

SIMON SOUNDS: a new paradigm for studying auditory categories

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INTRODUCTION

- In the area of cognition, the process of categorization is extremely important
- Categorization : treating discriminably different items as equivalent.
- Having categories helps minimize the cognitive load by preprocessing information in the environment
- Most categorization research has been conducted in the visual domain. Very little is known about categorization in audition.
- In the auditory domain, formation of sound categories is imperative to understanding speech
- Across domains, most categorization studies examine learning with feedback.
 - YES/NO tasks or "This or That" category
- Learning with feedback (explicit learning) is not much like real-world categorization
- Infants learn categories of native language sounds without explicit instruction

GOAL

The goal of this project was to develop a new auditory learning environment that provides less explicit feedback and allows investigation of categorical learning of sound categories.

"SIMON SOUNDS"

1

EQUIPMENT

An off the shelf Hasbro "Simon 2" game device adapted to interface via serial cable with sound perception computer hardware



2

BASIC SIMON GAME

The object of the game is to correctly repeat longer and longer sequences of signals. A 'signal' consists of a flashing color lens with a simultaneously presented sound.

Game Play

- SIMON will give the first signal (light and sound)
- The player must repeat what SIMON played by pressing the appropriate color lens
- SIMON will duplicate the first signal and add one
- The player duplicates these two signals, in order
- The game continues until the player makes an error in duplicating the SIMON sequence

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ADAPTATION FOR RESEARCH

The basic game of SIMON associates one sound with each color lens.

To expand the SIMON game to accommodate categorization experiments, a SIMON SOUNDS program was created to interface with the SIMON device. Through this program, each color lens may be associated with a category of sounds consisting of any number of exemplars.

- Each color lens can play a variety of predetermined sounds, enabling each area to be coded as separate category
- SIMON is scalable from 2 to 4 categories, with any number of stimuli per category
- Number of stimuli presented is controlled to give participants equivalent exposure

EXPERIMENT

GOAL

To demonstrate that players learn the association between colored lenses and sounds through play with the adapted SIMON game.

STIMULI

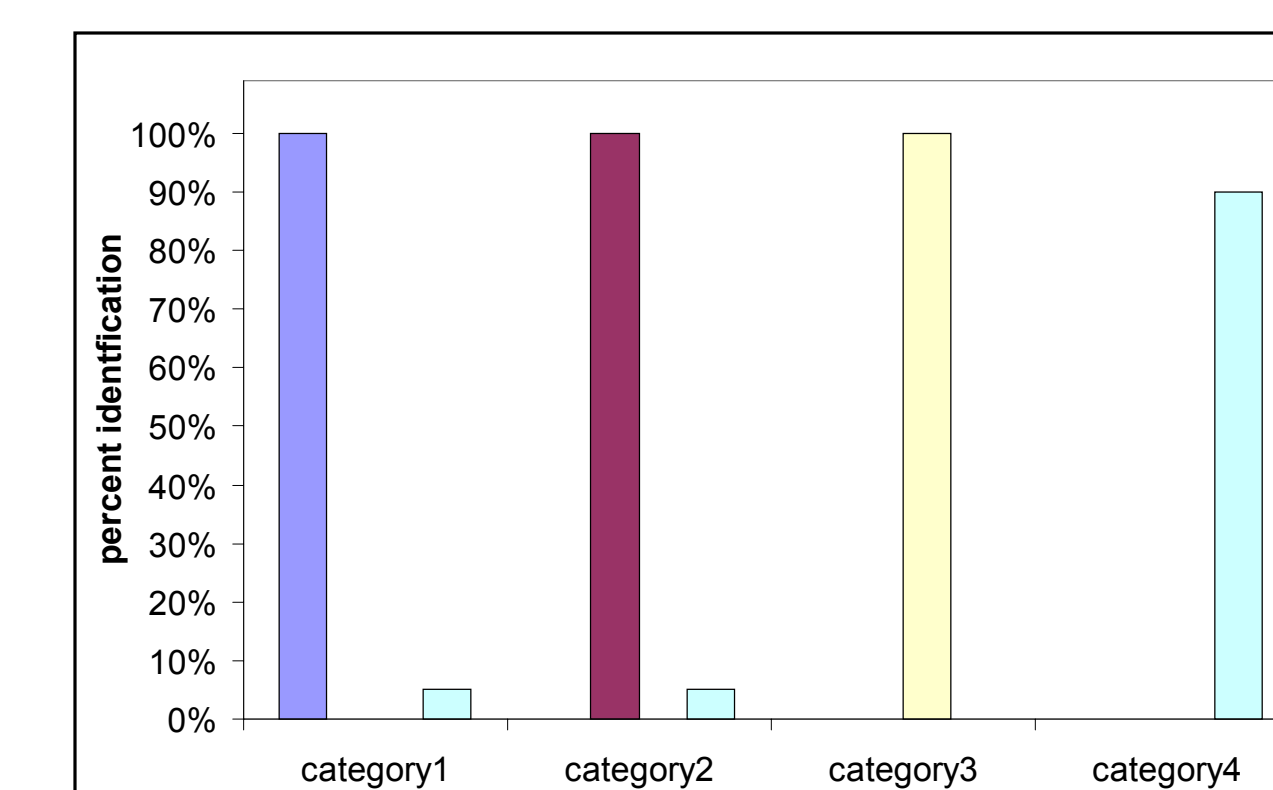
Four distinct sounds synthesized with sound development software.

METHOD

1 - EXPOSURE

Participants play SIMON for 1 hour. During this time they play 70 games of SIMON.

2 - CATEGORIZATION TEST



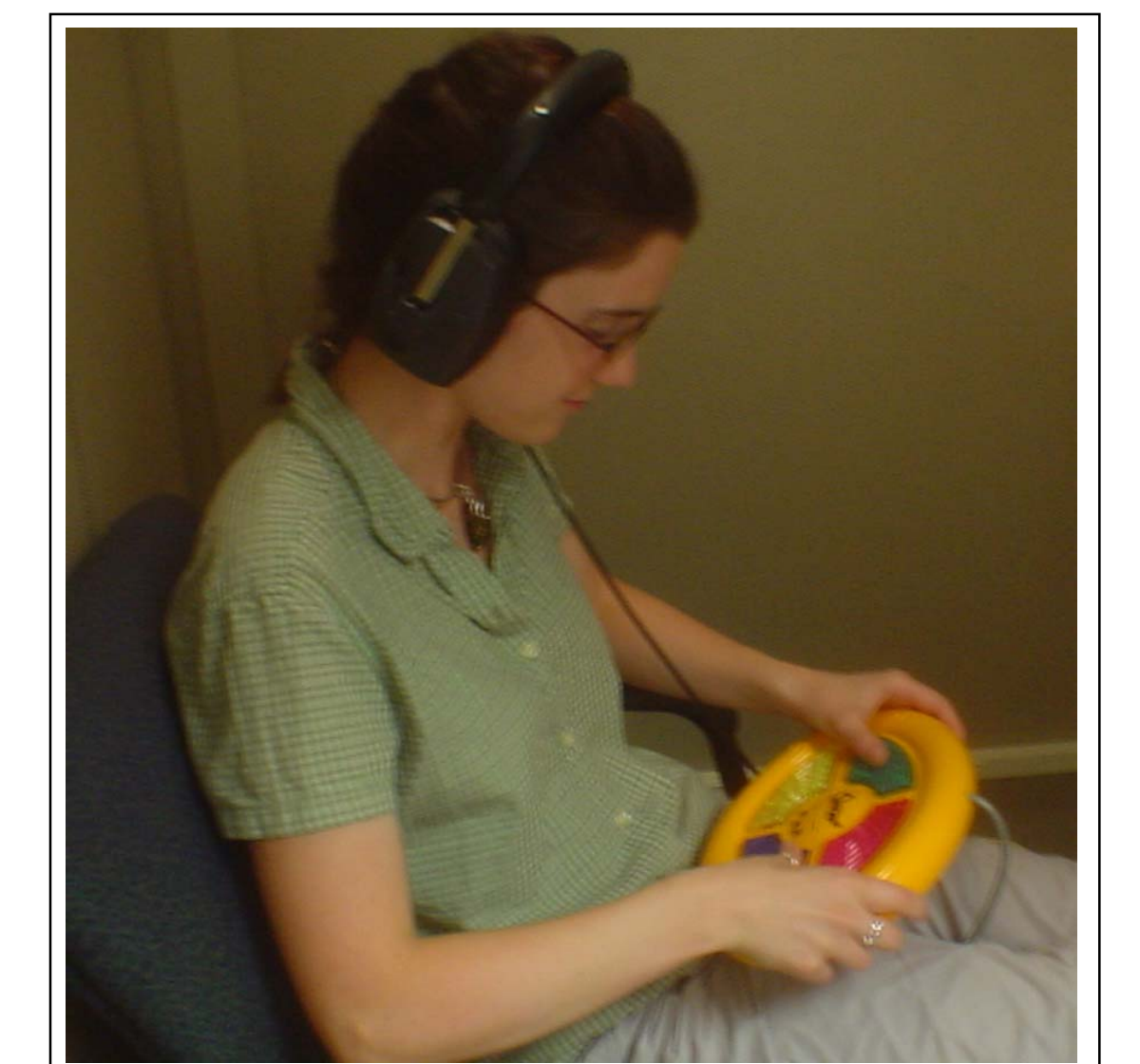
After play, participants are tested on the degree to which they mapped the sounds presented during play to the associated color lens. One stimulus is presented at a time. Participants' task was to press the color lens that best fits with the sound.

RESULTS

Participants were reliably able to map the sound stimuli to the color lens after exposure while playing SIMON. All of the category comparisons are significantly different from chance performance (25%) by $p < 0.0001$.

CONCLUSION

In the simple case of pairing one sound with each lens, participants readily learn the associations among buttons and sounds during the course of game play.



NEXT STEP

To examine whether players learn auditory categories composed of multiple exemplars in the course of playing SIMON. Each color lens will be associated with a distribution of sounds. Each distribution will have acoustic characteristics unique from the other categories, but exemplars within the category will vary. The goal will be to examine whether listeners learn these categories in the course of SIMON play. If they do, SIMON will provide a means of investigating a number of issues in learning complex auditory categories.