Exploratory approach to the study of typical development and Autism Spectrum Disorders

Methodological issues: Theory vs Practice

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“Galileo turned a primitive telescope to the night sky and became the first human to see Saturn’s rings.

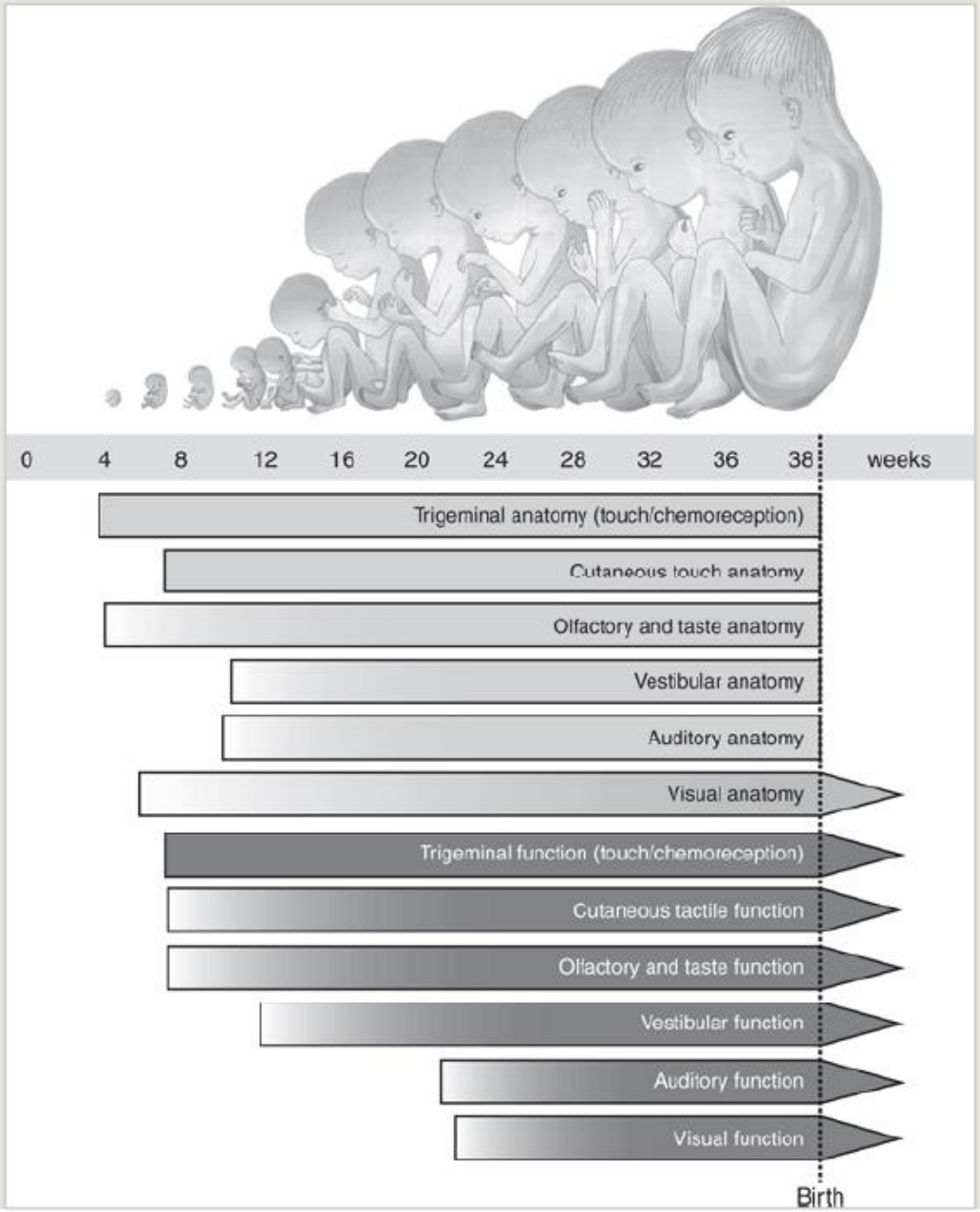
Since the telescope was primitive, Saturn always appeared blurred.

This is a statistical problem, of a sort.

We could look through the telescope a thousand times, and it will always give the same blurred image”

McElreath, 2015

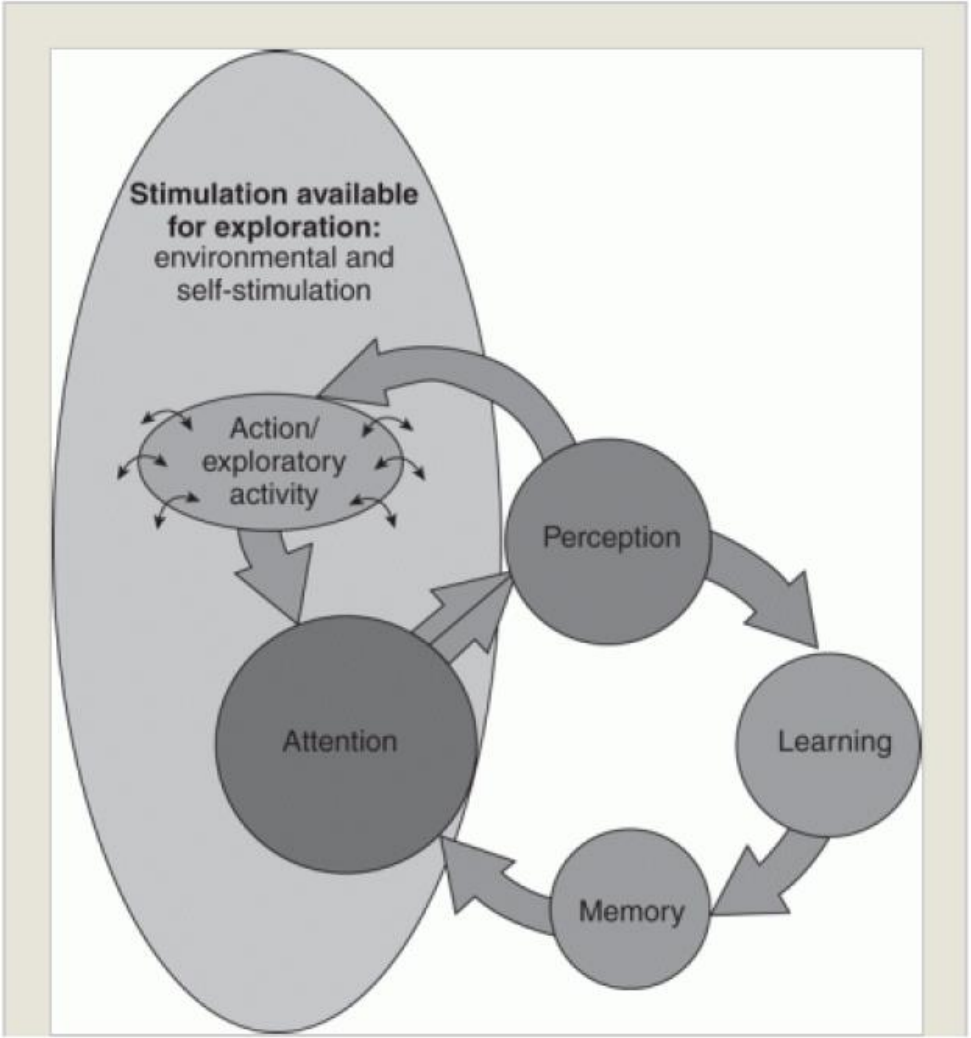
Multisensory development

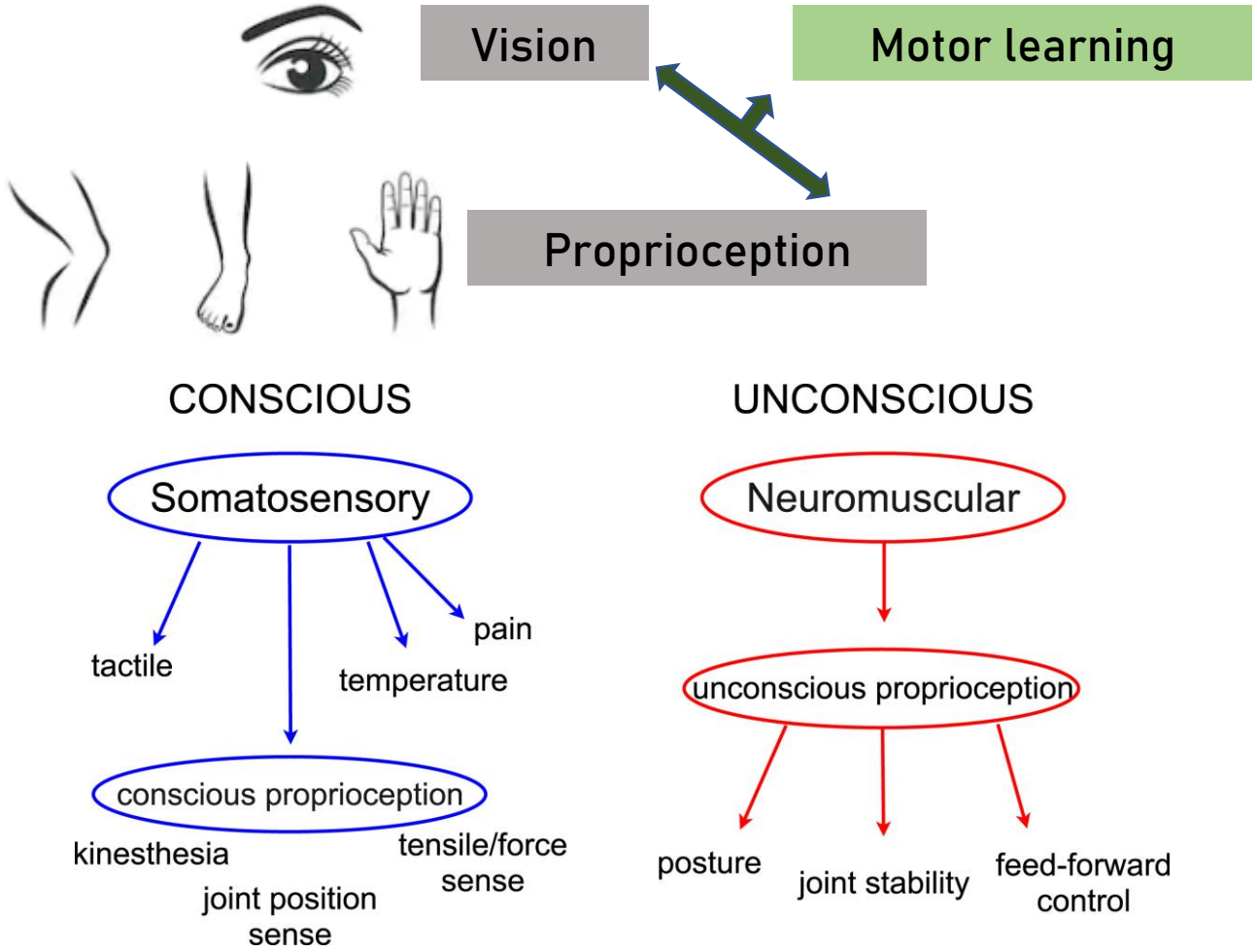


Our reliance on sensory information depends on the variability of information in that sensory modality, in the context of a particular task, environment, age, developmental trajectory

Bremner, Lewkowicz, Spense, 2012, *Multisensory Development*

Multisensory integration and self-motion





Typical vs Atypical development

Typical Development

- Non-monotonic development of visuo-proprioceptive integration
- Low proprioceptive reliability up to adolescence
- Visual dominance

Bremner, Lewkowicz, Spense, 2012, *Multisensory Development*

Autism Spectrum Disorders

- Unisensory facilitation
- Hyper-reliance on proprioception
- Hypo-reliance on vision

→ Associated to motor and social impairments

Izawa, et al., 2012

Collignon et al., 2013

+ Contradictory findings

Immersive Virtual Reality

Unique features of the tool

Typical Development

Children and adults differently combine vision and proprioception for self-motion in IVR

Petrini et al., 2016

Autism Spectrum Disorders

Individuals with ASD may show similar social behaviours (i.e., interpersonal distance) in virtual and real environments, even though neurotypical controls differently interact with a real versus virtual person

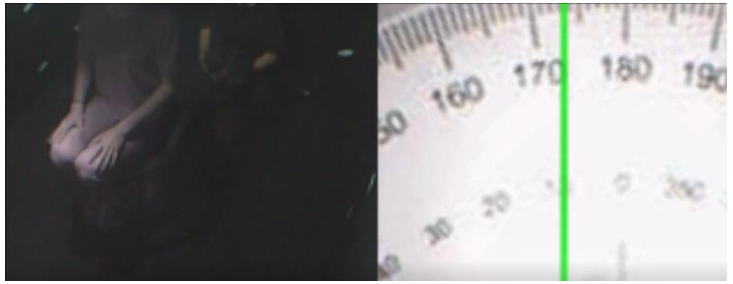
Simões, et al., 2020

Confirmatory research:
to test a priori alternative hypotheses

Exploratory research:
to determine whether any interesting (a posteriori) hypotheses might be generated from the data set

> I assert, and I count upon most of you to agree after reflection, that to implement the very confirmatory paradigm (*) properly we need to do a lot of exploratory work.
>
> Neither exploratory nor confirmatory is sufficient alone. To try to replace either by the other is madness. We need them both.

Tukey, 1978



6 Conditions

Environment		Perception
Reality	x	VP
IVR		V
		P

Design

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

PLOS ONE

Proprioceptive accuracy in Immersive Virtual Reality: A developmental perspective

Irene Valori, Phoebe E. McKenna-Plumley, Rena Bayramova, Claudio Zandonella Callegher, Gianmarco Altoè, Teresa Farroni

Published: January 30, 2020 • https://doi.org/10.1371/journal.pone.0222253 • >> See the preprint

Exploratory perspective to interpret results

Bayesian model comparison analysis

Default prior specification: non-informative priors

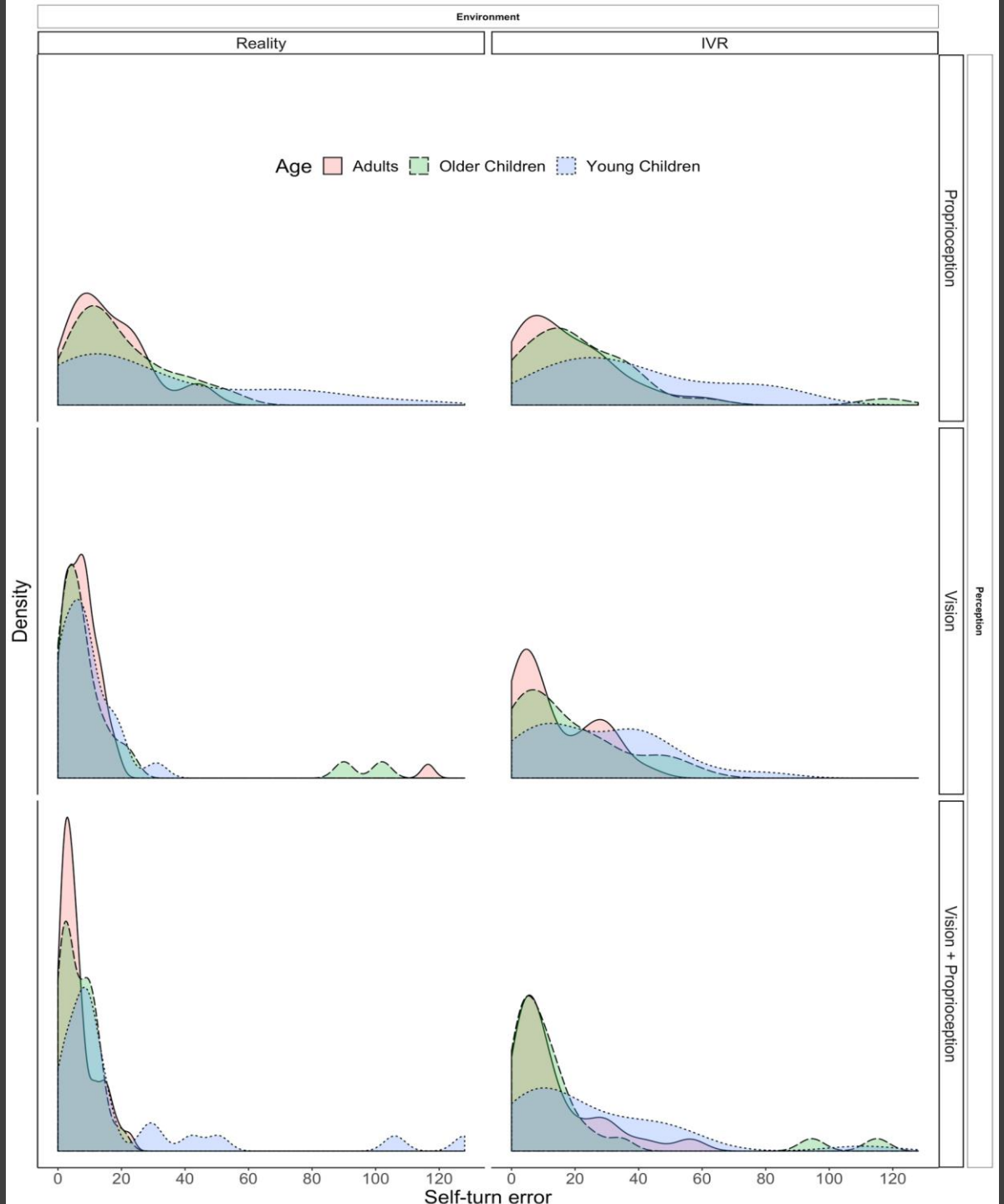
Posterior distributions mostly influenced by the observed data

Edited by Claudio Zandonella Callegher

Estimated distributions of the observed self-turn errors in the different conditions according to age.

($n_{participants}$ = 49; $n_{observations}$ = 578).

Age group		Years		Range	
	N	Mean	SD	Min	Max
Young Children	13	7.1	1.3	4	8
Older Children	13	11.3	2.1	9	15
Adults	23	32.4	6.7	20	43



brain sciences

MDPI

Article

Sensorimotor Research Utilising Immersive Virtual Reality: A Pilot Study with Children and Adults with Autism Spectrum Disorders

Irene Valori [1], Rena Bayramova [2†], Phoebe E. McKenna-Plumley [3†], and Teresa Farroni [1,*]

- Children (N=4) and adults (N=5) with Autism Spectrum Disorder
- Exploratory perspective
- Descriptive statistics and graphical visualisations

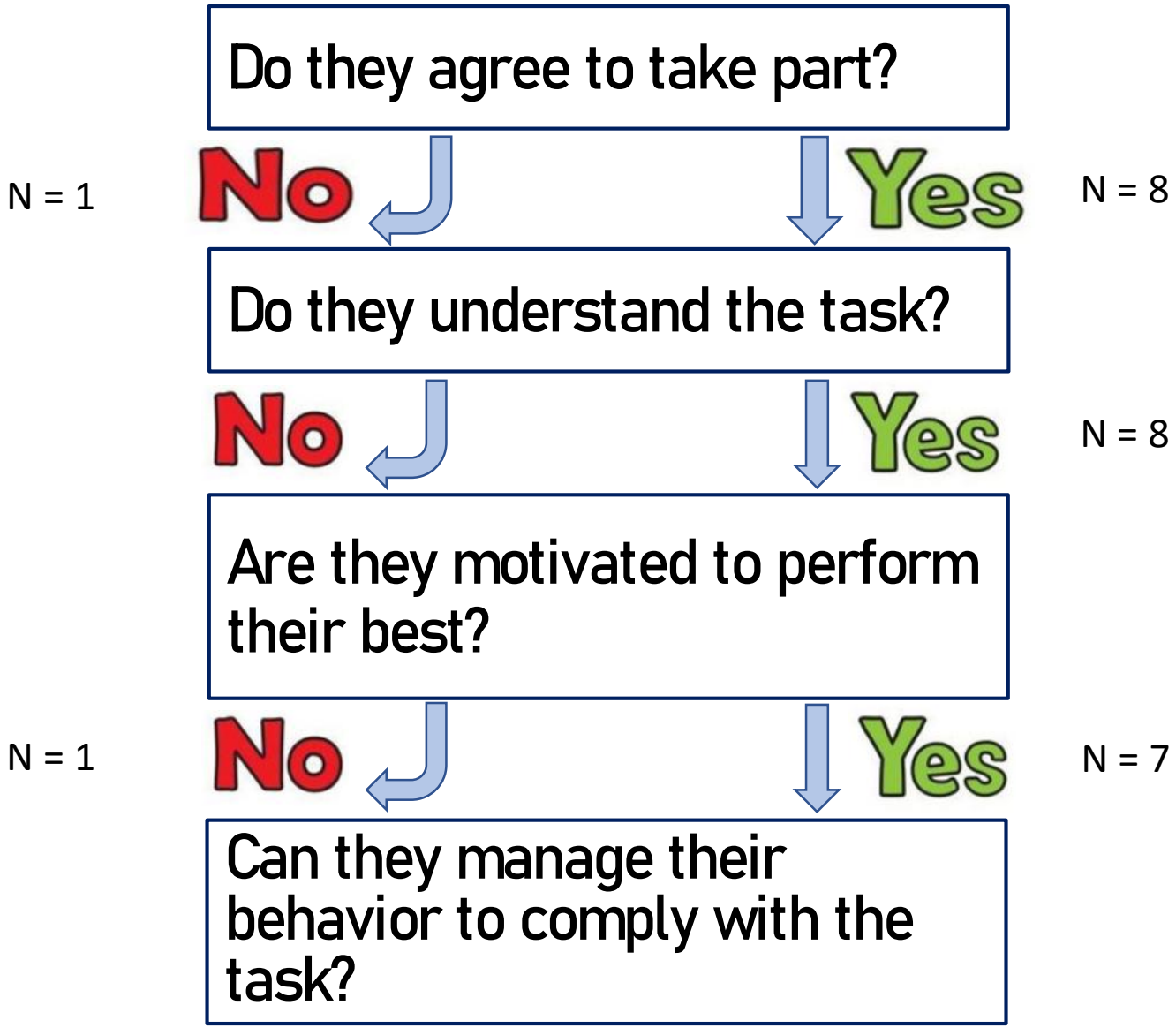
“Rather than focusing our study reports on uncertain conclusions, we should thus focus on describing accurately how the study was conducted, what problems occurred, what data were obtained.”

Amrhein, V., Trafimow, D., & Greenland, S. (2019). Inferential statistics as descriptive statistics: There is no replication crisis if we don’t expect replication. The American Statistician, 73(sup1), 262-270.

Table 1. Participants' demographic information.

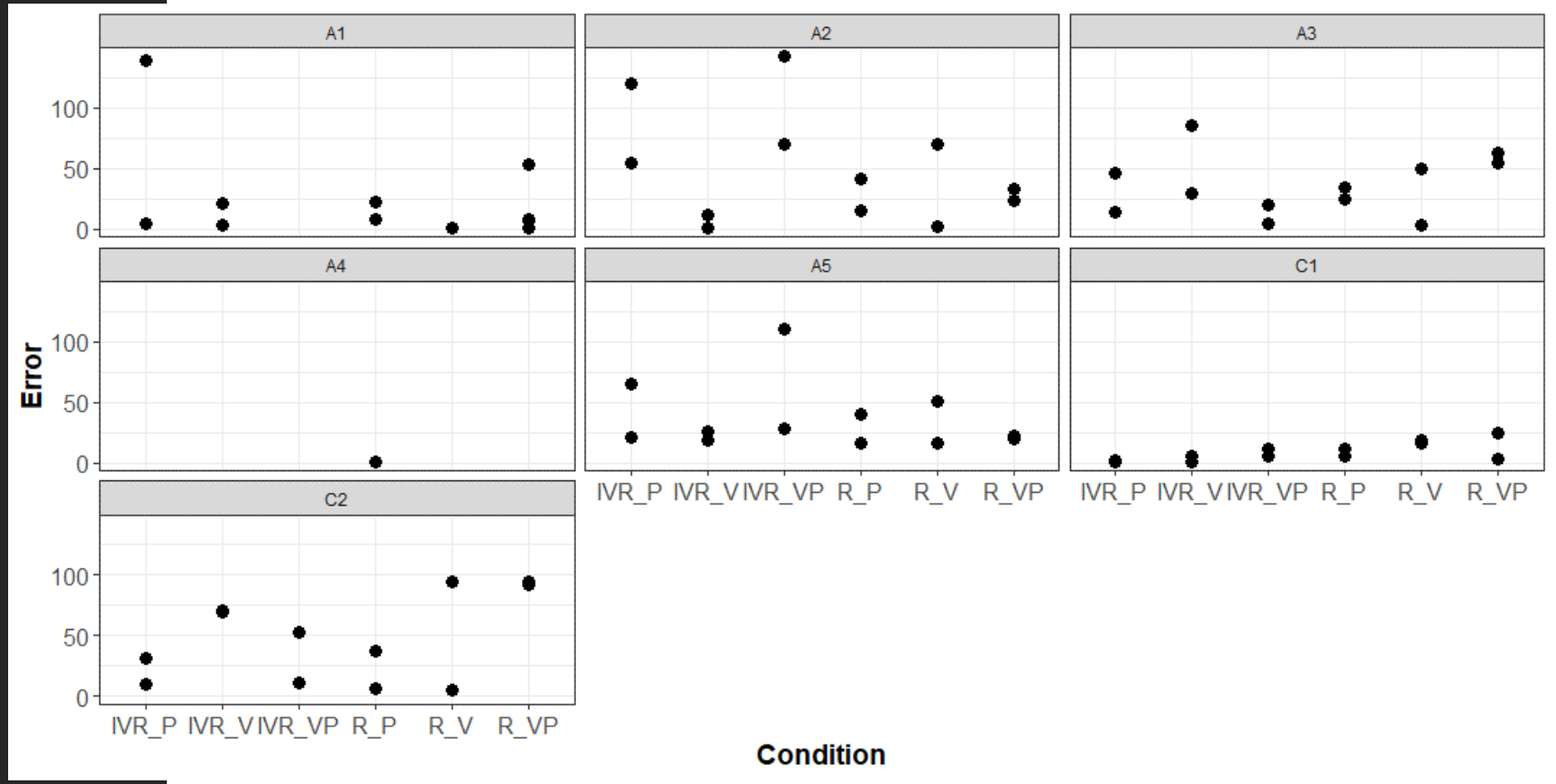
Participant	Age	Diagnosis
C1	8	ASD, ADHD[1], ODD[2], Dysgraphia
C2	8	ASD, Mild ID[3]
C3	10	ASD, Mild ID
C4	13	ASD, Moderate ID
A1	36	ASD, Severe ID
A2	26	ASD, Mild ID
A3	20	ASD, Mild ID
A4	23	ASD, Mild ID
A5	39	ASD, Severe ID

[1] ADHD (Attention Deficit Hyperactivity Disorder); [2] ODD (Oppositional Defiant Disorder); [3] ID (Intellectual Disability)



Feasibility issues

Individual observations

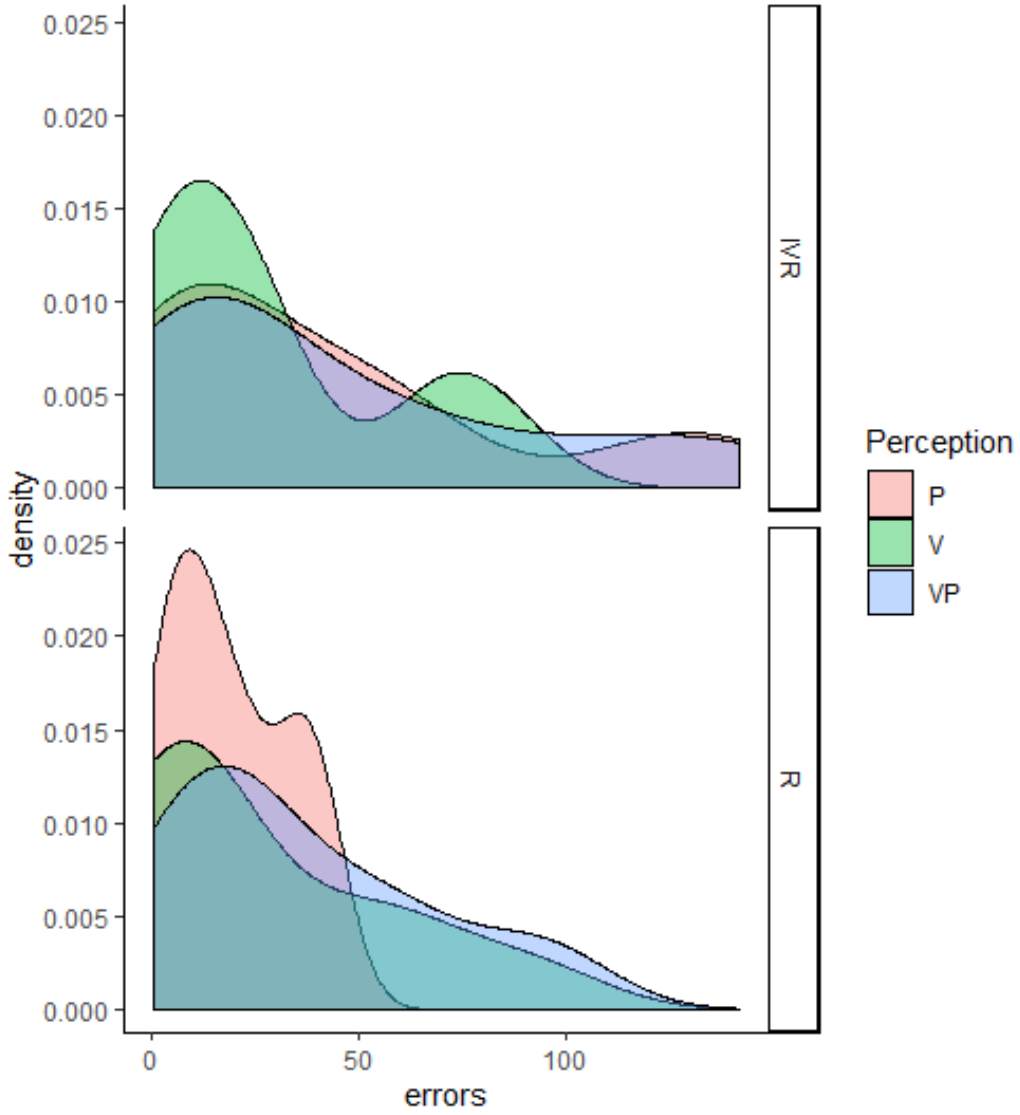


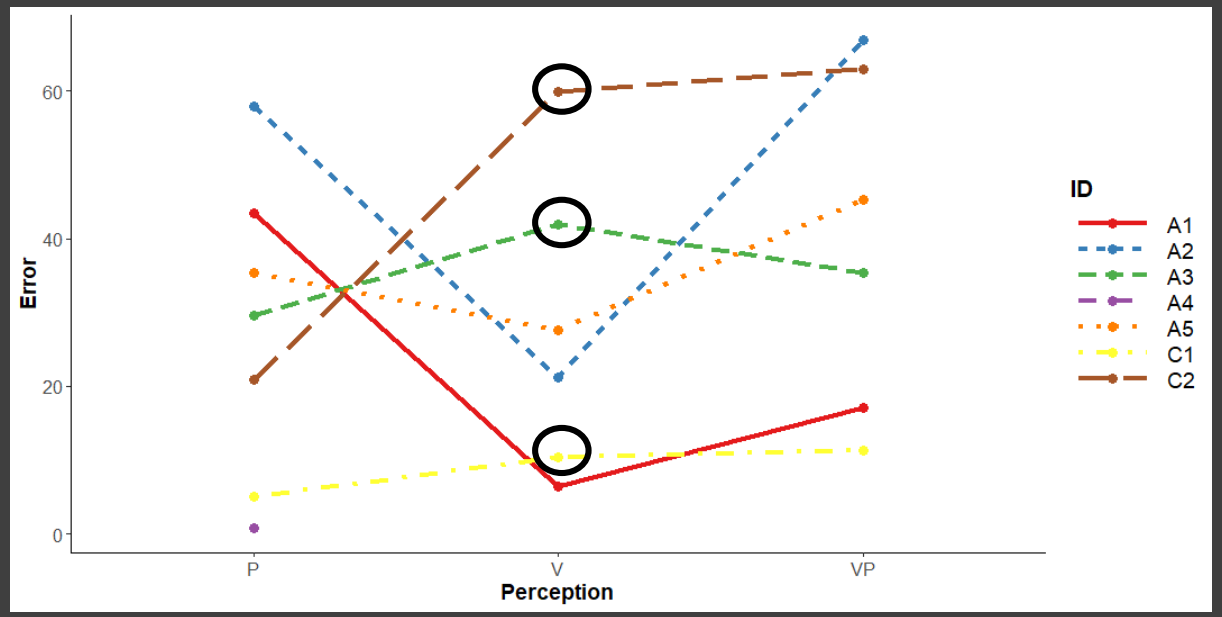
At the group level

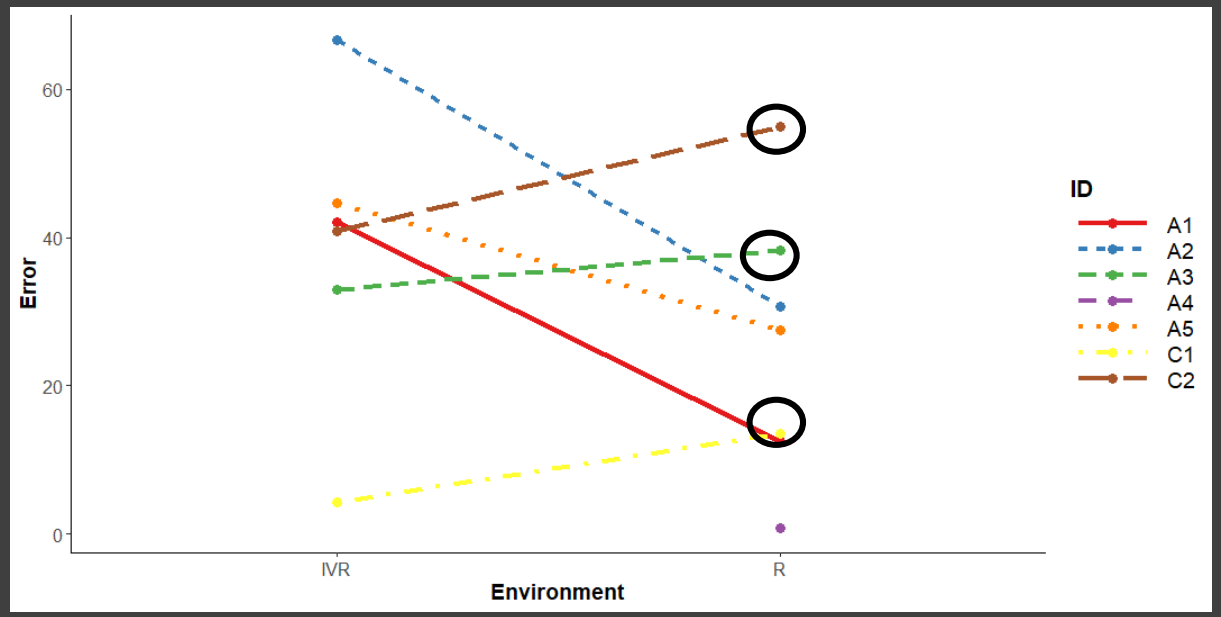
Density distributions of the self-turn errors among conditions.

Children ($n_{participants}$ = 2; $n_{observations}$ = 24).

Adults ($n_{participants}$ = 5; $n_{observations}$ = 50).







2 potential sub-groups?

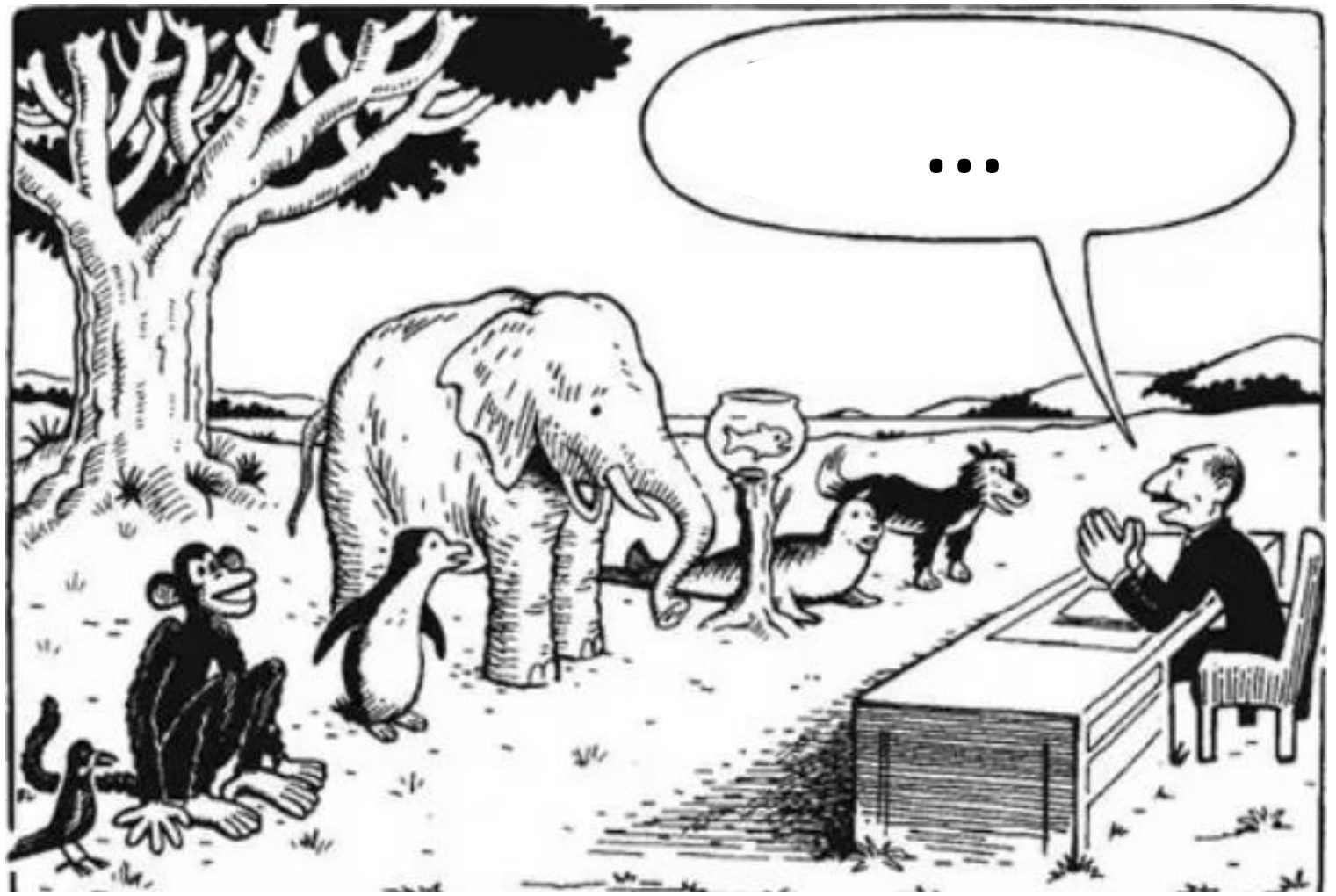
MAJOR points:
Group representativeness vs meaningful individual differences

«Minor» points:
Inclusion criteria
Sample size and Number of trials

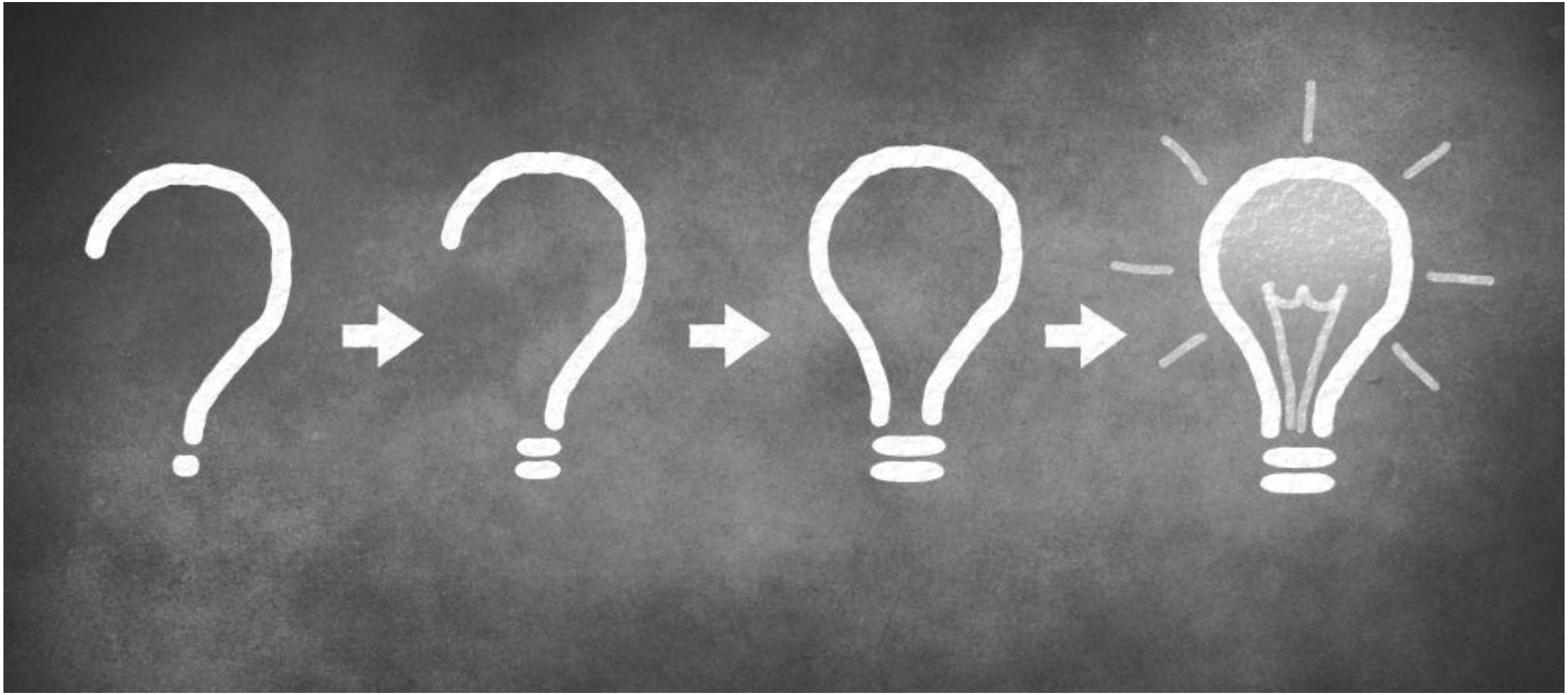
Open questions


FOR A FAIR SELECTION EVERYBODY HAS TO TAKE THE SAME EXAM: PLEASE CLIMB THAT TREE

Theory



Practice



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