# A Comparative Analysis of Imitation and Emulation Tasks and the Identification of Co-requisites for Emulation

Grant Gautreaux, Natalie Leow-Dyke, Tricia Clement, Paula White, Lori Scott, Derek Shanman, Angela Moran, Angelle St. Pierre, Heather Allemond, Bobbi Freeman

# Accounting for untaught behavior

- Stimulus equivalence
- Naming
- RFT
- Observational Learning
- Mapping

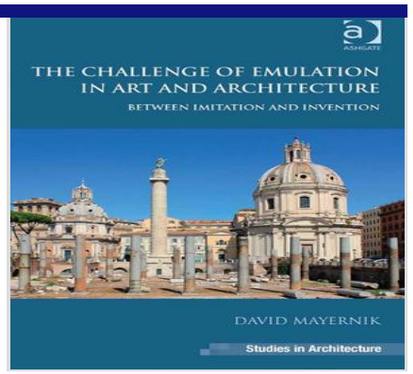
# Emulation in the real world

# Emulation in the literature

- Confused with other phenomenon
- not directly addressed within BA literature
- some direct references in the animal literature (Bryne & Russon; Horner & Whiten, 2005; Tennie, et al., 2006; Zentall, 1996)
- problem with including observing the model (Bryne & Russon; Horner & Whiten, 2005; Tennie, et al., 2006; Zentall, 1996; Greer & Speckman, 2009)
- is discussed across a myriad of disciplines

# The Challenge of Emulation in Art and Architecture

## Between Imitation and Invention




By **David Mayernik (/products/search?author=David Mayernik)**



296 pages

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## About the Book

Emulation is a challenging middle ground between imitation and invention. The idea of rivaling by means of imitation, as old as the Aenead and as modern as Michelangelo, fit neither the pessimistic deference of the neoclassicists nor the revolutionary spirit of the Romantics. Emulation thus disappeared along with the Renaissance humanist tradition, but it is slowly being recovered in the scholarship of Roman art. It remains to recover emulation for the Renaissance itself, and to revivify it for modern practice. Mayernik argues that it was the absence of a coherent understanding of emulation that fostered the fissuring of artistic production in the later eighteenth century into those devoted to copying the past and those interested in continual novelty, a situation solidified over the course of the nineteenth century and mostly taken for granted today. This book is a unique contribution to our understanding of the historical phenomenon of emulation, and perhaps more importantly a timely argument for its value to contemporary practice.

# Definitions of Emulation

- A) *creating something novel by observing a product and reproducing it (which can include vocal reproductions);*
- *B) obtaining a product through manipulating stimuli in the environment in a new manner.* (Rothstein, 2009)
- C) *The term 'emulation' is used when the goal, i.e., the function of a behavior is the focus rather than the topography Thus, emulation equates to imitation of an 'operant', rather than to topographical correspondence.* (Lindsay, C. J., Moore, D. W., Anderson, A., & Dillenburger, K., 2013)

matching, capacity for sameness, conditioned reinforcement for 2-d; 3-d stimuli, fluent motor skills

## Imitation

Targeted Bx Model
observing response(s)
point-to-point correspondence w/ physical motor behavior/or object manipulation
reinforcement for correspondence via model

## Generalized Imitation

Novel Bx modeled
Observing response(s)
point-to-point correspondence w/ physical motor behavior/or object manipulation
reinforcement is correspondence

## Emulation #1

Targeted Bx Model & Produces Product

observing response(s)

emits behavior that function to produce similar product

reinforcement is correspondence (may need to be mediated by model)

*(key: model emitted behavior which was observed; behavior of the emulator does not have be point-to-point correspondence with model)

likelihood of imitation greater than emulation

## Emulation #2

Final product in the environment

observing response(s)

emits behavior that function to produce similar product

reinforcement is correspondence (may need to be mediated by model)

*(key: is model is not present- there is no behavior to actually imitate or emulate only the product - similar only in functional or essential elements)

greater likelihood of emulation and problem solving

# Why study emulation?

- More independence
- Less prompting
- Addressing the need for functional life skills
- Allows for expansion of skills without direct teaching
- Experience with trial and error
- Problem solving

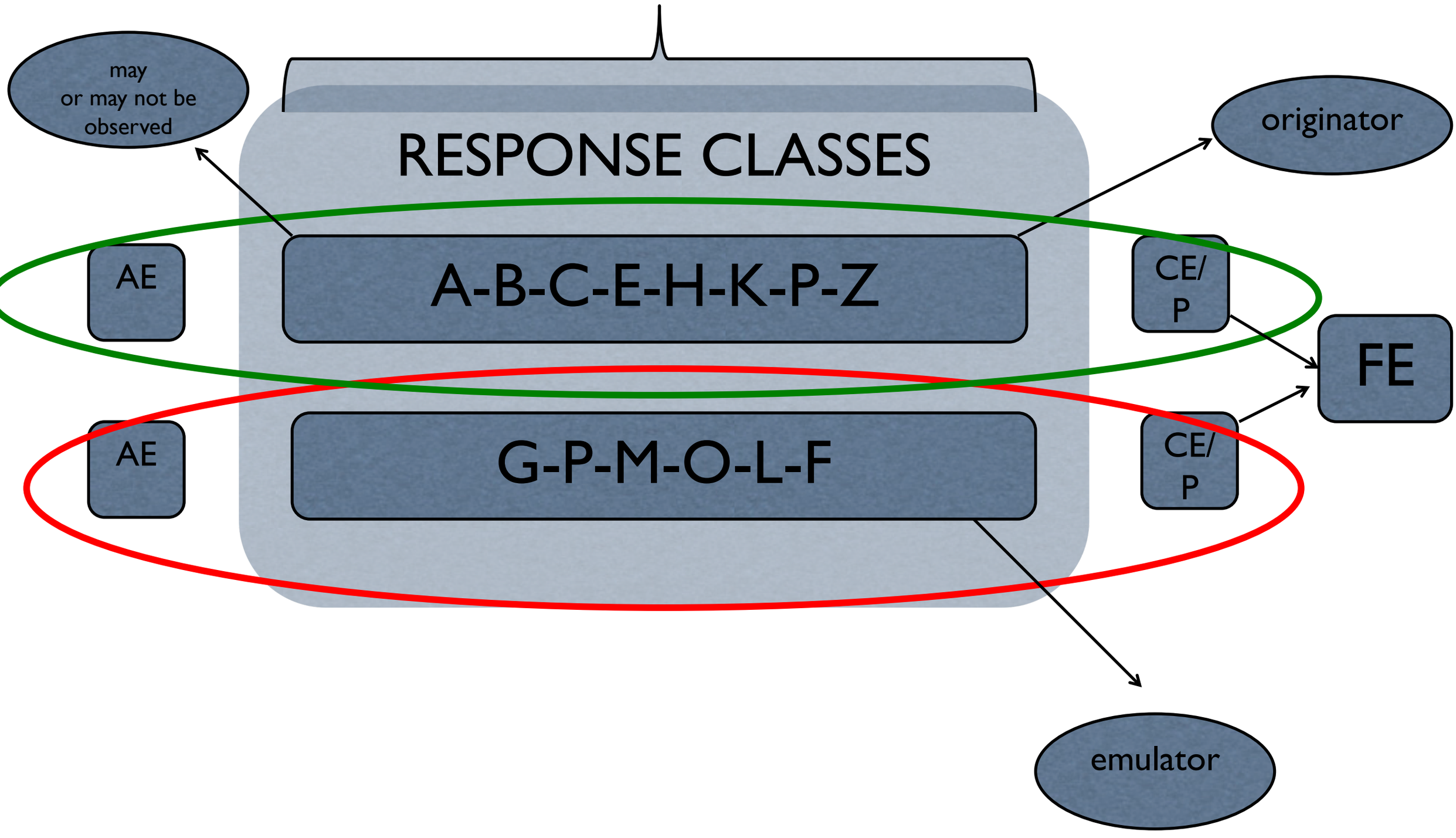
# Stimulus Control- Prompt dependency

- A: teacher direction; R: pupil behavior: C: teacher consequence
- Problem is…. We teach the pupil not to response to other aspects of the environment.
- After acquisition- pupil “appears” to be prompt dependent.
- Changes in programming: response size of the learn unit may subvert this.

# Research questions

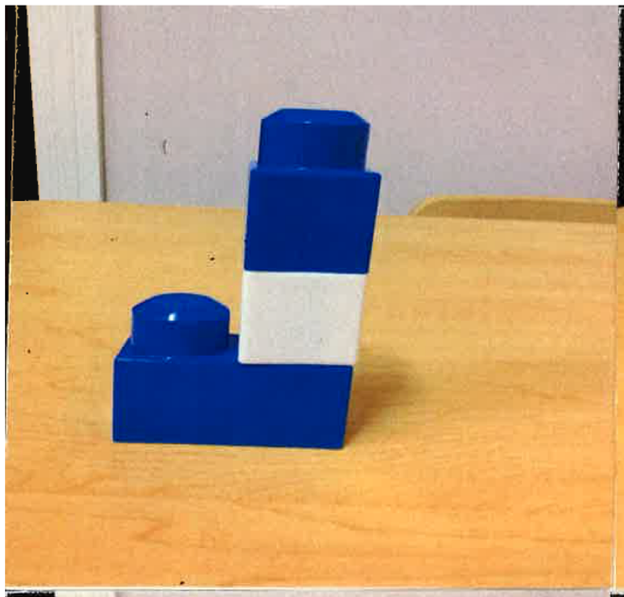
- Are there correlations between emulation and behavioral cusps/capabilities? (previous research on imitation focused on correlations with specific prerequisite skills)
- Do we need to change curricula/programming?
- Can we induce emulation?
- What is the stimulus control and source of reinforcement necessary for emulation?

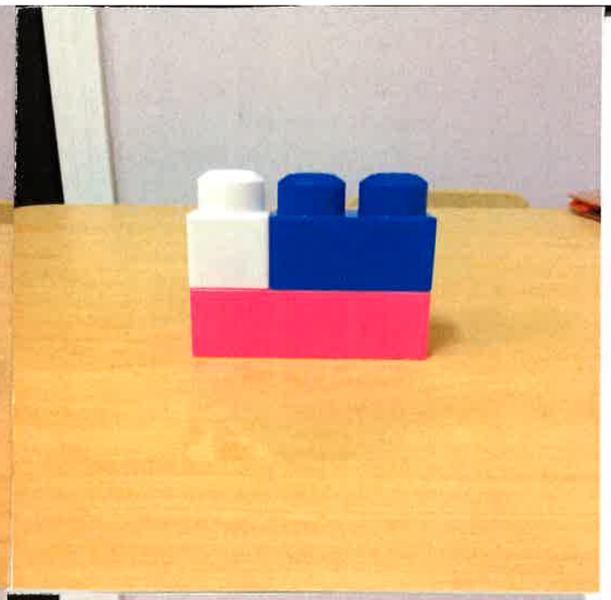
# Schematic of Emulation

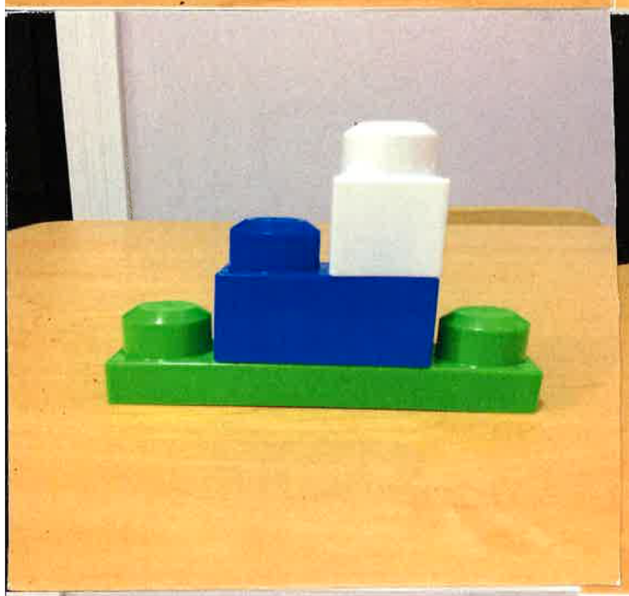


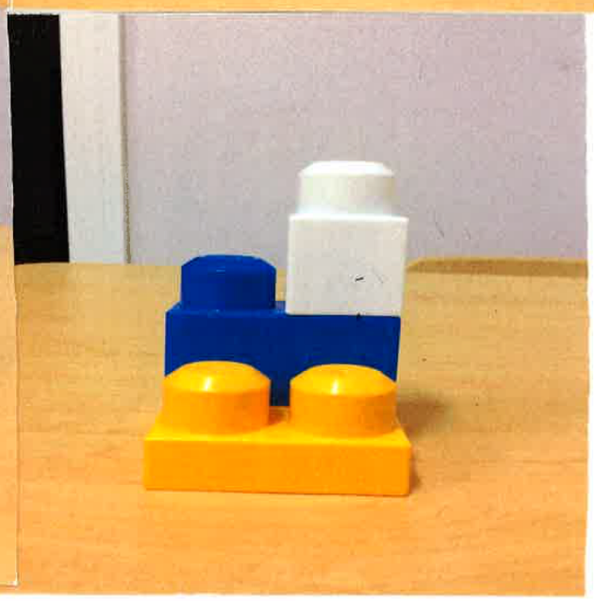
- Participants:
- 47 individuals diagnosed with autism.
- 8 females; 39 males.
- 3 to 13 years of age
- Receiving 20+ hours of ABA services weekly

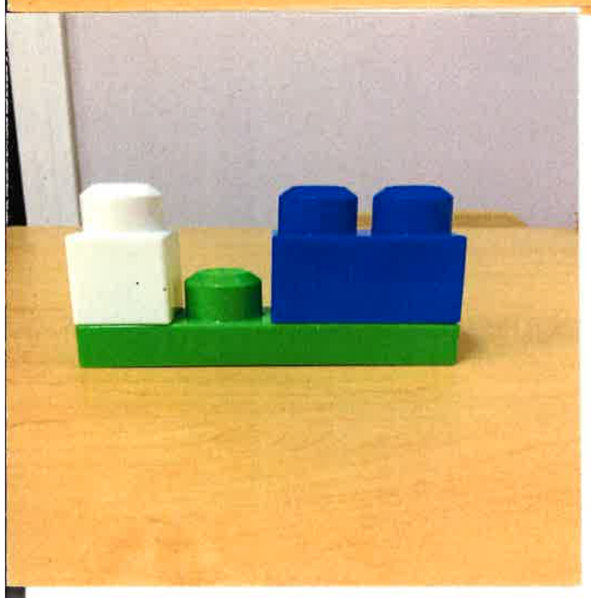
- Setting:
- 3 Locations of a Private ABA center providing CABAS based instruction
- 1:1 and 2:1 Staff-to-client ratios
- Participants have received services between 3 months and 2 years.
- Range of VB emergent speakers to early reader-writers



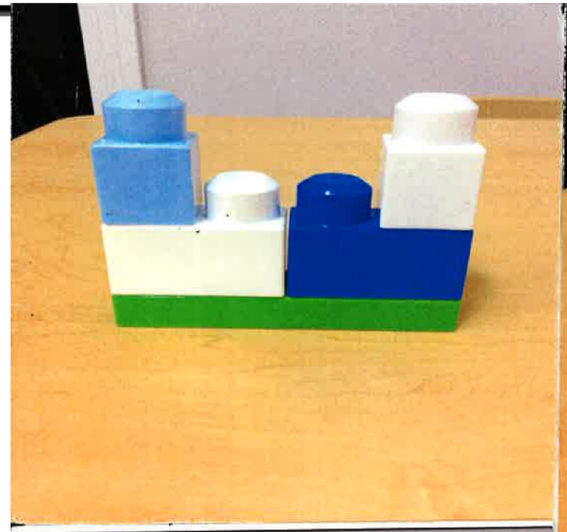


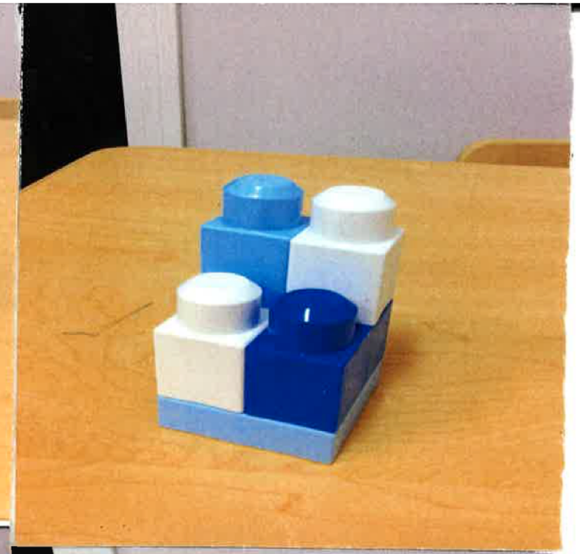


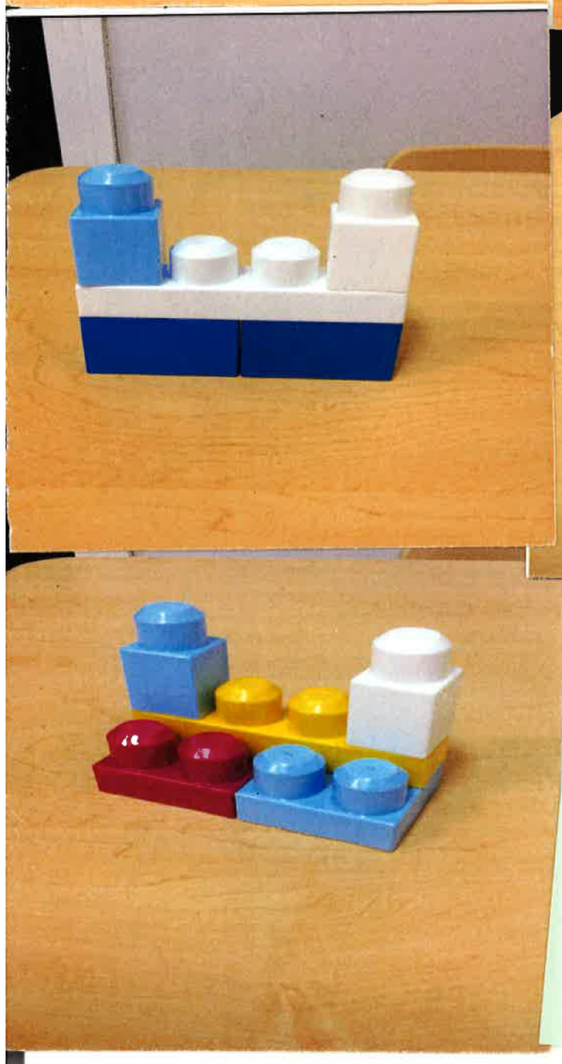




Imitation
Blocks
Basic (3 blocks)

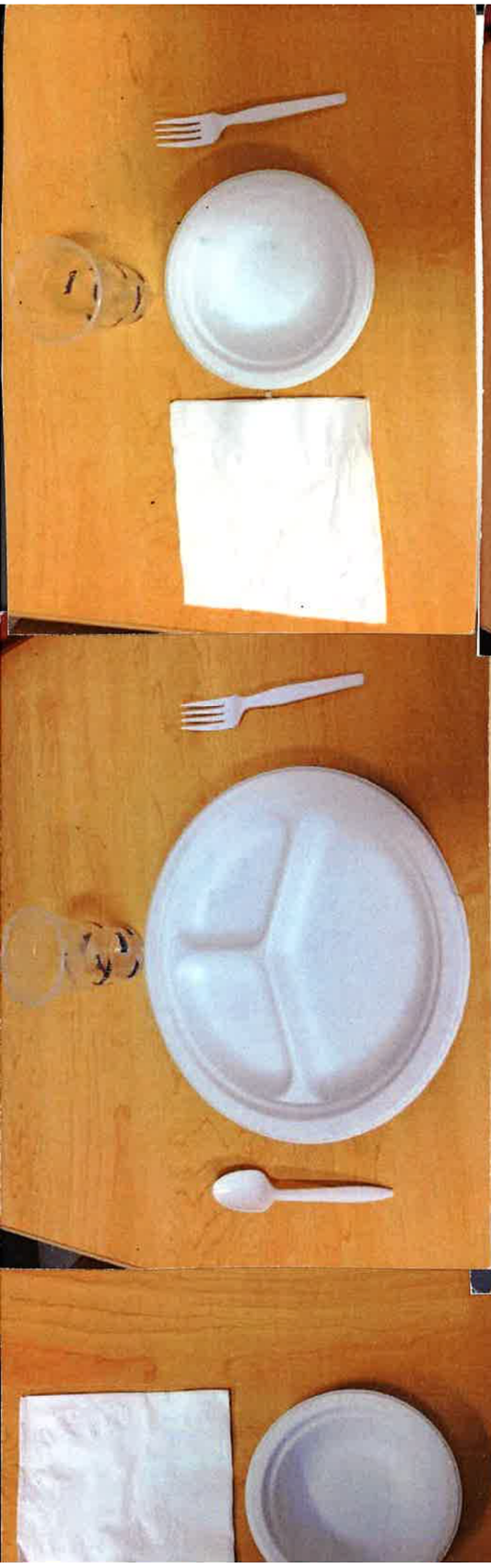








Imitation
Blocks
~~Basic (3 blocks)~~
Complex (5 blocks)





Imitation

Basic [redacted]

Table Setting

Imitation

[redacted]

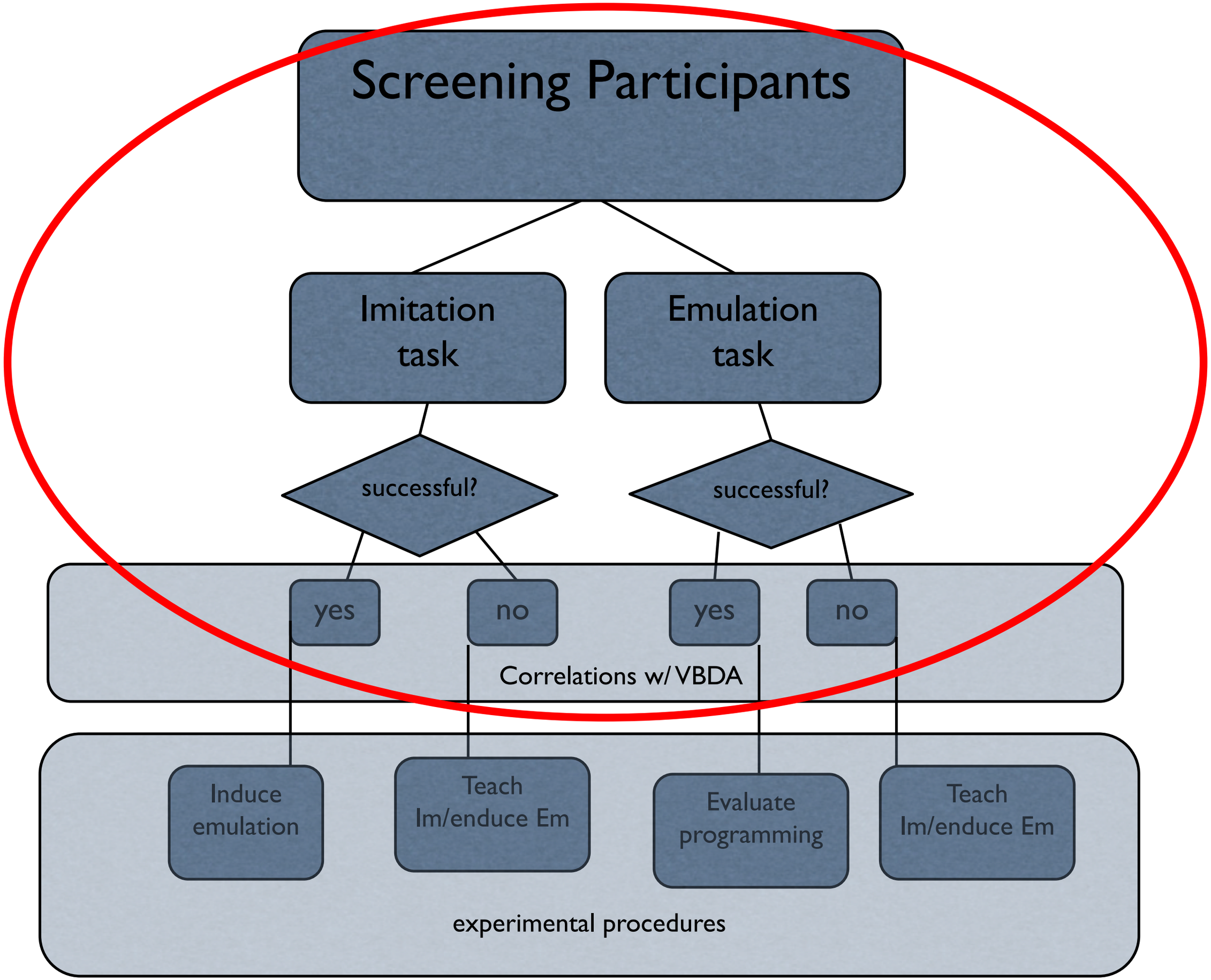
Table Setting (Complex)

# Test for imitation/emulation

- Imitation:
- A: present picture, “Make the structure in this picture, I will show you how”
- T: step 1; C: step 1; (reinforcement/correction), first error= (minus)
- Emulation:
- A: present picture, “Make the structure in this picture, do it on your own, get started”
- T: when indication pupil stopped, or 2 mins, “let’s see if it’s the same”, yes/no

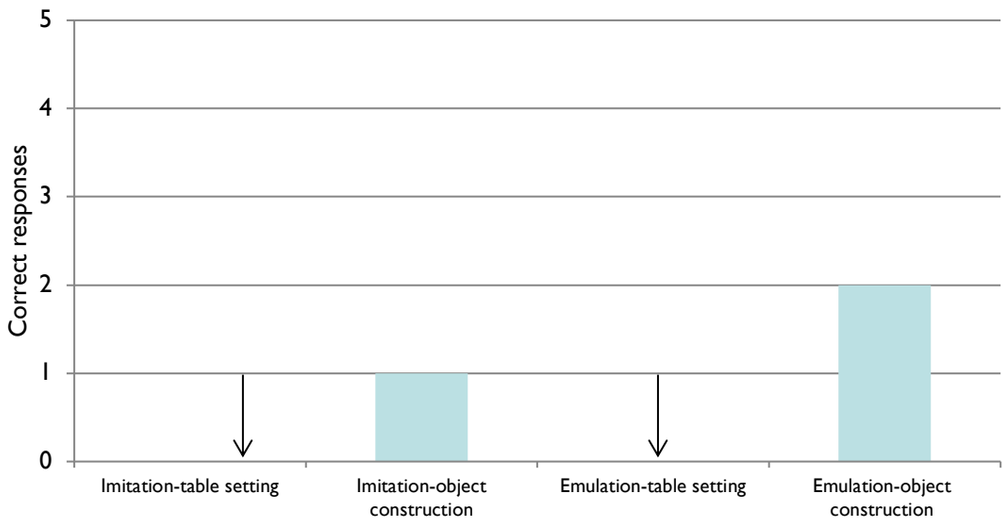
# Experimental procedures

- For this phase we only analyzed our screening results (test for imitation/emulation)
- Attempt to induce emulation currently in process
- Counter balanced Multiple baseline design across matched pairs

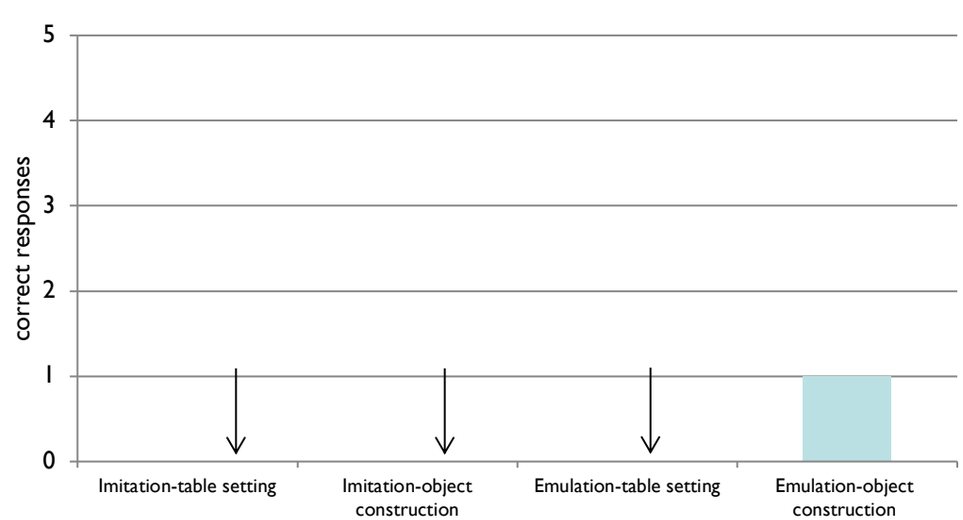

Screening Participants
Imitation task
Emulation task
successful?
successful?
yes
no
yes
no
Correlations w/ VBDA
Induce emulation
Teach Im/enduce Em
Evaluate programming
Teach Im/enduce Em
experimental procedures

# results

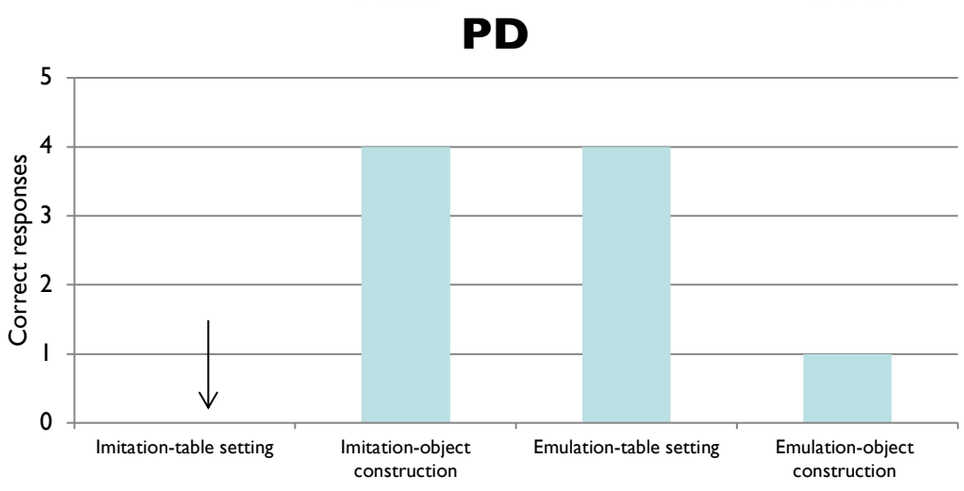
**CD**



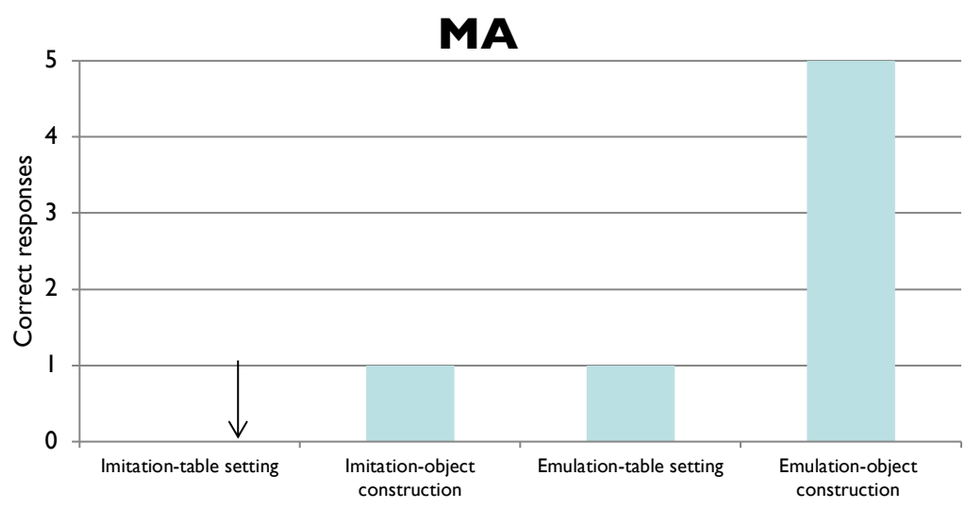

**HL**



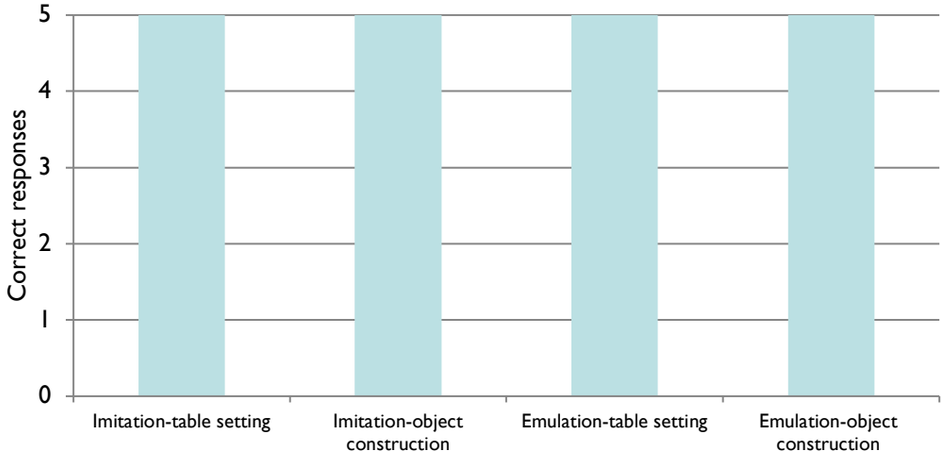

**PD**



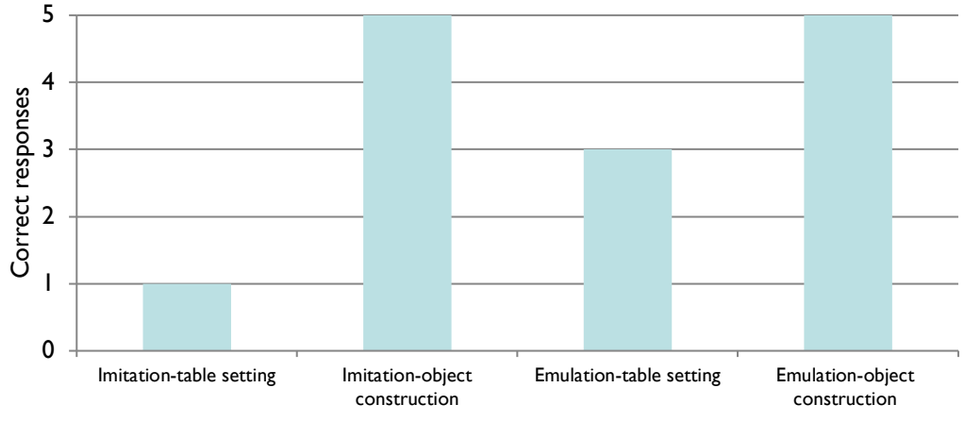

**MA**




**CH**

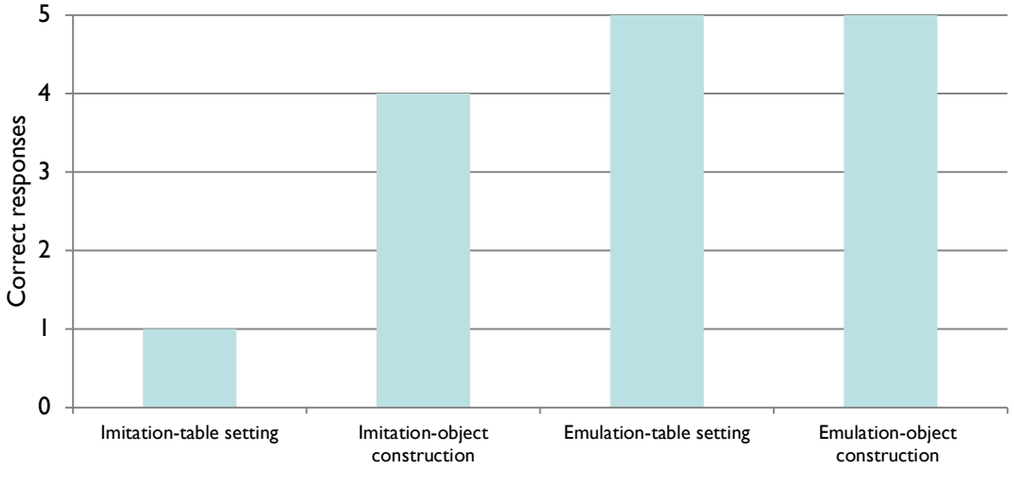



**DN**



# results

**BL**

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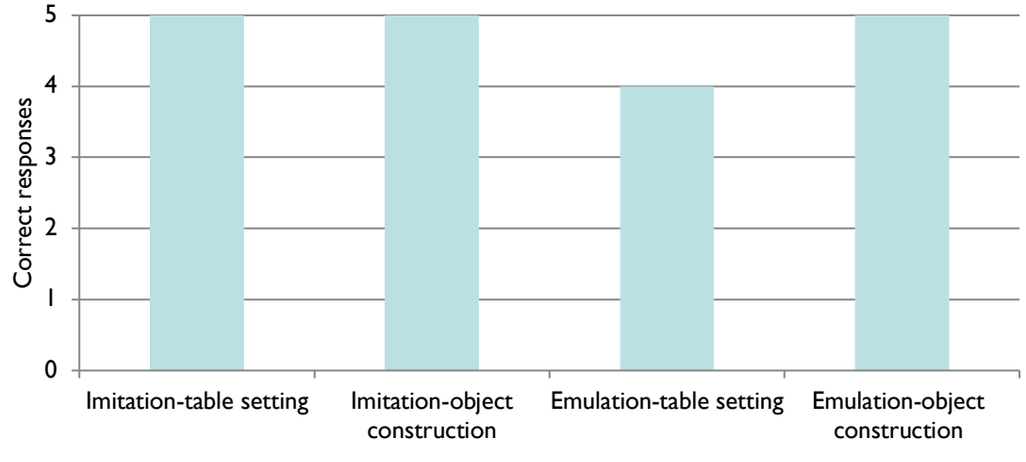


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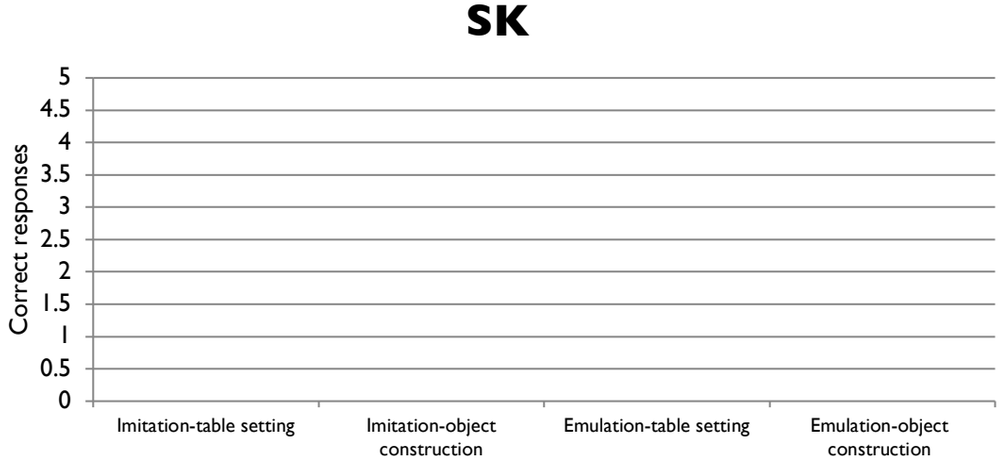


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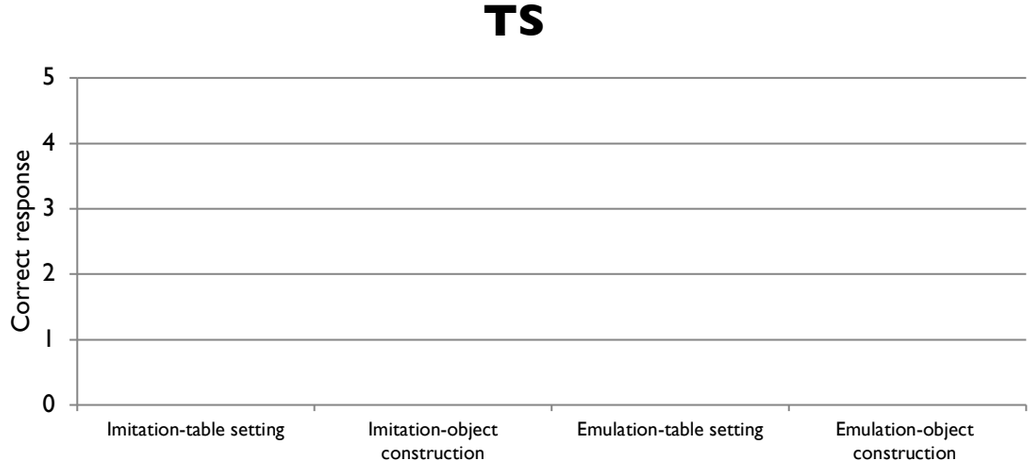


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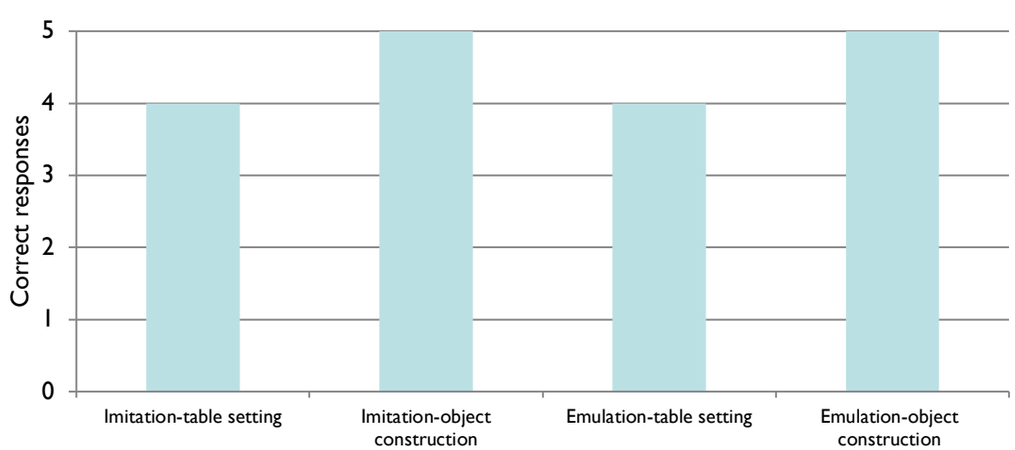
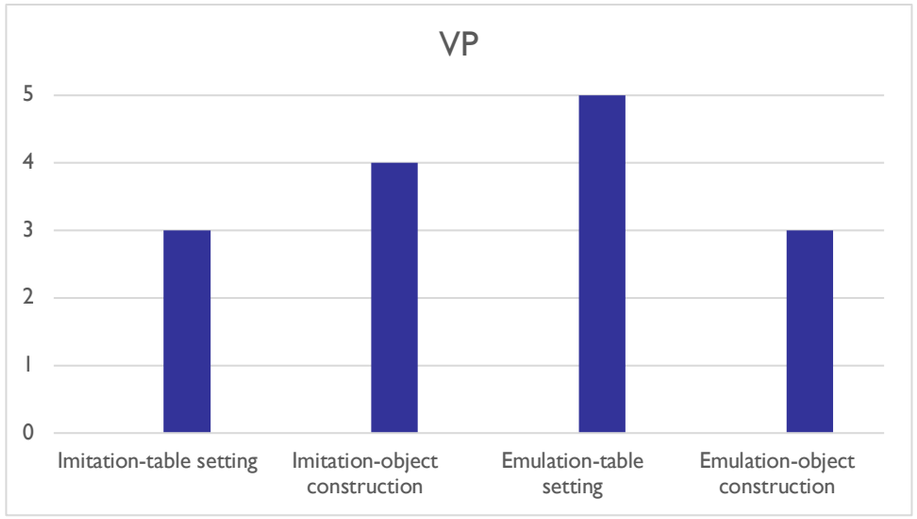
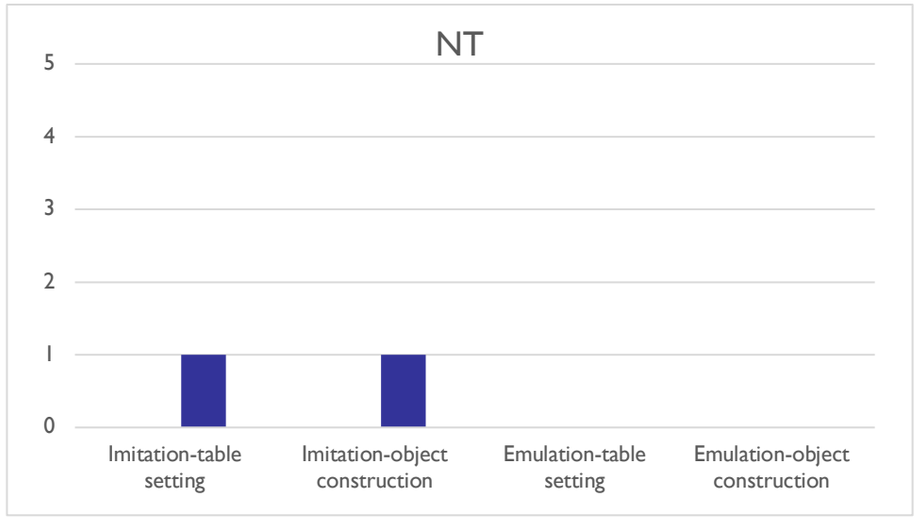


# results


VP
5
4
3
2
1
0
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction


NT
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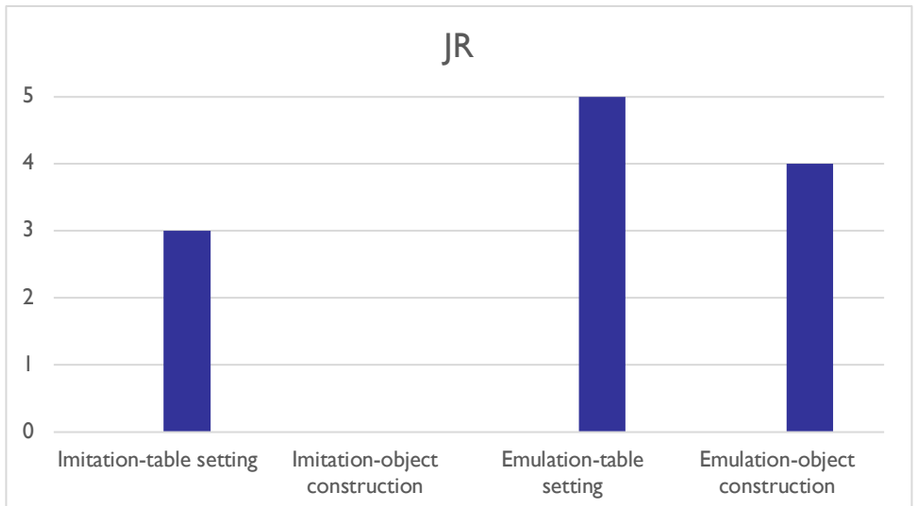
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction


JR
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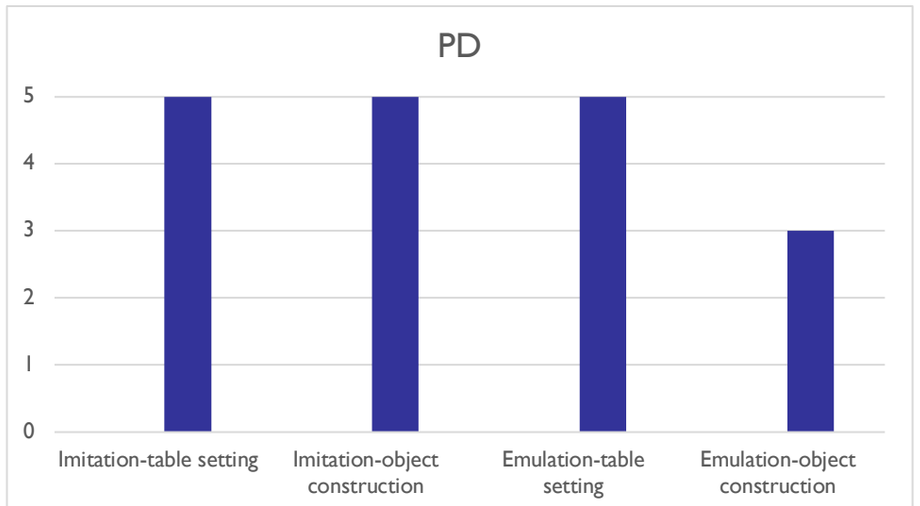
4
3
2
1
0
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction


PD
5
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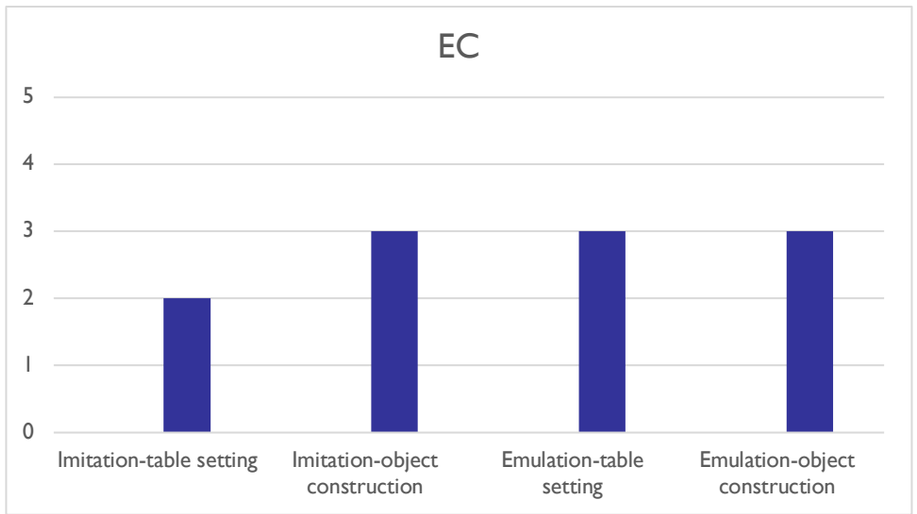
1
0
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction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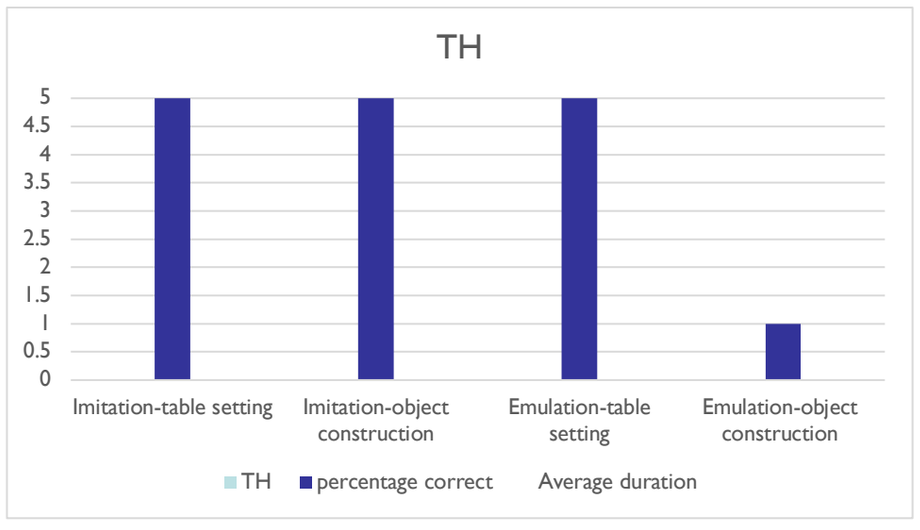
Imitation-object construction
Emulation-table setting
Emulation-object construction


TH
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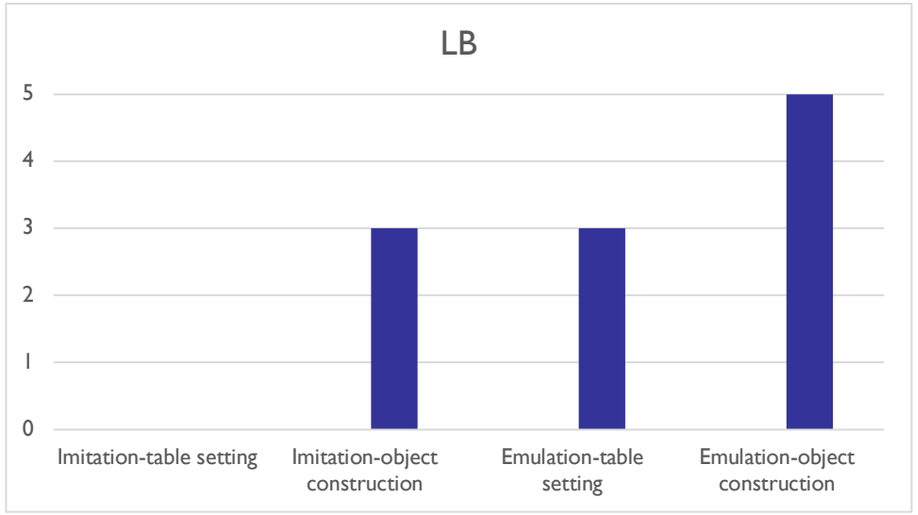
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction
TH
percentage correct
Average duration

# results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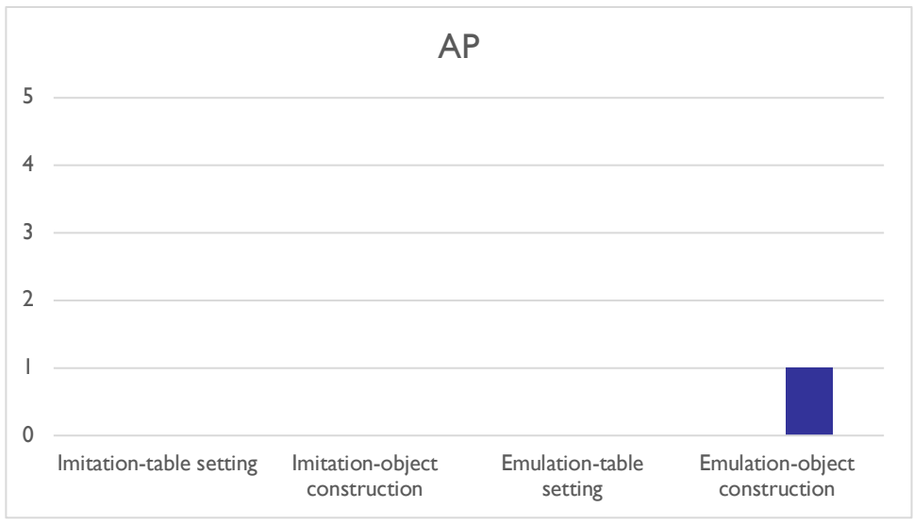
Imitation-object construction
Emulation-table setting
Emulation-object construction


AP
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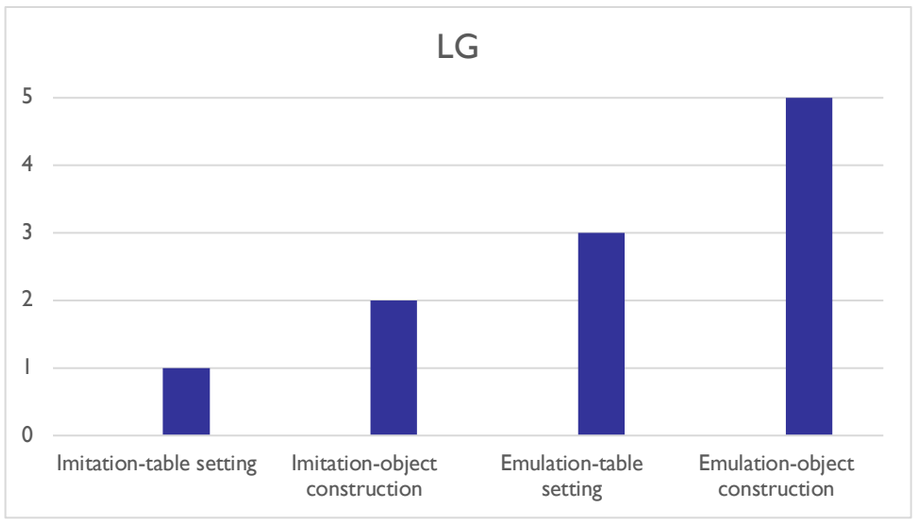
Imitation-object construction
Emulation-table setting
Emulation-object construction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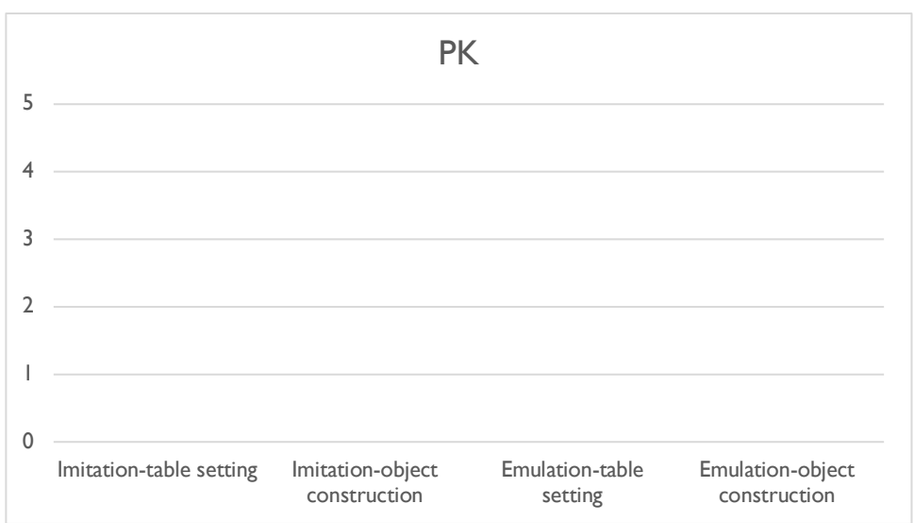
Emulation-object construction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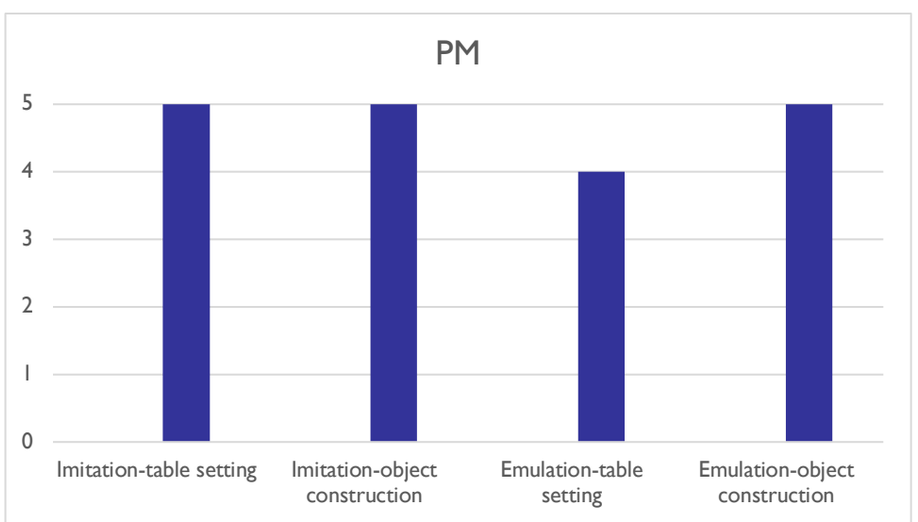
Imitation-object construction
Emulation-table setting
Emulation-object construction


PM
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4
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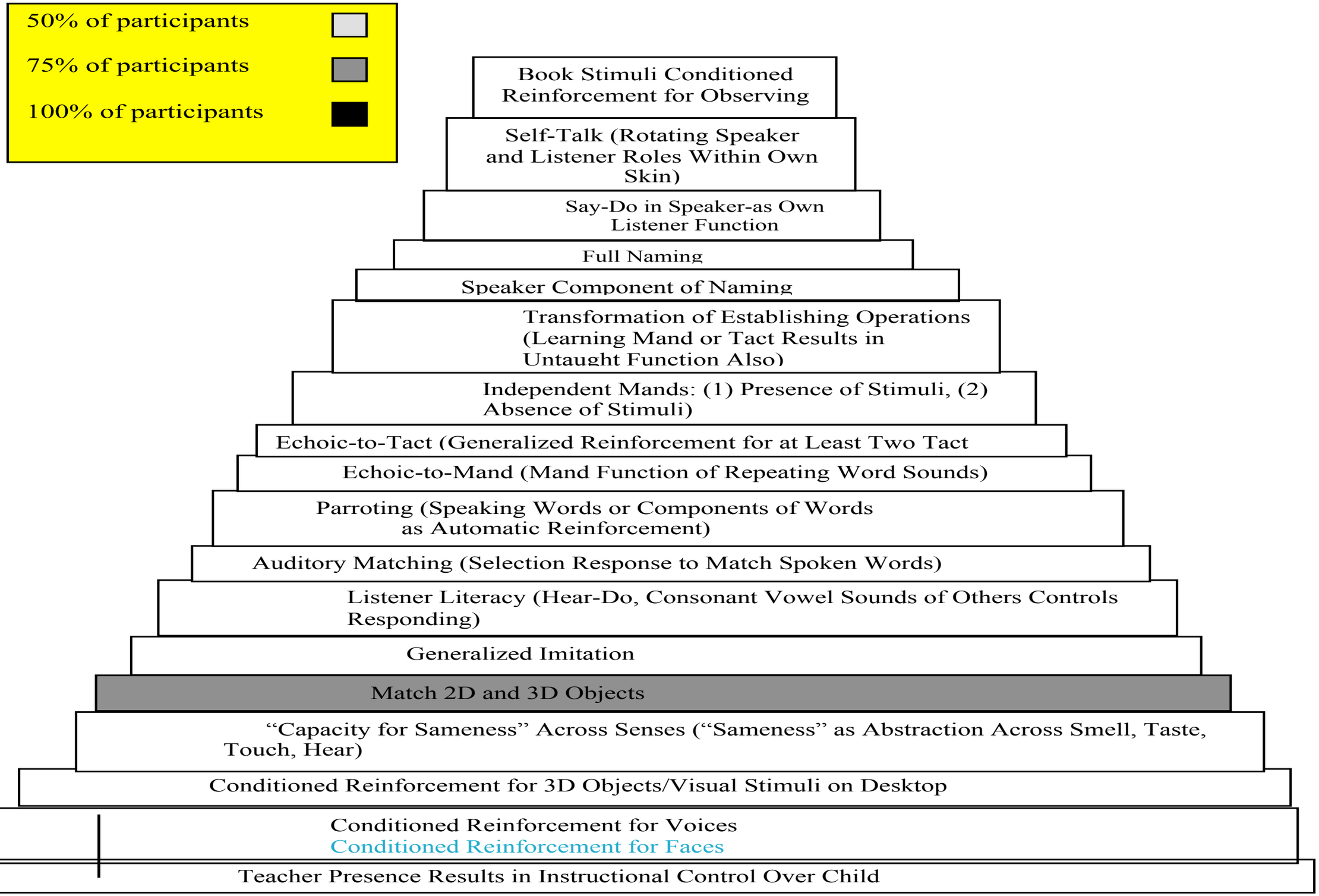
0
Imitation-table setting
Imitation-object construction
Emulation-table setting
Emulation-object construction

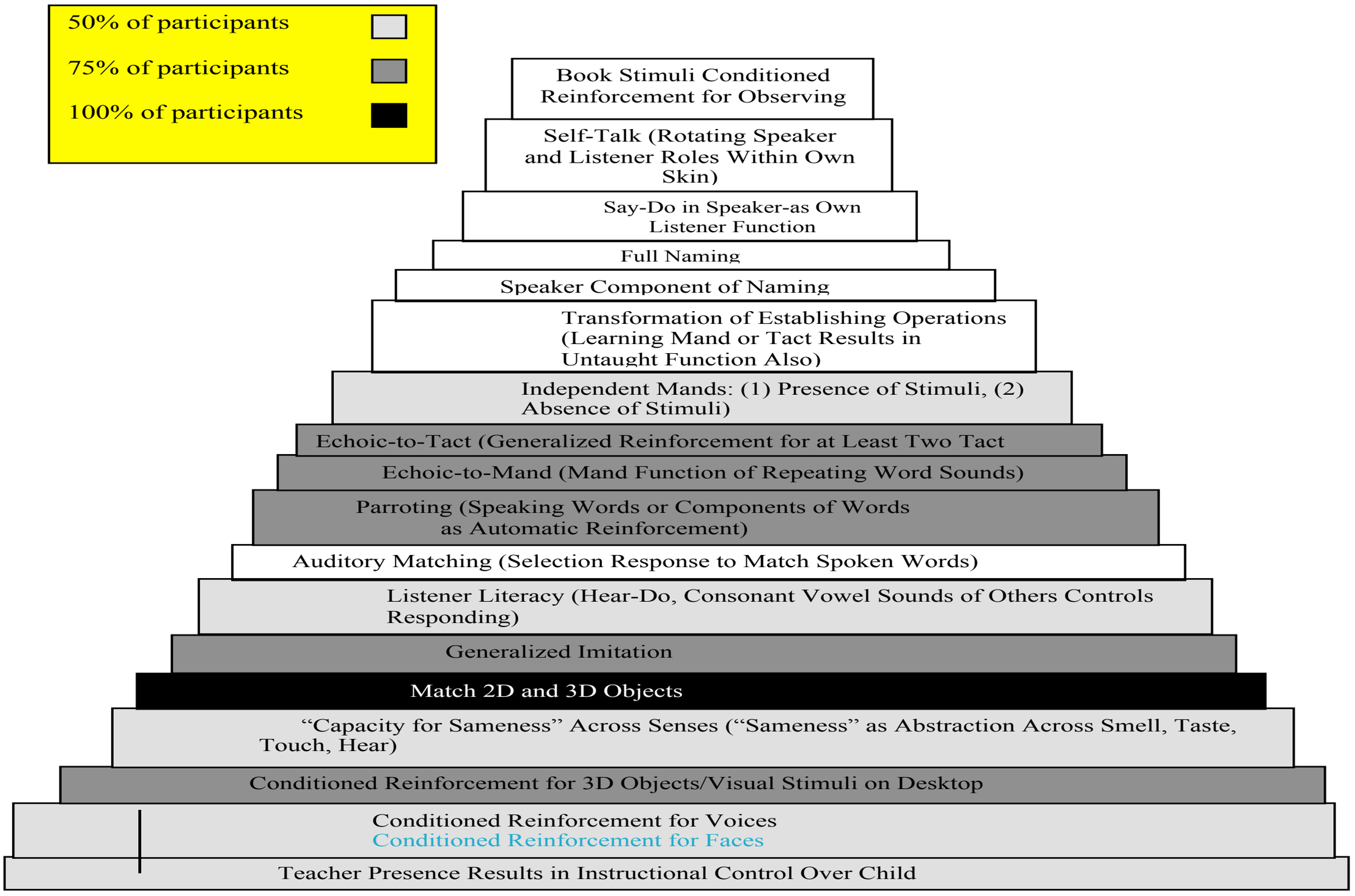
# Correlations VBDA

Participants who did not Emulate or Imitate across exemplars with 80% Accuracy
(n=17)



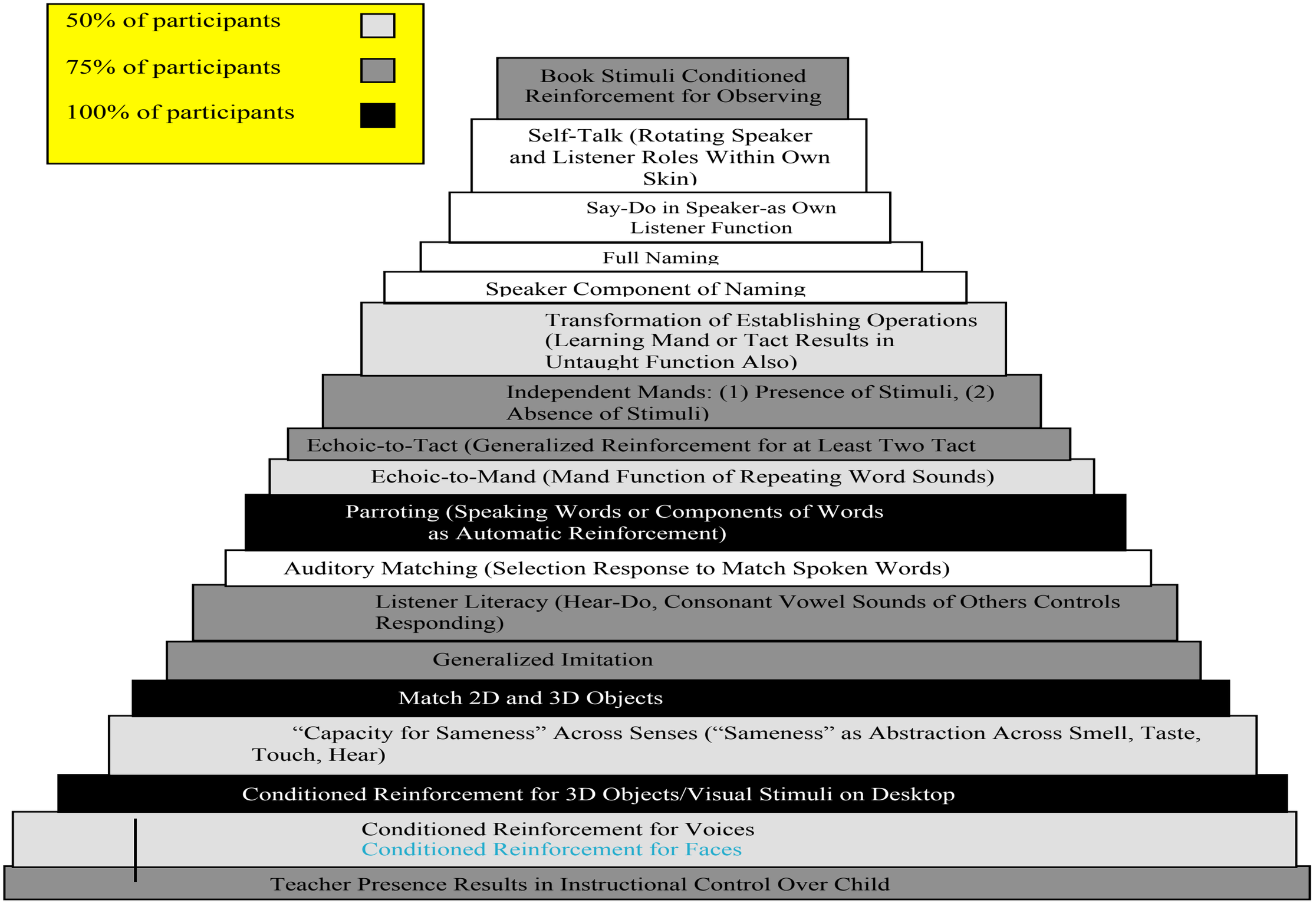
# Correlations w/ VBDA

Participants who emulated but not imitated across exemplars with 80% Accuracy
(n=8)



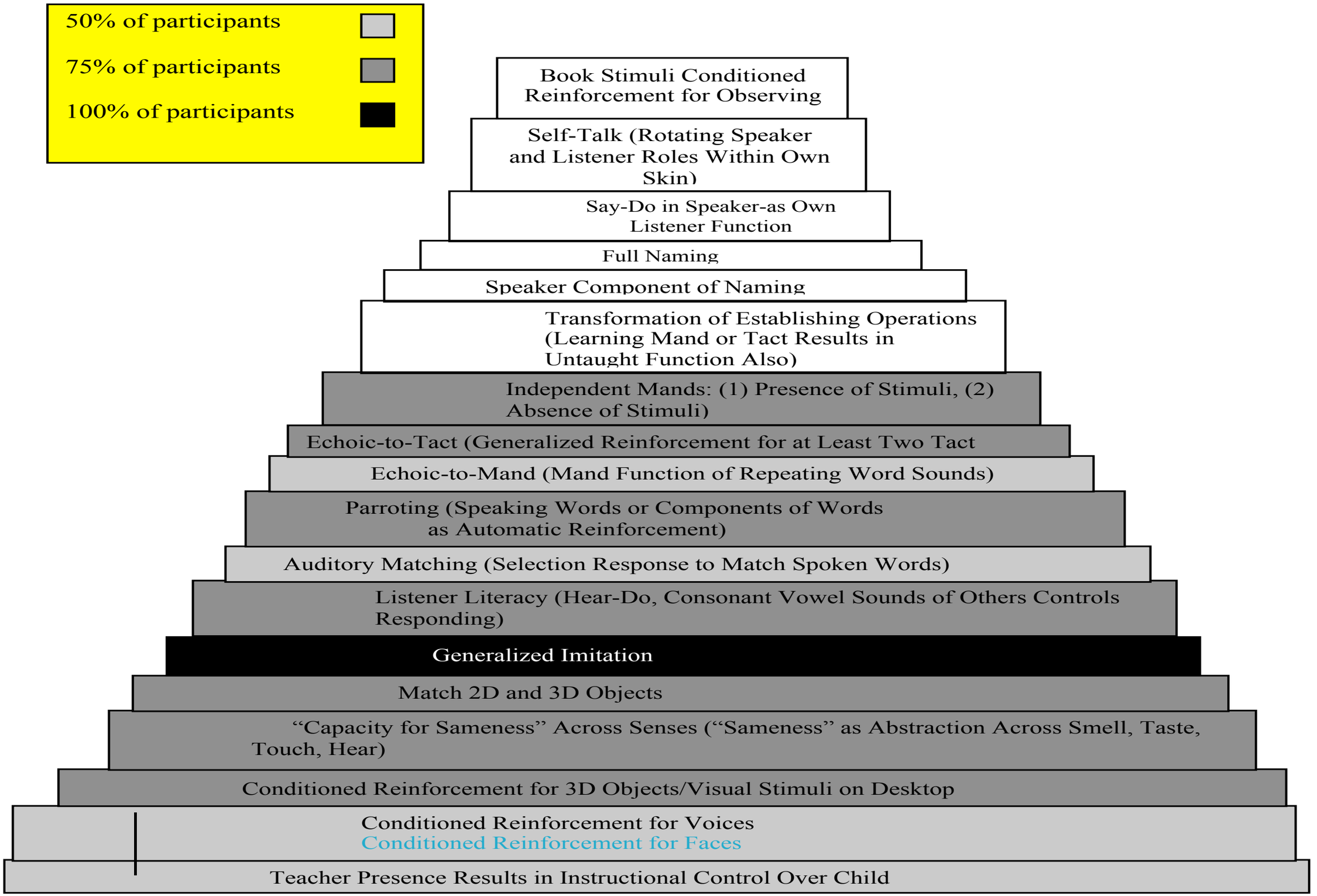
# Correlations w/ VBDA

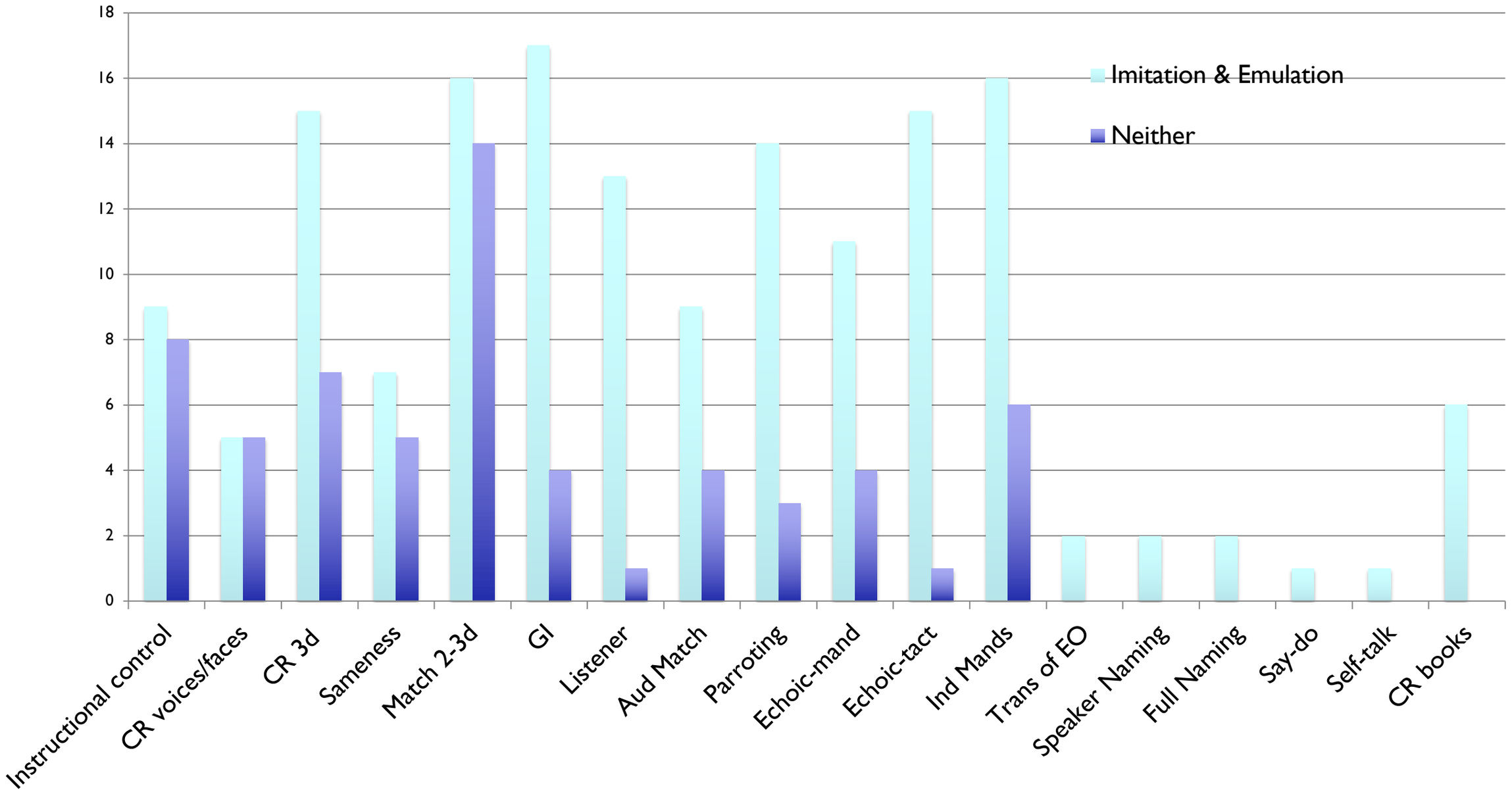
Participants who imitated but not emulated across exemplars with 80% Accuracy (n=6)



# Correlations w/ VBDA

Participants who Emulated and imitated across exemplars with 80% Accuracy
(n=17)

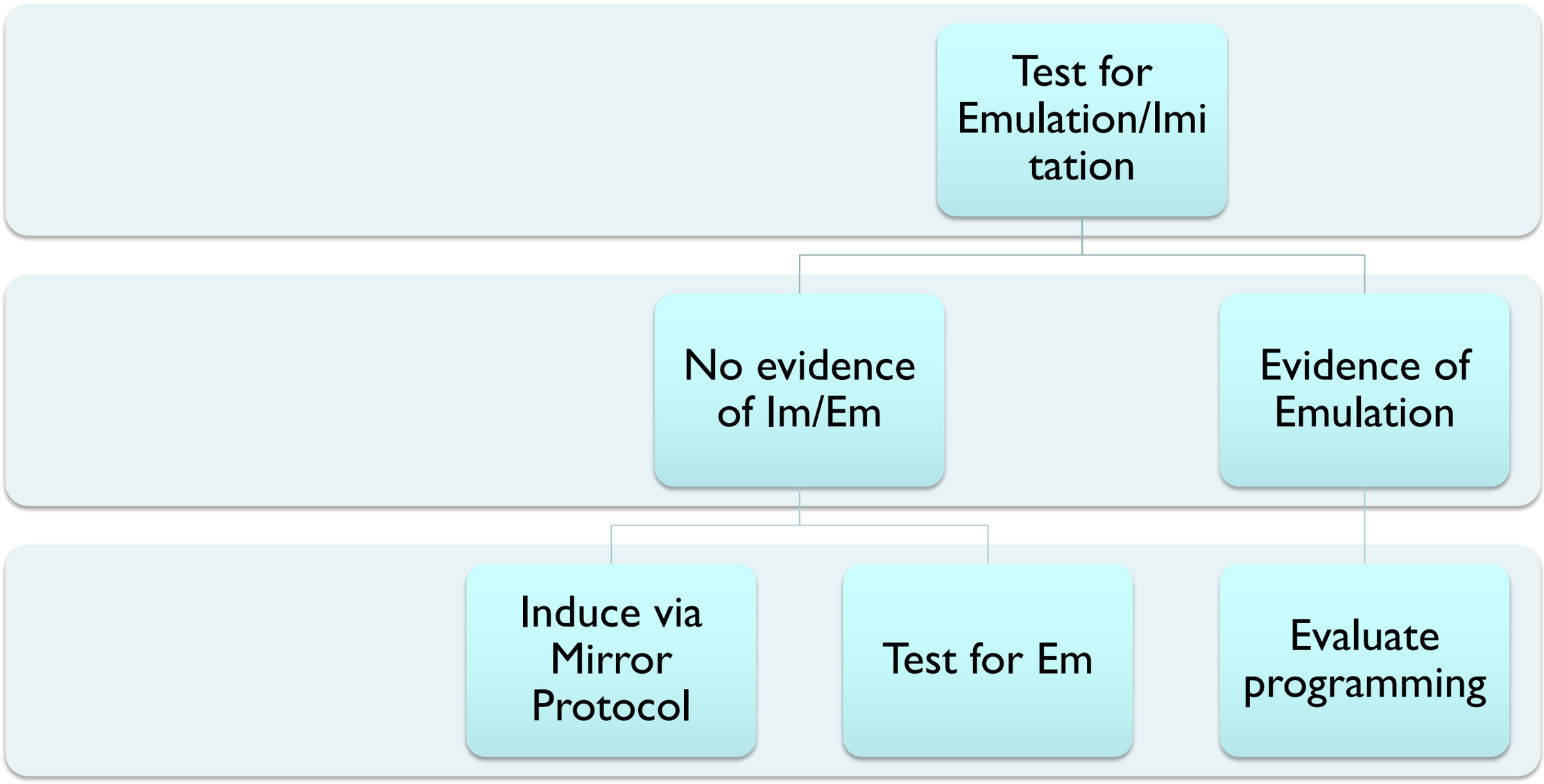



18
16
14
12
10
8
6
4
2
0
Imitation & Emulation
Neither
Instructional control
CR voices/faces
CR 3d
Sameness
Match 2-3d
GI
Listener
Aud Match
Parroting
Echoic-mand
Echoic-tact
Ind Mands
Trans of EO
Speaker Naming
Full Naming
Say-do
Self-talk
CR books

# Once emulation is possible

- Teaching via imitation is not necessarily efficient
- Increase opportunities to emulate

# Next steps


Test for Emulation/Imitation
No evidence of Im/Em
Evidence of Emulation
Induce via Mirror Protocol
Test for Em
Evaluate programming

# Considerations

- Isolating the source of reinforcement for the correspondence of the finished product with the model. Isolate correspondence- trial and error behavior continues when correspondence does not exist and ceases when it does.
- Interspersing object manipulation within procedures like listener emersion and mirror protocol
- When testing for generalized imitation include opportunities for object manipulation

# References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