Learning in a multisensory world



Dr Hannah Broadbent <u>Hannah.Broadbent@rhul.ac.uk</u> Royal Holloway, University of London











ROYAL HOLLOWAY UNIVERSITY OF LONDON

Learning in a multisensory classroom

- Formal learning occurs in dynamic multisensory environments
- Numerous educational programmes advocate using multisensory information







Development of multisensory integration

- Multisensory information supports perception in infants and learning in adults (e.g., Bahrick et al., 2002; Shams & Seitz, 2008)
- Multisensory supports children's learning: e.g., reading and numerosity (Jordan & Baker, 2011; Joshi et al., 2002)
- However, development of multisensory integration until at least 8 to 10 years of age (Gori et al., 2008; Nardini et al., 2008)





Multisensory learning research

- Multisensory studies typically at level of perception
 - In the classroom, multisensory cues may not even be presented synchronously
- Typically use explicit learning tasks
 - What about incidental learning?
- Is multisensory information always supportive of learning?
 - Consider developmental changes in attention, inhibitory control, cognitive flexibility etc





- 1. How does the use of complimentary multisensory information effect incidental learning across childhood?
- 2. Can this improve retention of learning?
- 3. What are the effects of multisensory concurrent tasks on learning?
- 4. Is it just that having more information is better?







1. How does the use of complimentary multisensory information effect incidental learning across childhood?

2. Can this improve retention of learning?

3. What are the effects of multisensory concurrent tasks on learning?

4. Is it just that having more information is better?







`Catch the frog' (MALT: Multisensory Attention Learning Task)

N= 181 children (5 to 10 year-olds)





Once caught, target travels to habitat in net, depending on the condition (V, A, AV)

The animals....













Results in brief...

- Reliable benefit to learning using multisensory stimuli between 6 and 10 years of age.
- This benefit increases through the early primary school years
- Improvement with age in learning from AV and A information
- Younger children poor with auditory-only info



Broadbent et al (2017) Developmental Science

1. How does the use of complimentary multisensory information effect incidental learning across childhood?

2. Can this improve retention of learning?

3. What are the effects of multisensory concurrent tasks on learning?

4. Is it just that having more information is better?







Retention of multisensory learning

Same task (N= 180, 5- to 9-year-olds)

24 hours later...

- AT FIRST GLANCE Only multisensory information leads to better-than-chance learning
- **BUT** lots of children (especially given only A or V info) remembered there were two different categories but not where they lived
- **SO**... multisensory info does not only lead to better retention of category boundaries but also category labels







1. How does the use of complimentary multisensory information effect incidental learning across childhood?

2. Can this improve retention of learning?

3. What are the effects of multisensory concurrent tasks on learning?

4. Is it just that having more information is better?







Multisensory concurrent task

N = 180 children (6, 8, 10 years)



Frogs and stars: Results



18.0 16.0 Mean Category Test Correct 14.0 12.0 **—**A 10.0 8.0 -AV 6.0 4.02.0 0.0 6 years 8 years 10 years

6 years < 8 and 10 years

All groups still perform well on category learning task

Except: 6 year-olds with Auditory concurrent task

> Auditory distracting?

V

Switching difficulties?

Α

1. How does the use of complimentary multisensory information effect incidental learning across childhood?

2. Can this improve retention of learning?

3. What are the effects of multisensory concurrent tasks on learning?

4.Is it just that having more information is better?







Is more information better?

Two Visual (Spots and lines) Two Auditory (croaks and bubbles)

Family 1



Family 1

())

Family 2

((<





Is more information better?

N= 273 children (6, 8, and 10 years) + MALT study (N=181)



6 years < 8 and 10 years

AV > all unisensory VV > all unisensory AA not significantly different from unisensory

5 year-olds at chance for AA and unisensory

Summary

- Combination of visual and auditory information enhances category learning for children aged 5 to 10 years and also improves retention of learning.
- Relative difficulty in the use of auditory information to support category learning in 5-year-olds, unless combined with complementary visual information.
- Auditory more distracting to 5 year-olds
 - Difficulty in switching between different sensory modalities in younger children?

Summary

- Multisensory information may not be more beneficial to younger children when information from a single sense (e.g., visual) is dominant.
- Two pieces of information in one sensory modality also enhances learning more than having just one piece of sensory information.
 - Especially in young children (5 years) compared to Auditory cues

Further questions:

- Is multisensory ever more beneficial to learning than multi-cues?
- What about other sensory modalities combinations, e.g., visuotactile?

Thank you!

To you for listening!

Participating Primary Schools

All our participants

Economic and Social Research Council (ESRC)





Collaborators

Multisensory lab group







Denis Mareschal

Natasha Kirkham

Leslie Tucker



Hayley White

Tamsin Osborne



Anna Peng



Retention of multisensory learning



Visuotactile learning

