and requiring color responses (Experiment 2) led to learning.

References & Acknowledgments

References

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Acknowledgements

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