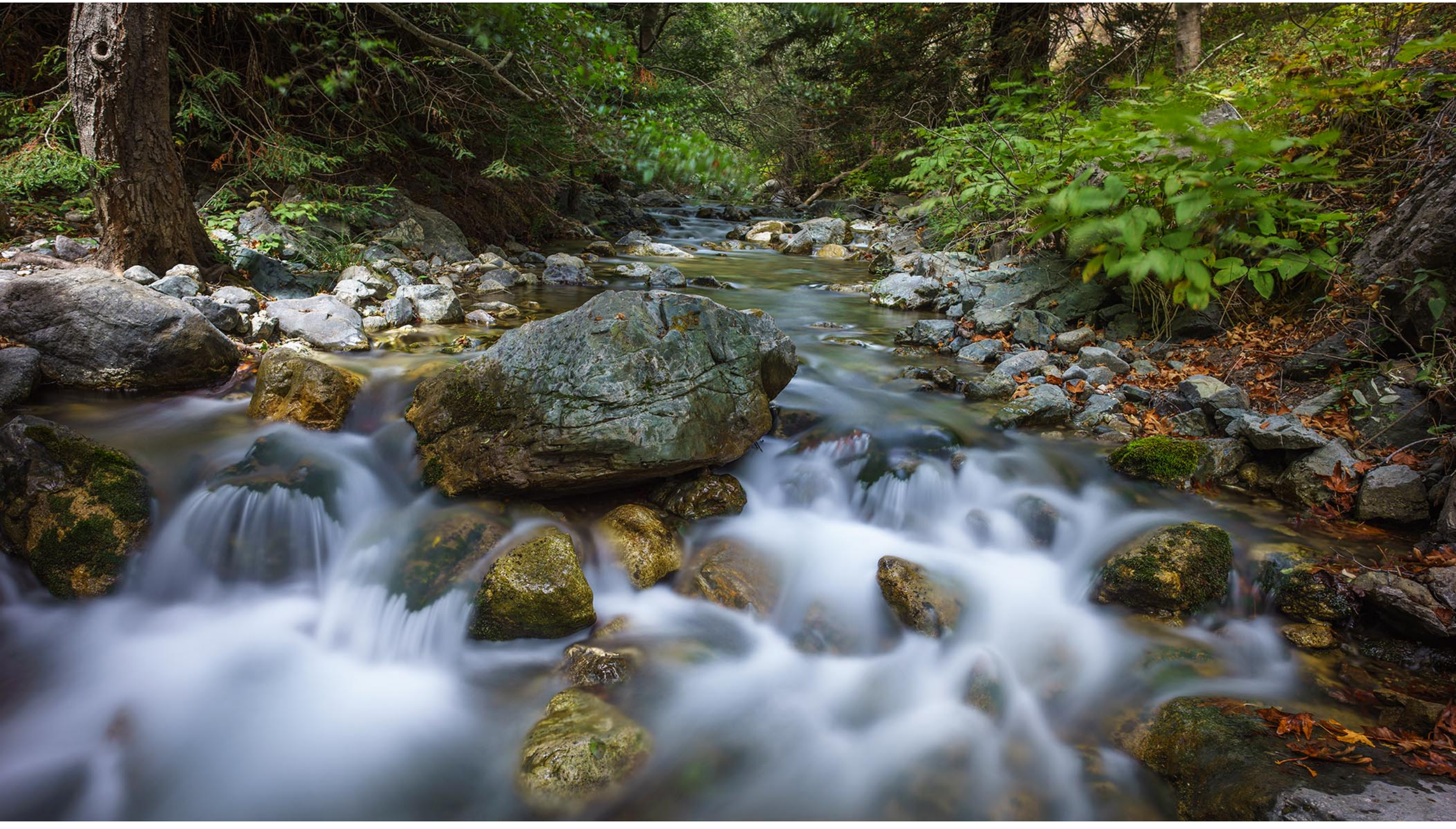
vitamin N & cognitive growth

@cjlortie

debate about (N)atural



less native, somewhat natural

different species & different complexity

11 million bits of information per second in cities

Plambech et al. 2015

people are animals too

ecology is always about interactions
(with one another, other species, and the environment)

the promise of environmental neuroscience

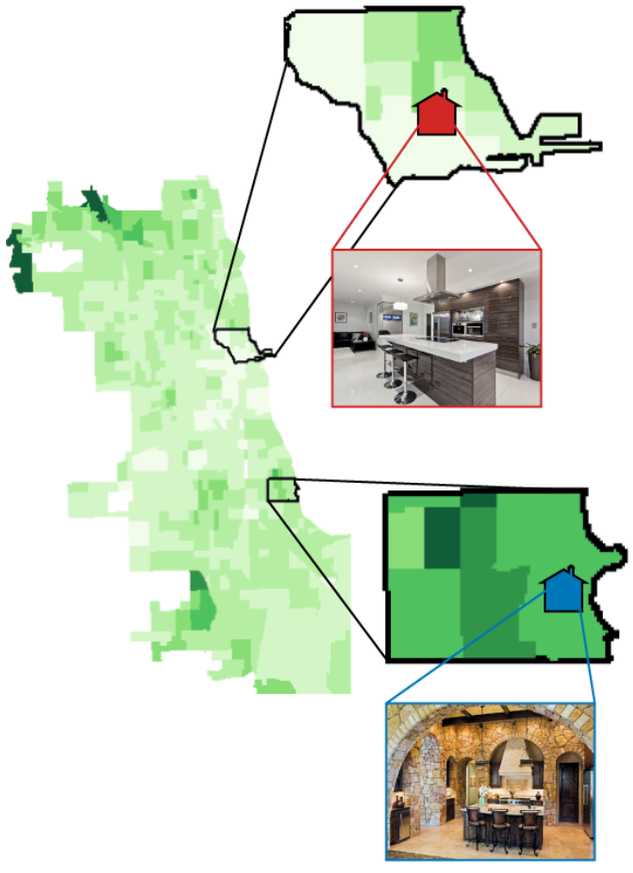
Generative approach

Environmental psychology
Social psychology and social neuroscience

Environmental neuroscience

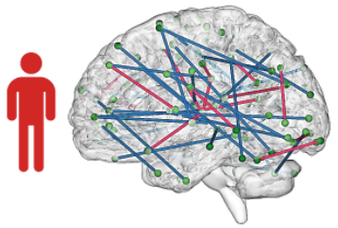
Cognitive neuroscience and
behavourial neuroscience

Physical elements (outdoor and indoor)

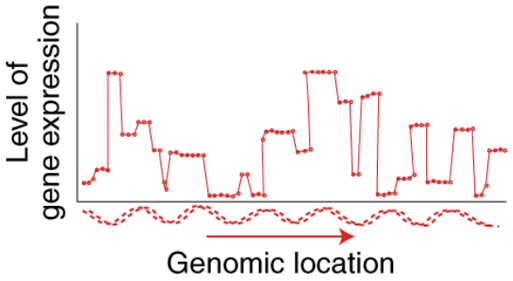


Social elements

Functional connectome



(Epi)genetics



Behaviour = *f*(genetics, neurobiology, psychology, environment)

Levels of analysis:
- Quantification of physical environments (interior and exterior)
- Individual behavior (e.g., memory, attention and self-control)
- Functional and structural neuroimaging
- Genetics systemic (e.g., genetic susceptibility)
- Social context and social behavior

Levels of analysis:
- Functional and structural neuroimaging
- Neuroscience molecular
- Epigenetic
- Cellular

Mechanisitc approach

Berman et al. 2019

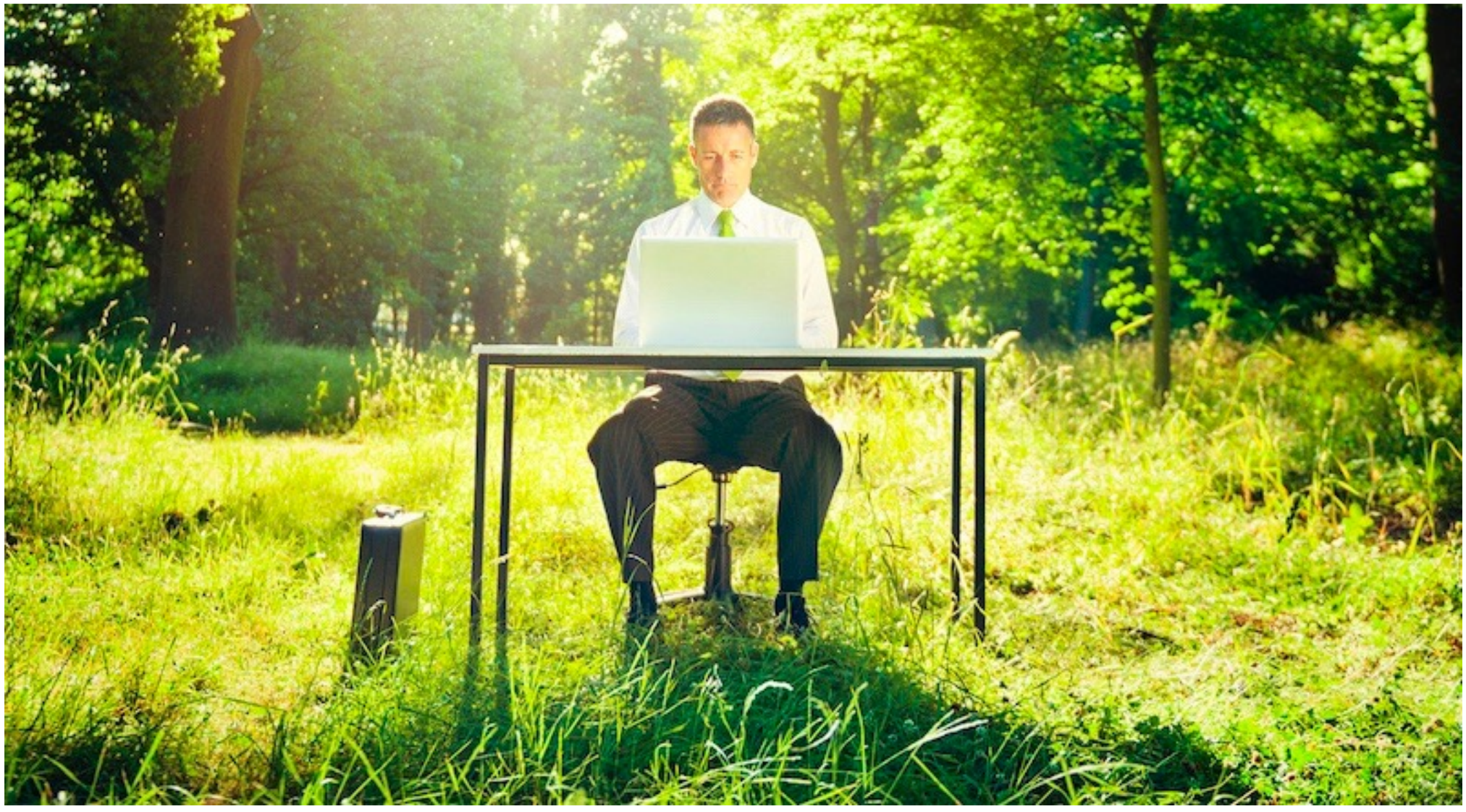
explore this interaction set

as an antidote to this interaction set

screen time

ART

attention restoration theory



Berman et al. 2008 & Bratman et al. 2015

BET

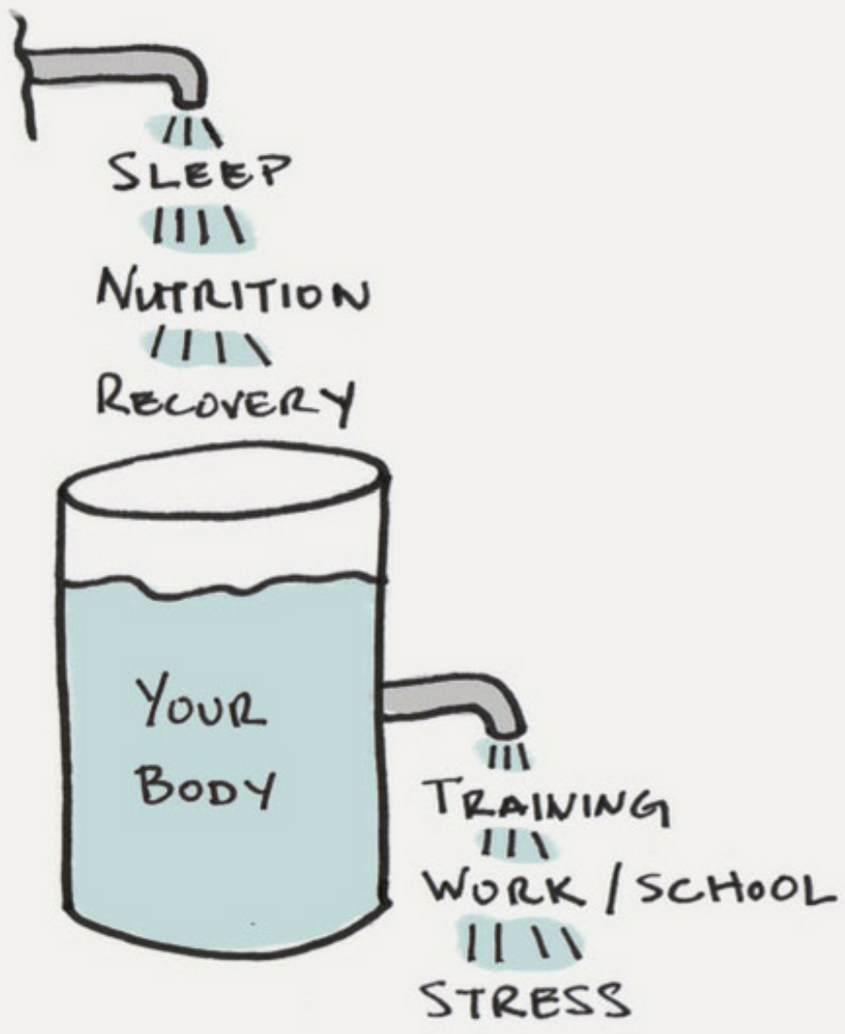
biophilia effect

evolutionary history & connectedness

Kellert & Wilson 1993

SRT

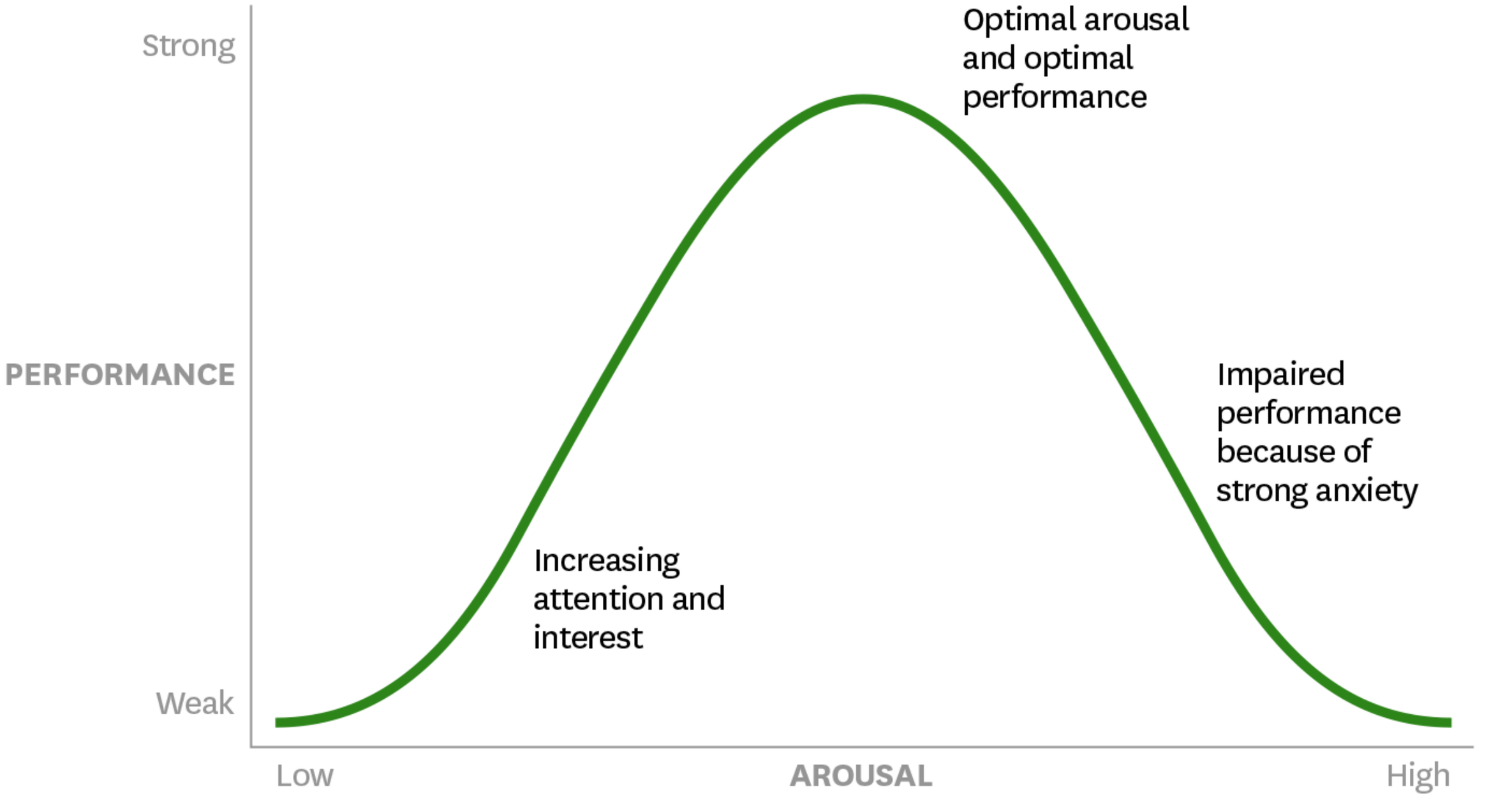
stress-reduction theory



Ulrich et al. 1991

The Yerkes-Dodson Law

How anxiety affects performance.



SOURCE ROBERT M. YERKES AND JOHN D. DODSON

cognition

knowledge, processing, experience, perception, learning, reasoning

0, 5, 3, 2, 7

10, 9, 8, 7, 6, 5

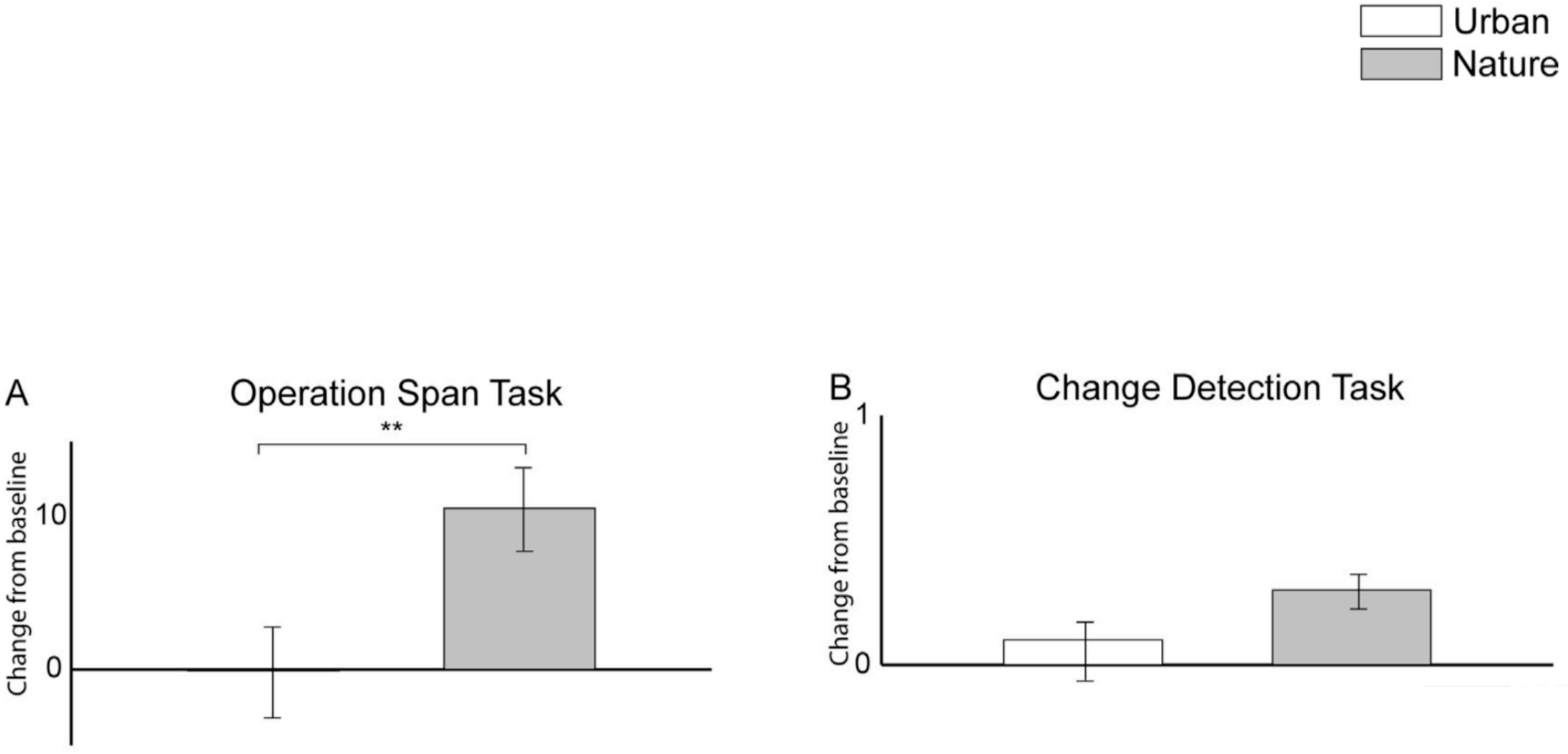
50 individuals tested all typically showed modest increases from a walk outside or imagery

TABLE 1

Behavioral Results From Experiments 1 and 2

	Natural setting		Urban setting	
Measure	Before interaction	After interaction	Before interaction	After interaction
Backward span				
Experiment 1	7.90 (0.37)	9.40 (0.41)	7.90 (0.30)	8.40 (0.33)
Experiment 2	7.92 (0.96)	9.33 (0.86)	7.83 (1.04)	8.83 (0.90)
ANT effects (ms)				
Executive	86 (11.30)	67 (8.45)	81 (15.50)	93 (17.96)
Orienting	47 (6.46)	55 (7.33)	46 (10.01)	43 (4.73)
Alerting	32 (6.86)	31 (5.23)	36 (6.52)	46 (5.63)

Berman et al. 2008



~**250** people test to date show mean change at
+**20%** with a short walk (15-50mins)

Bratman et al. 2015

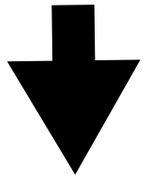
stress

2356 people tested
20-40% of variation explained by experiencing nature
(viewing or outside)

Table 3. Overall effect size estimates for the effect of brief exposure to natural environments on positive and negative affect.

Outcome	N	k	r	95% CI for r (lower, upper)	T^2	I^2
Positive affect	2284	31	0.31	0.24, 0.37	0.02	56.95
Negative affect	1630	20	−0.12	−0.17, −0.07	0.00	13.08
Overall	2356	32				

Note: N = number of participants included in analysis; k = number of studies; r = effect size estimate; CI = confidence interval; T^2 = estimate of between-study variability; I^2 = estimate of total variability due to between-study variability.



stress

McMahan & Estes 2015

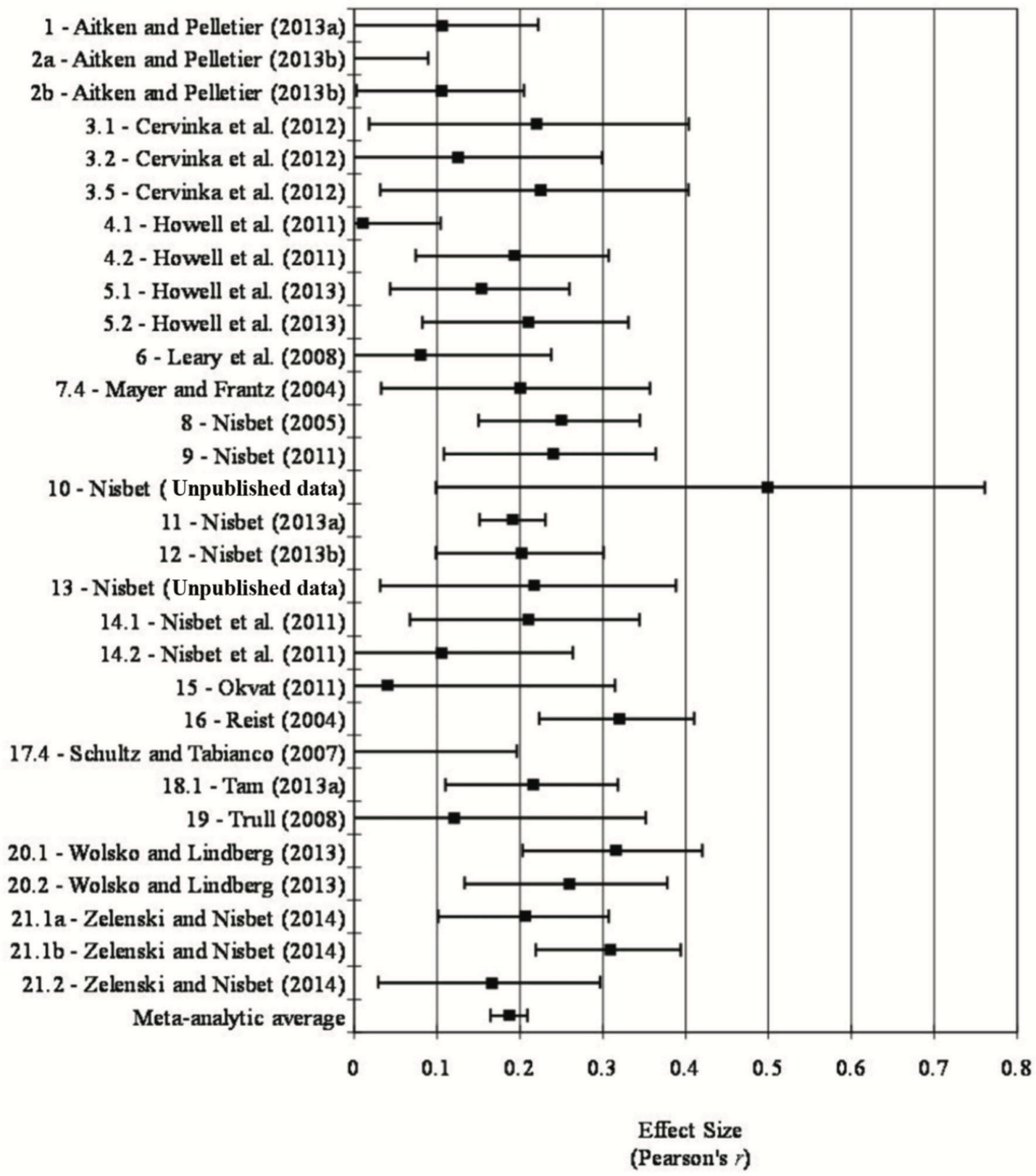
lab < outside

manicured nature = wild nature

Sweden < Canada < USA < Japan

McMahan & Estes 2015

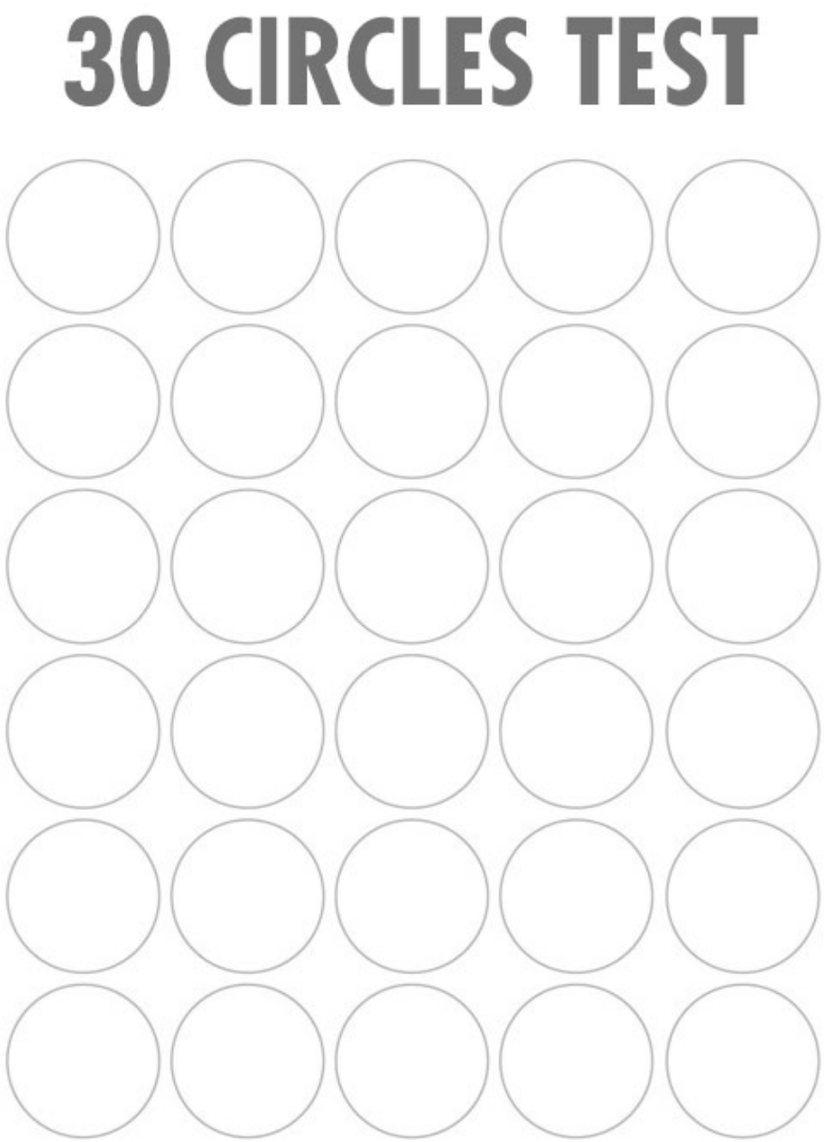
8523 people happier with nature



Capaldi et al. 2014

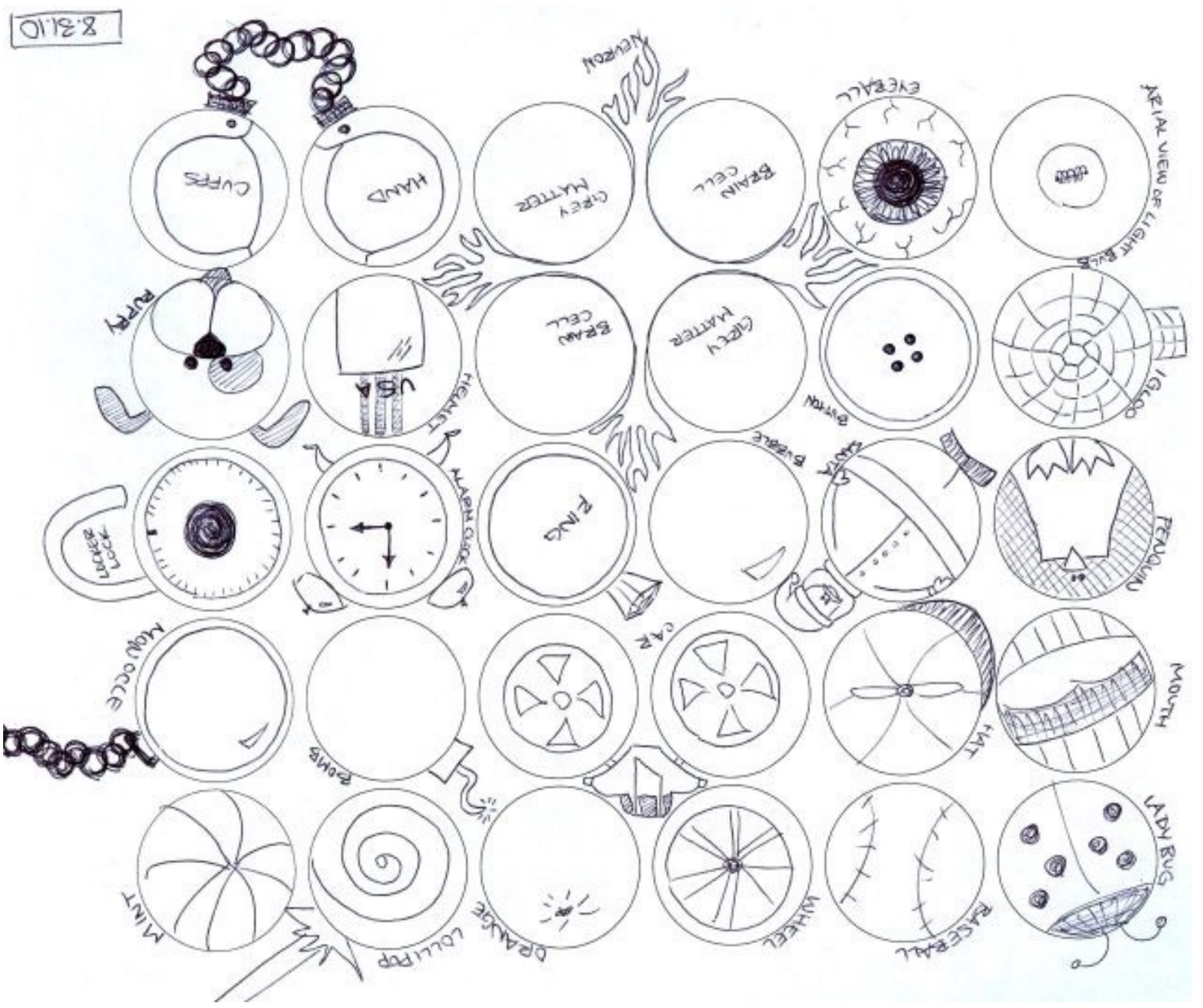
creativity

104 people tested for verbal & visual creativity
with & without natural views/plants



Studente et al. 2016

8.31.10


CURLS
HAND
GREY MATTER
BRAIN CELL
NERVOU
EYEBALL
AERIAL VIEW OF LIGHT BULB
PUPPY
USA
BRAIN CELL
GREY MATTER
BUTTON
IGLOO
LOCKER LOCK
MAGNET
RING
BUBBLE
BANANA
PENGUIN
MOON ROCK
BOMB
CAR
HAT
MOUTH
MINT
LOLLIPOP
DRAGON
WHEEL
BASEBALL
LADY BUG

visual creativity (judged by others) increased by **nearly 20%**

but not all measures universally increased

problem solving

RWPS

real world problem-solving

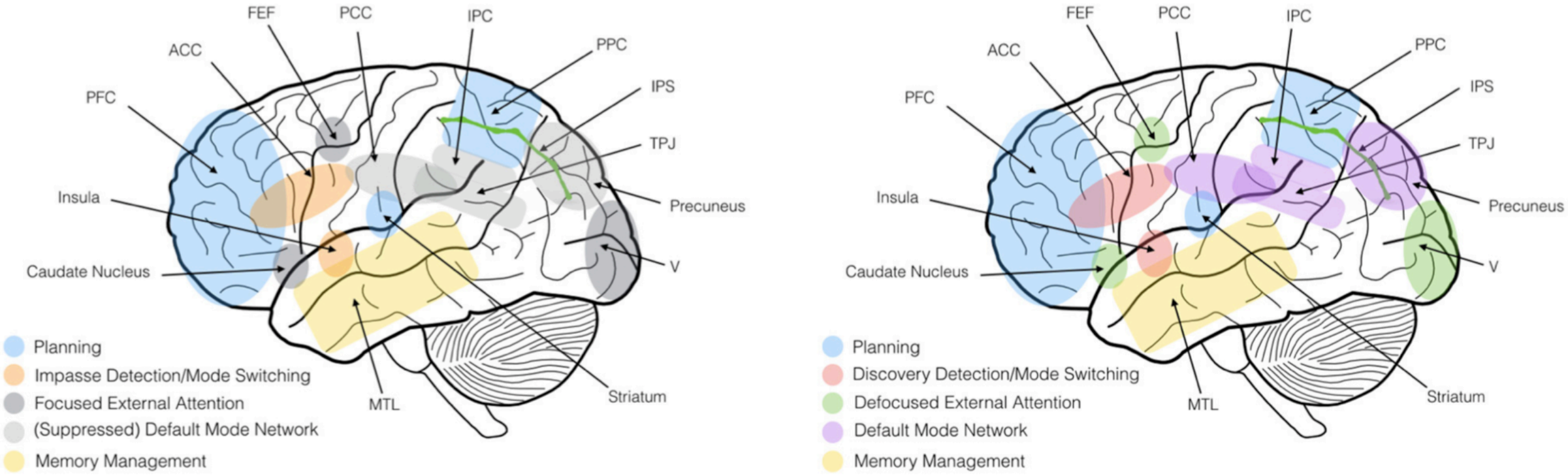
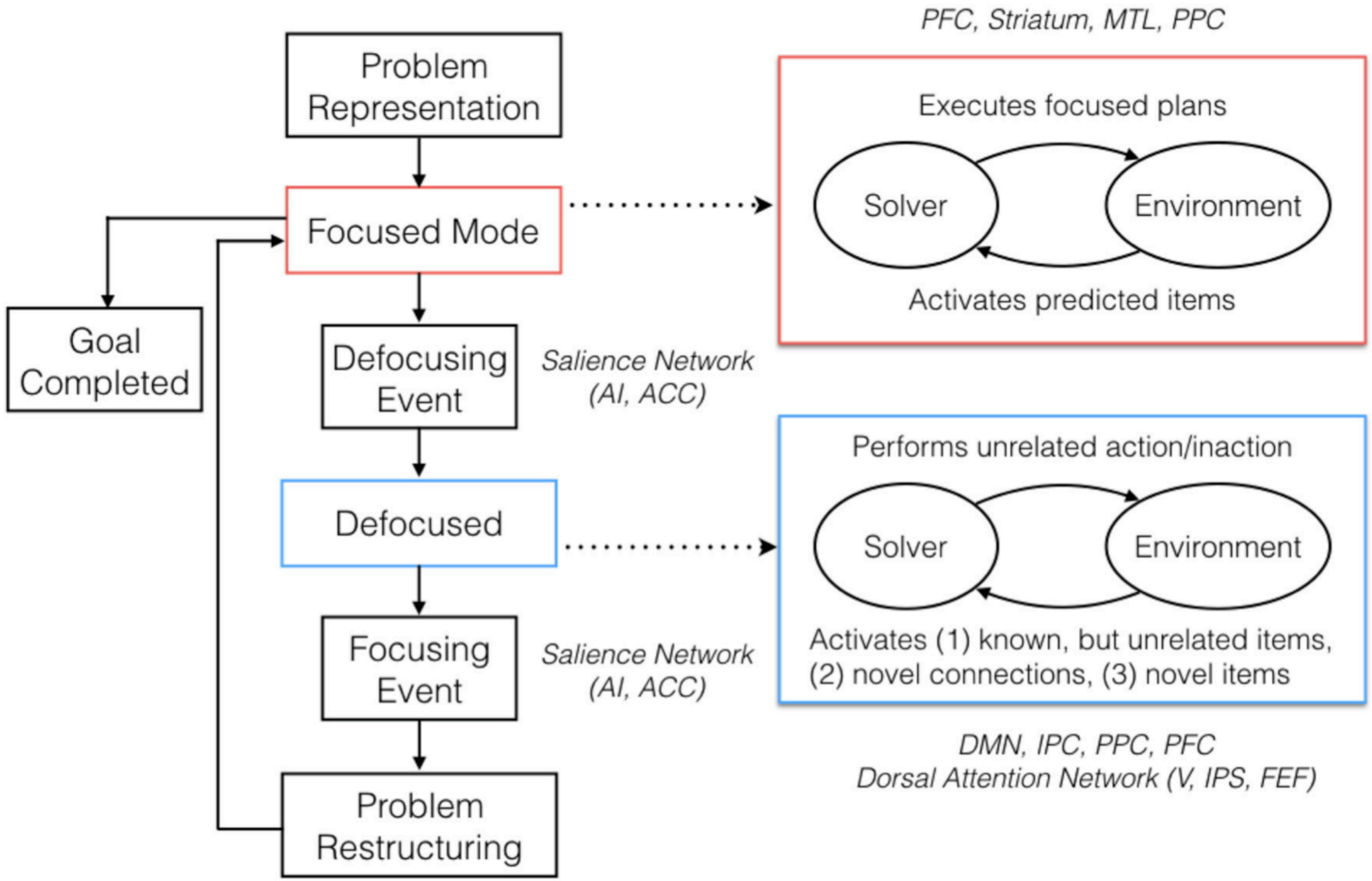
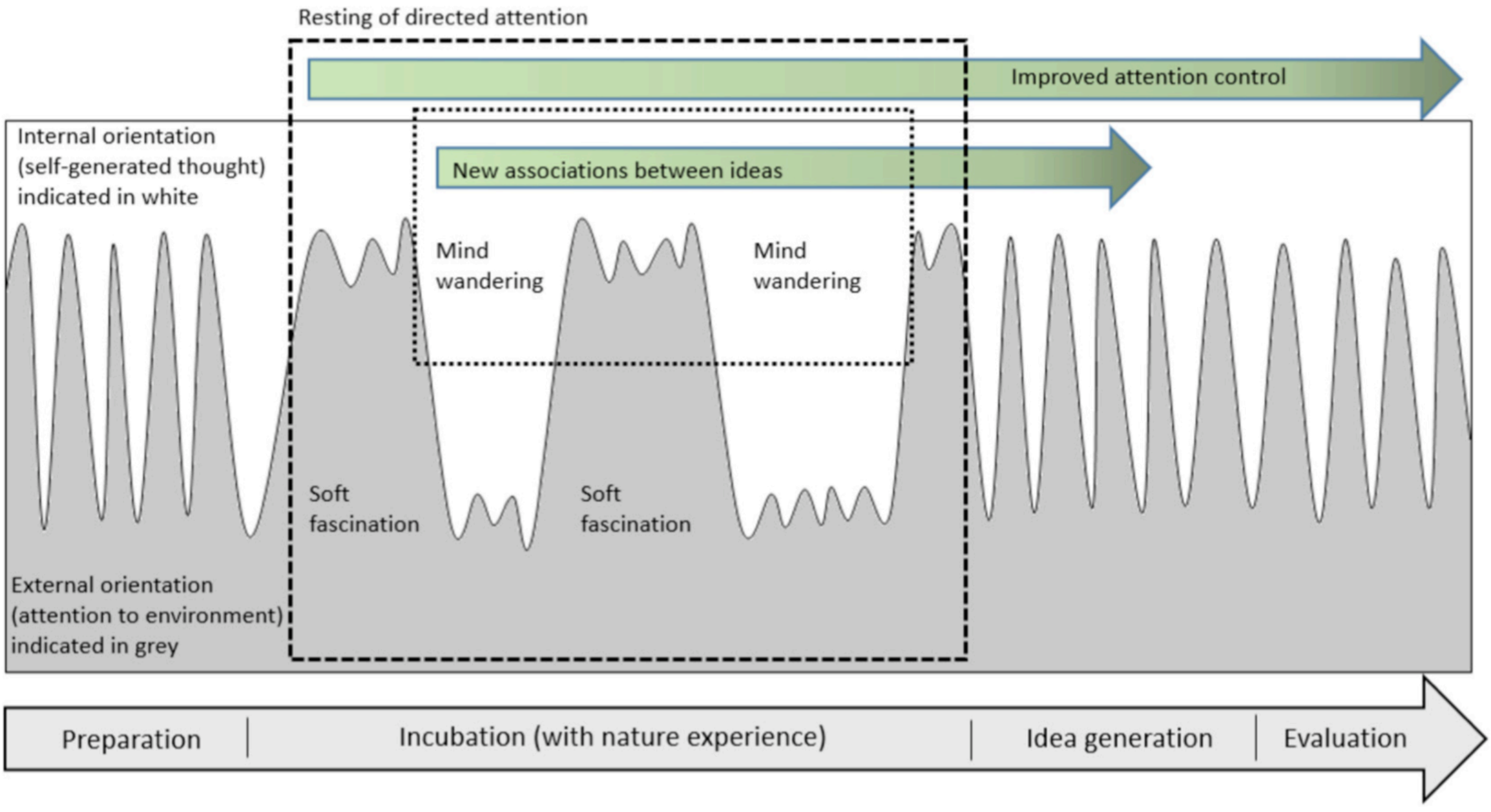


FIGURE 1 | Summary of neural activations during focused problem-solving **(Left)** and defocused problem-solving **(Right)**. During defocused problem-solving, the salience network (insula and ACC) coordinates the switching of several networks into a defocused attention mode that permits the reception of a more varied set of stimuli and interpretations via both the internally-guided networks (default mode network DMN) and externally guided networks (Attention). PFC, prefrontal cortex; ACC, anterior cingulate cortex; PCC, posterior cingulate cortex; IPC, inferior parietal cortex; PPC, posterior parietal cortex; IPS, intra-parietal sulcus; TPJ, temporoparietal junction; MTL, medial temporal lobe; FEF, frontal eye field.

Sarathy 2018



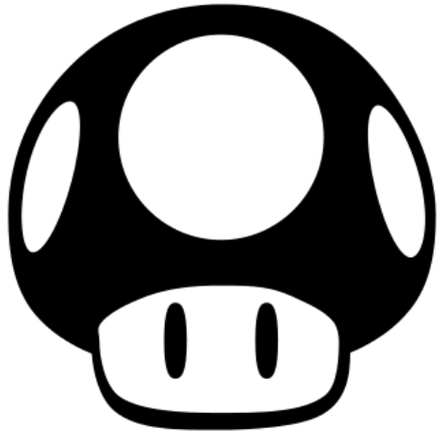
Sarathy 2018



Williams et al. 2018

implications

less-demanding **complexity** on cognition
reductions in top-down attentional **control**
evolutionary history & **refuge** effects
autonomic nervous system **tuning**



bonus items

mitigate onset of short-sightedness
increased fertility

how low can you go?

Fig. 1. Subjects filling in the questionnaires in Alppipuisto (urban park).

Fig. 3. Viewing session in Helsinki city centre.

vegging out sufficiency

tools

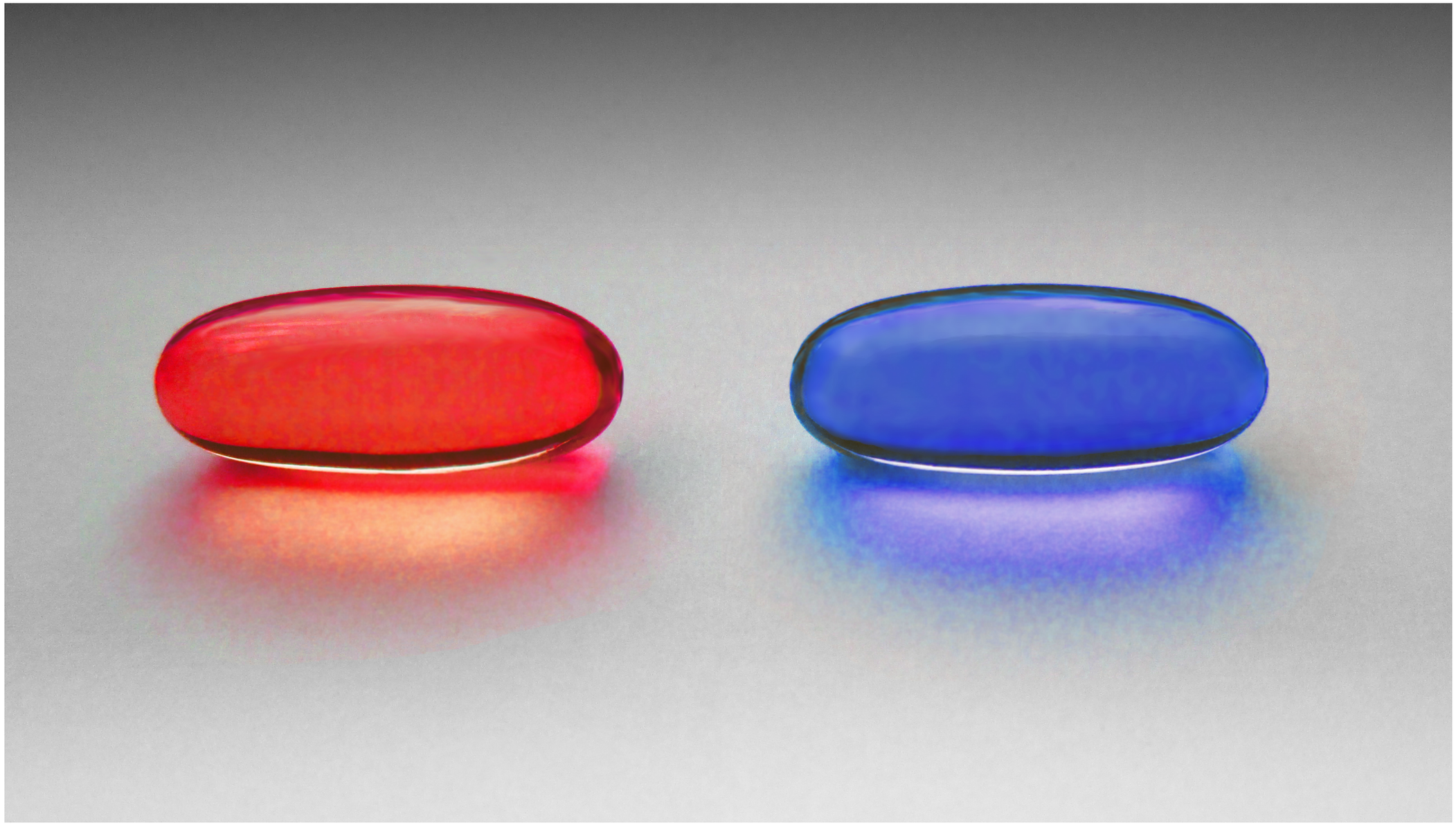
get outside
develop an environmental identity
photos, windows, views
use active interactions with nature
explore whatever natural elements are immediately present
walk and walking meetings
change your 'learning' environment
challenge or **risk** or **play outside**

25,782 participants benefitted from risky outdoor play

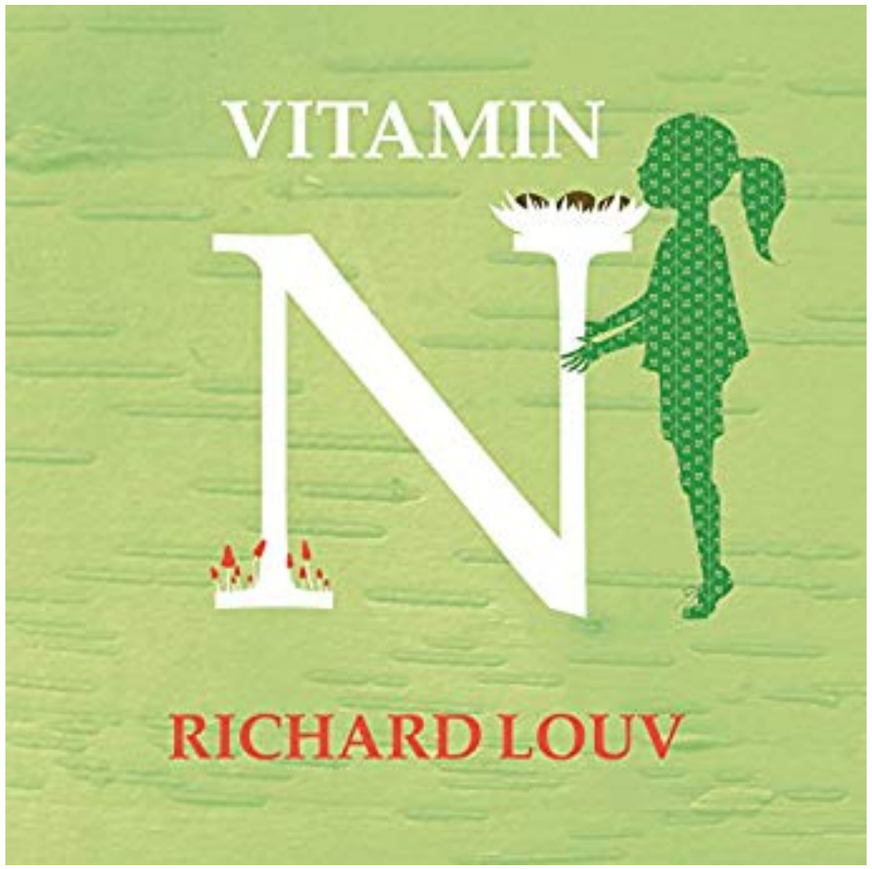
Table 1. Definitions used to guide the systematic review (risky play behaviours).

Risky Play Thrilling and exciting forms of play that involve a risk of physical injury. The risk can be real or perceived [7,14]		
Risky Play Categories [5,6]	**Definition**	**Examples**
Great heights	Danger of injury from falling	Climbing/jumping from surfaces, balancing/playing on high objects (e.g., playground equipment), hanging/swinging at great heights
High speed	Uncontrolled speed and pace that can lead to collision with something (or someone)	Swinging at high speed
Dangerous tools	Can lead to injuries and wounds	Cutting tools (e.g., knives, saws, or axes), strangling tools (e.g., ropes)
Dangerous elements	Where children can fall into or from something	Cliffs, water, fire pits, trees
Rough and Tumble Play	Where children can be harmed	Wrestling or play fighting with other children or parents
Disappear/get lost	Where children can disappear from the supervision of adults or get lost alone	Exploring alone, playing alone in unfamiliar environments, general independent mobility, or unsupervised play

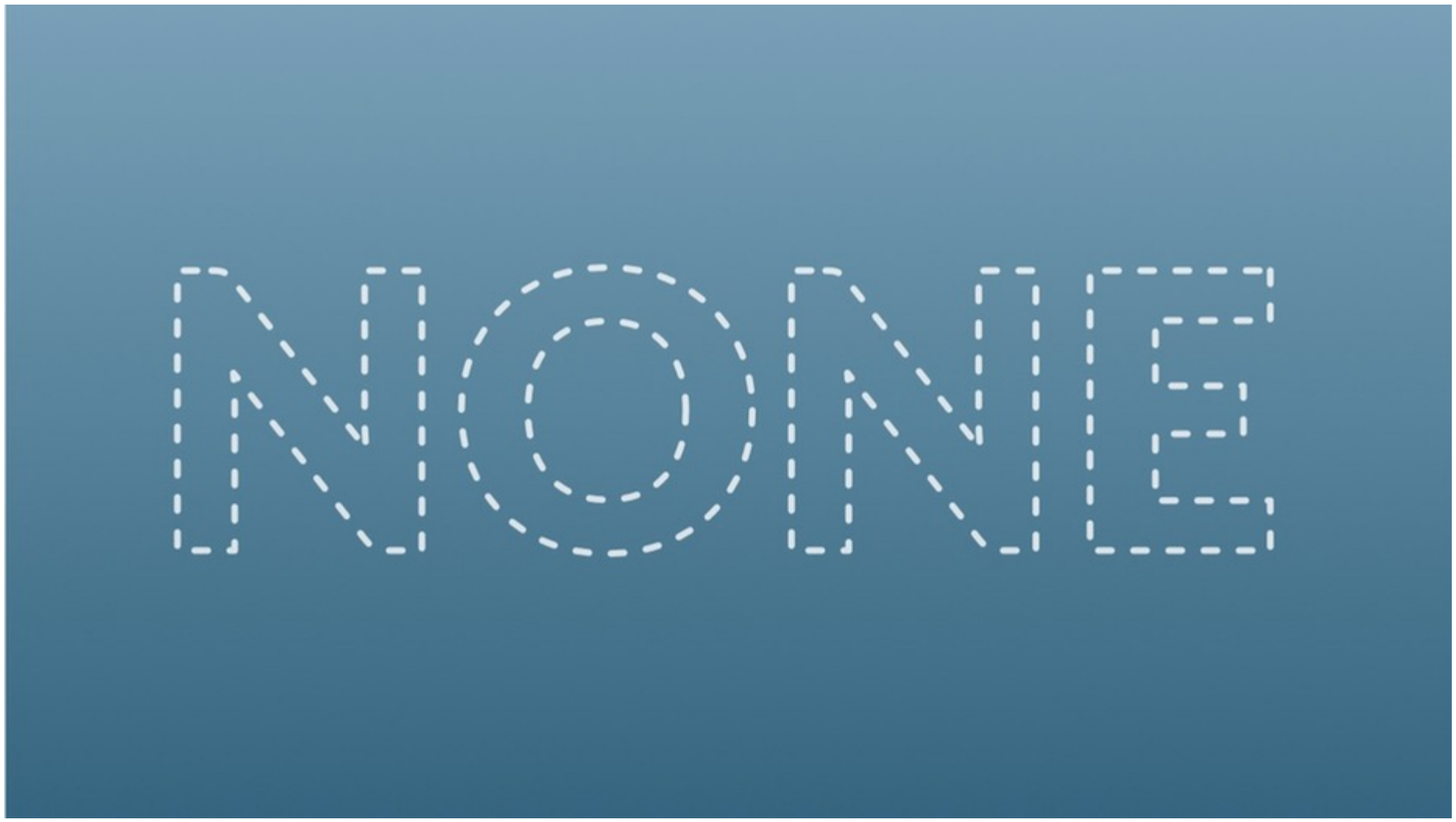
Brussoni et al. 2015



take the green pill



side effects



natural complexity
is the
answer