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Why is it so difficult to attend?: My view about what attention is and the cost of attending.

Juan Lupiáñez

*Departamento de Psicología Experimental, CIMCYC
Universidad de Granada (Spain)*



Attention:

Attention: “*mecanismo central de capacidad **limitada** cuya función primordial es **controlar** y **orientar** la actividad **consciente** del organismo de acuerdo con un **objetivo** determinado*” (Tudela, 1992, p.138)

Attention: "central **limited-capacity** mechanism whose primary function is to **control** and **orient** the **conscious** activity of an organism in pursuing a specific **goal**" (Tudela, 1992, p.138)

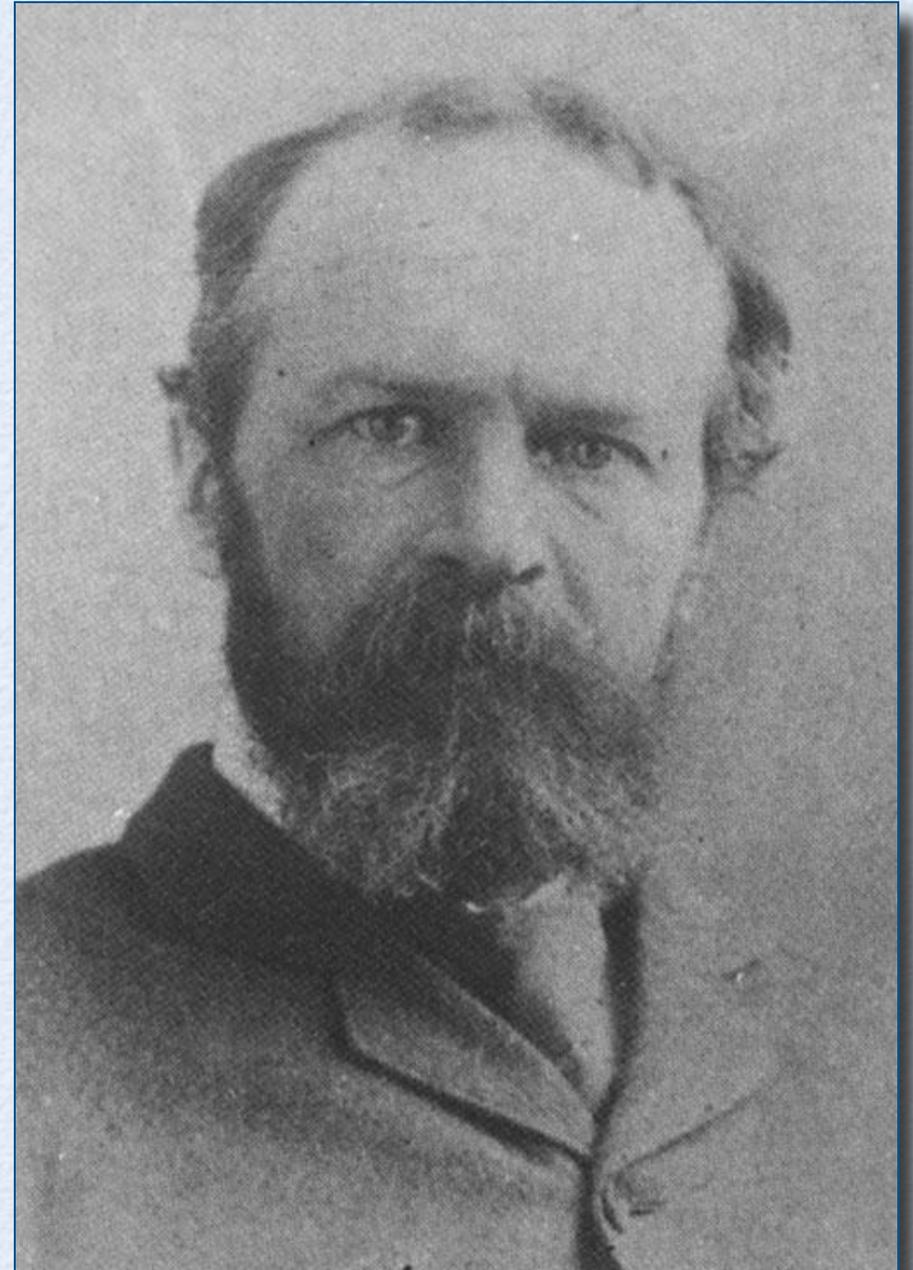
Selection (for a goal)
Control (voluntary)

Attention:

Selection

William James

*“Everyone knows what attention is. It is the taking possession by the mind in clear and vivid form, of **one** out **of** what seem **several** simultaneously possible objects or trains of thought...It implies withdrawal from some things in order to deal effectively with others,...” (James, 1890, p.403)*



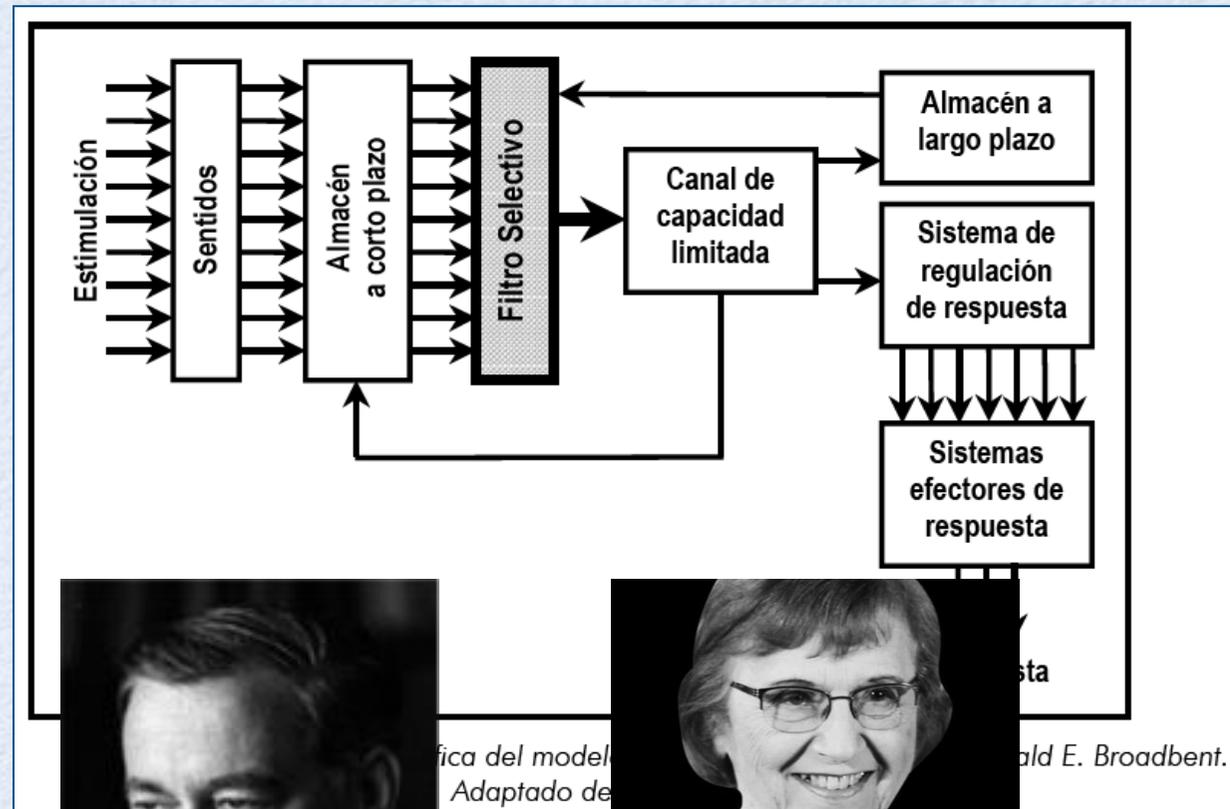
Attention:

William James

Broadbent and the filter models: The problem of **selection**

The energetic model of *Kahneman*: The problem of **resources** and its management

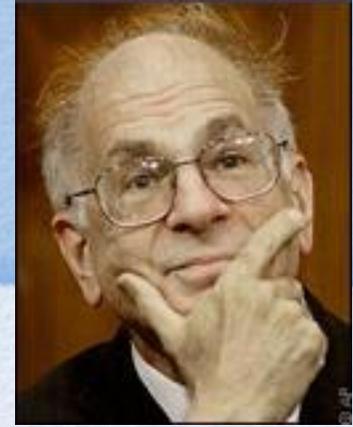
Norman & Shallice: The problem of **control**



Anne Treisman

early vs. **late** selection

Attention:

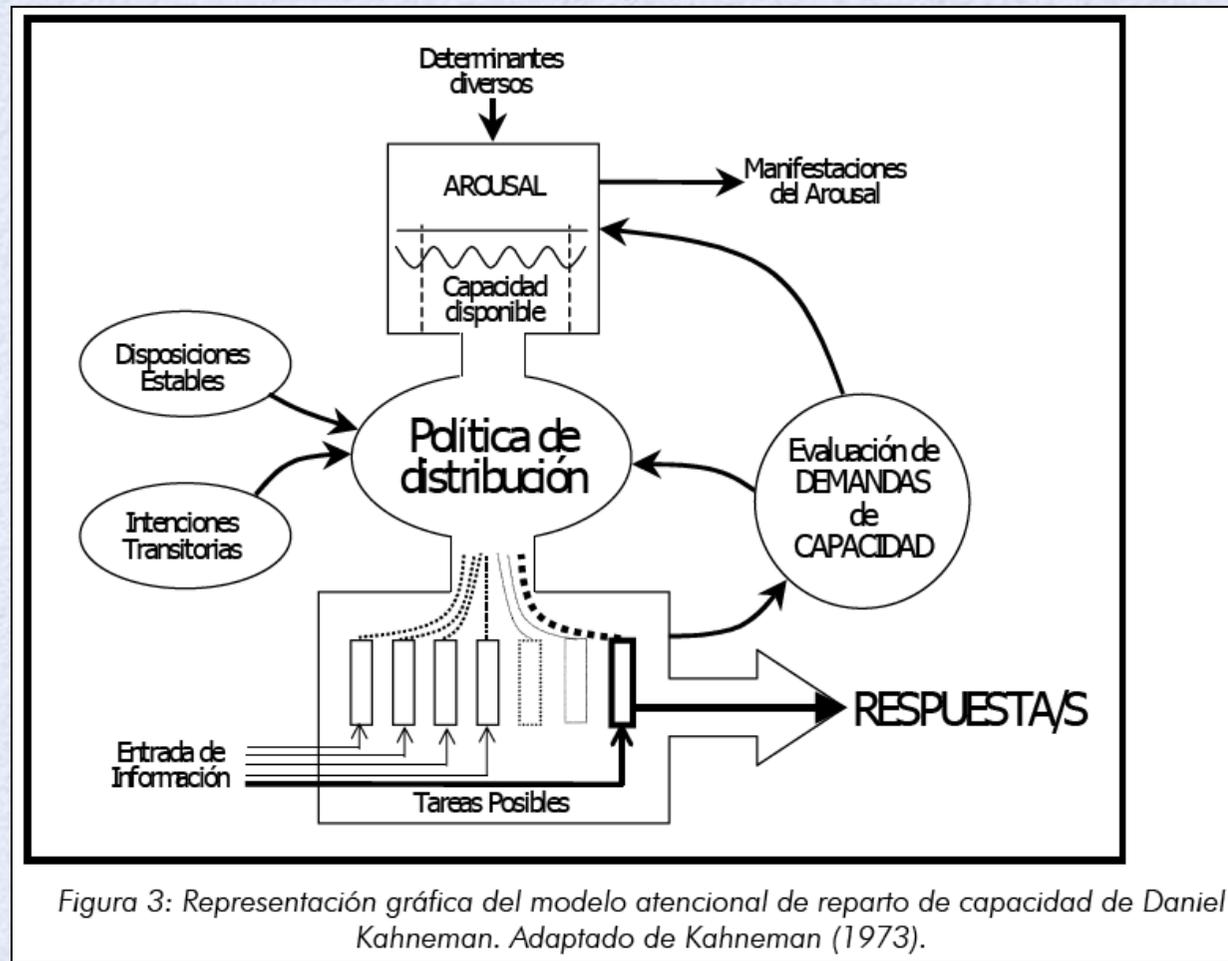


William James

Broadbent and the filter models: The problem of **selection**

The energetic model of *Kahneman*: The problem of **resources** and its management

Norman & Shallice: The problem of **control**



the problem of **capacity**

Attention:



William James

Broadbent and the filter models: The problem of **selection**

The energetic model of *Kahneman*: The problem of **resources** and its management

Norman & Shallice: The problem of **control**

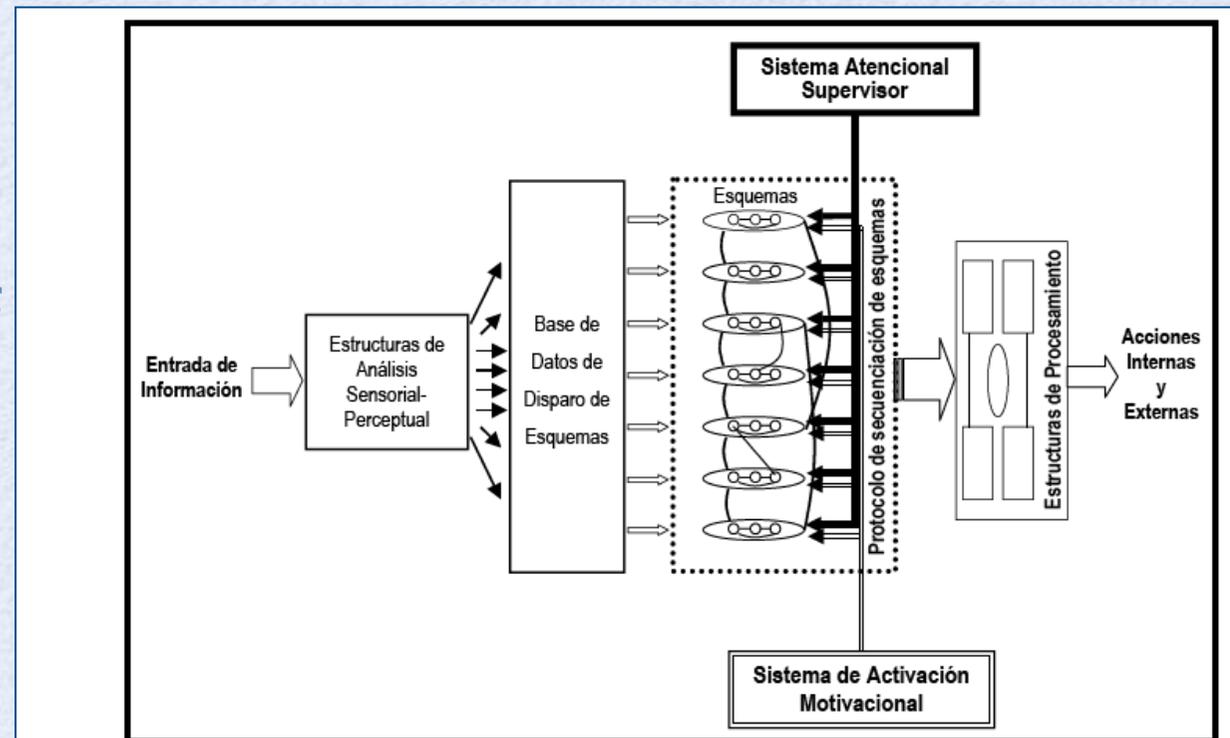


Figura 22: Representación gráfica del modelo de Norman y Shallice de control sobre la acción.

controlled vs. **automatic** processing

Attention: Three main PROBLEMS

- The problem of *selection* (early-late)
- The problem of *capacity/arousal* (allocation of resources in time)
- The problem of *control* (vs. automaticity)

“No one knows what attention is”

“... we challenge the usefulness of “attention” as a unitary construct and/or neural system [...] the concept has too many meanings to justify a single term...”

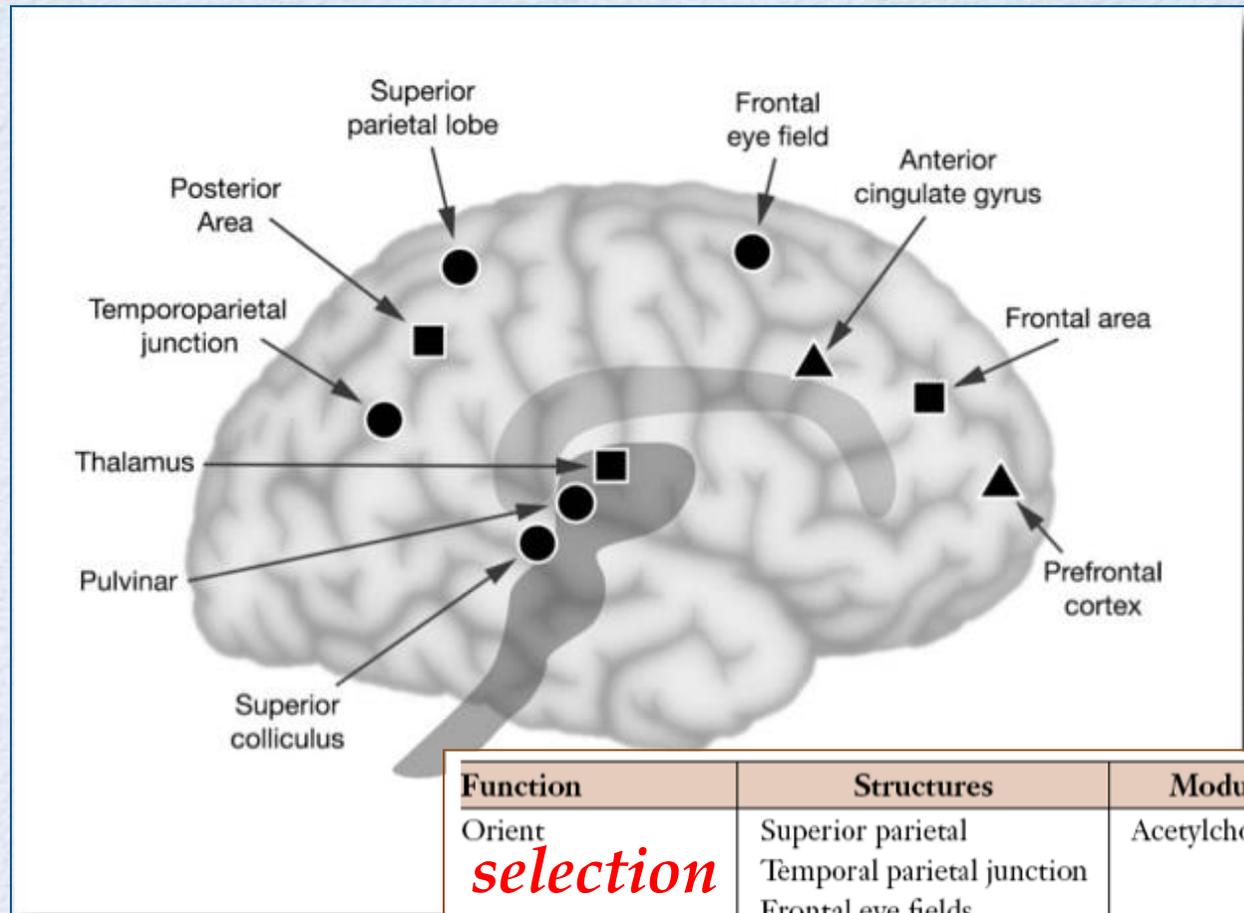
Hommel et al. (2019)



Posner's integrative model



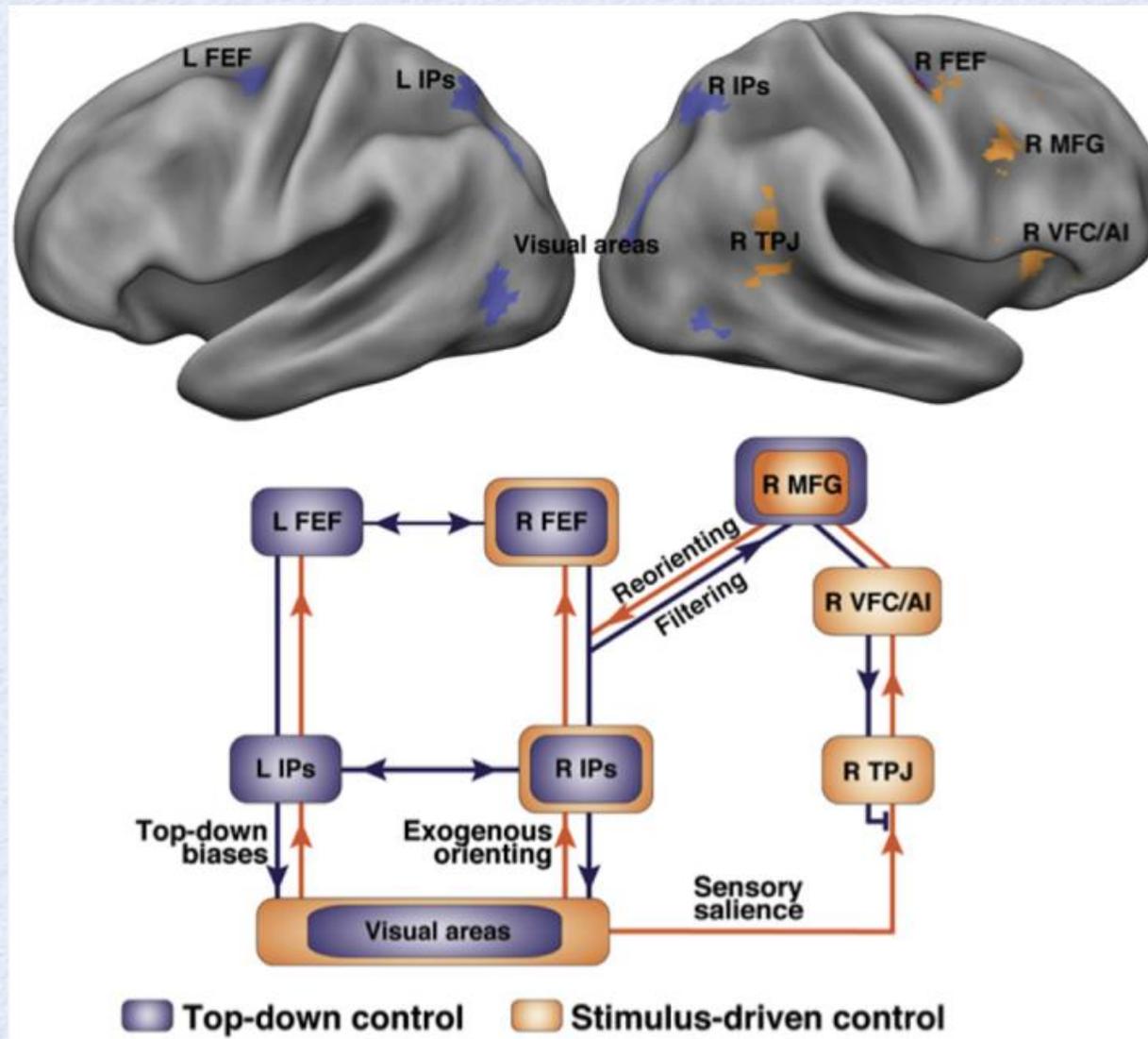
Michael Posner



Function	Structures	Modulator
Orient <i>selection</i>	Superior parietal Temporal parietal junction Frontal eye fields Superior colliculus	Acetylcholine
Alert <i>capacity</i>	Locus coeruleus Right frontal Parietal cortex	Norepinephrine
Executive attention <i>control</i>	Anterior cingulate Lateral ventral Prefrontal Basal ganglia	Dopamine

3 attentional functions
brain (neural basis)

Corbetta & Shulman: Two sources of control



Attention: 3 functions & 2 sources of control

control

		Voluntary (top down)	Involuntary (stimulus driven)
<i>selection</i>	<i>capacity</i> Activation / Alertness		
	<i>early</i> Selection / Orienting		
	Control <i>late</i>		

Attention: 3 functions & 2 sources of control

control

		Voluntary (top down)	Involuntary (stimulus driven)
<i>capacity</i> Activation / Alertness		Temporal Orienting Vigilance	Intensity, Reflex, Novelty, Sequential effects, Rhythms vs. unpredictability
<i>selection</i>	<i>early</i> Selection / Orienting		
	Control <i>late</i>		

Attention: 3 functions & 2 sources of control

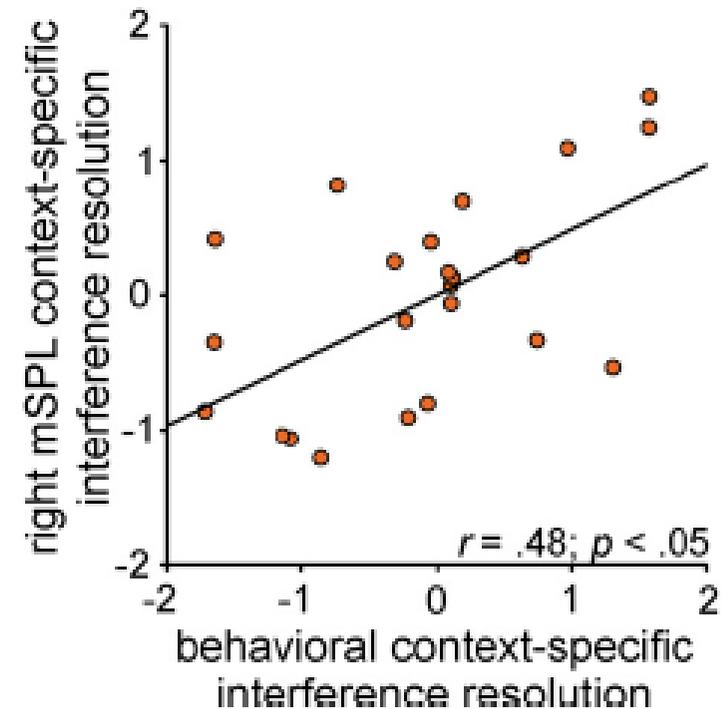
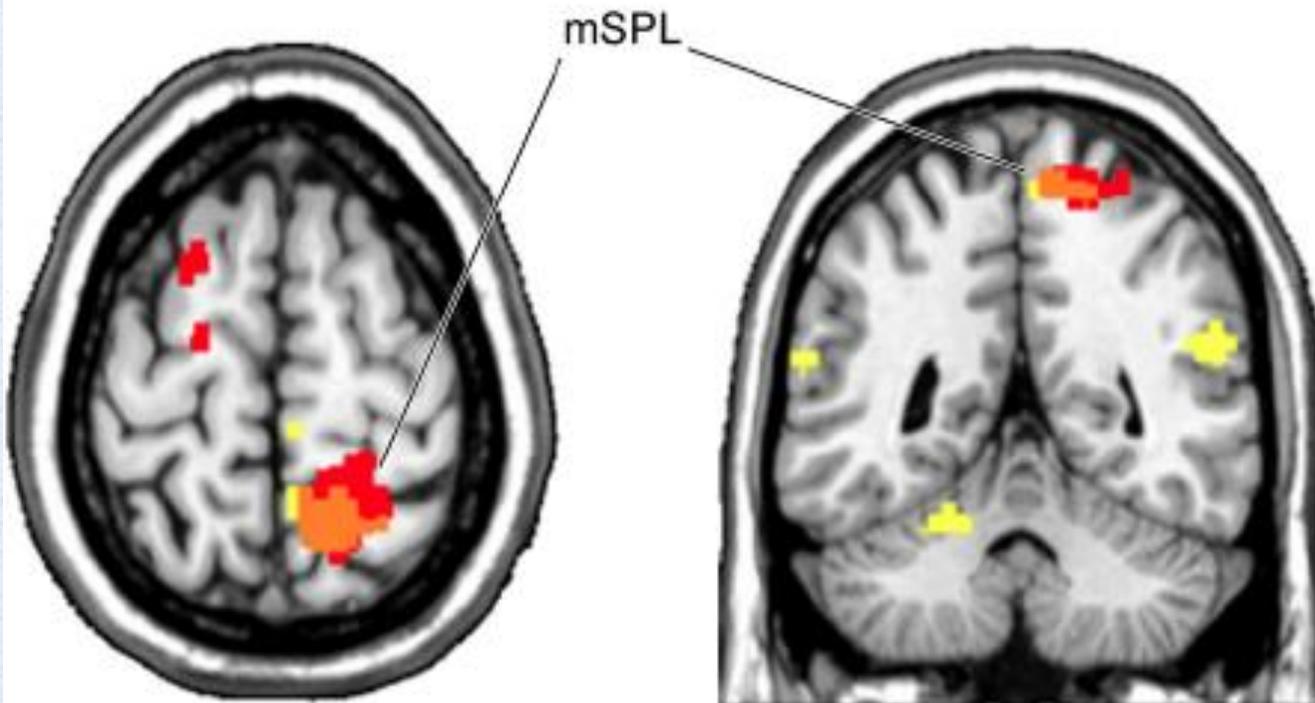
control

		Voluntary (top down)	Involuntary (stimulus driven)
<i>capacity</i> Activation / Alertness		Temporal Orienting Vigilance	Intensity, Reflex, Novelty, Sequential effects, Rhythms vs. unpredictability
<i>selection</i>	<i>early</i> Selection / Orienting	Symbolic informative cueing	Peripheral cue, Arrows, Gaze, Unconscious Expectancies, Sequential effects, Context cuing, Learned value, Selection History...
	Control <i>late</i>		

Cognitive Control: Voluntary vs. Involuntary

Priming of Control: Impaired Attentional Set

Joseph A. King, Franziska M. Korb, and Tobias
Center for Cognitive Neuroscience, Duke University, Durham



Attention: Bifunctional & 2 sources of control

Voluntary control is not the default
Why is it so powerful? Why is it limited?

		<i>control</i>	
		Voluntary (top down)	Involuntary (stimulus driven)
<i>selection</i>	<i>capacity</i> Activation / Alertness	Temporal Orienting Vigilance	Intensity, Reflex, Novelty, Sequential effects, Rhythms, predictability
	<i>early</i> Selection / Orienting	Symbolic informative cueing	Peripheral cue, Arrows, Gaze, Unconscious Expectancies, Sequential effects, Context, Learned value, Selection History...
	<i>late</i> Control	Proactive, effortful, Control	Reactive Control, Sequential effects, Context specific effects

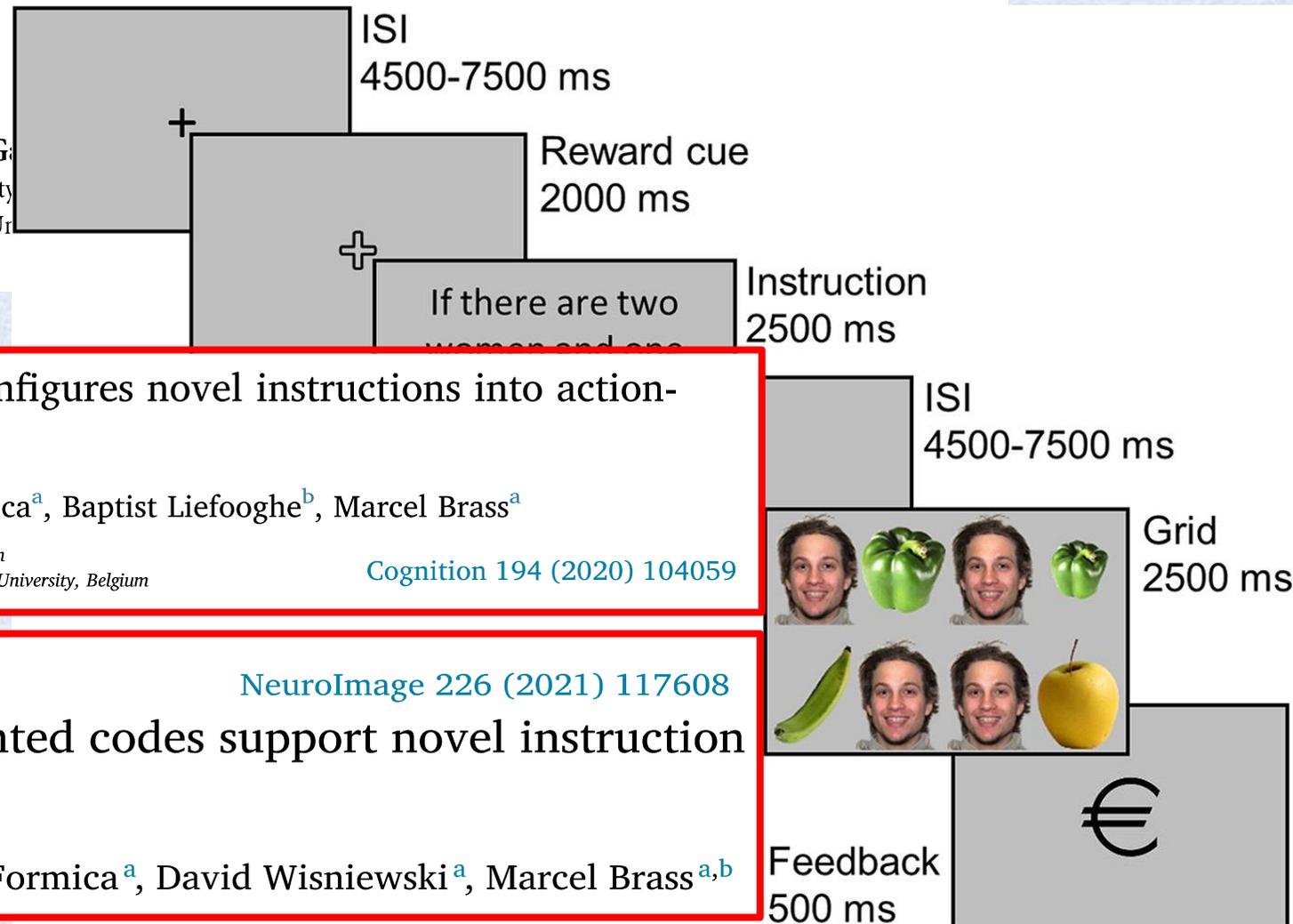
Voluntary control

✓ What is the **power** of cognitive control?

Representational Organization of Novel Task Sets during Proactive Encoding

Ana F. Palenciano,¹ Carlos González-García^{1,2}

¹Mind, Brain, and Behavior Research Center, University of Ghent, Ghent, Belgium, and ²Psychology Department, University of Ghent, Ghent, Belgium



Attentional prioritization reconfigures novel instructions into action-oriented task sets

Carlos González-García^{a,*}, Silvia Formica^a, Baptist Liefoghe^b, Marcel Brass^a

^a Department of Experimental Psychology, Ghent University, Belgium

^b Department of Experimental-Clinical & Health Psychology, Ghent University, Belgium

[Cognition 194 \(2020\) 104059](#)

[NeuroImage 226 \(2021\) 117608](#)

Frontoparietal action-oriented codes support novel instruction implementation

Carlos González-García^{a,*}, Silvia Formica^a, David Wisniewski^a, Marcel Brass^{a,b}

Voluntary control

- ✓ What is the **power** of cognitive control?
- ✓ Why is it **difficult** (capacity; ability)? Where do **limitations** come from?
 - Resources??? The **virtue/problem** of shared representations (Musslick & Cohen, 2021).

The Bitter Truth About Sugar and Willpower: The Limited Evidential Value of the Glucose Model of Ego Depletion



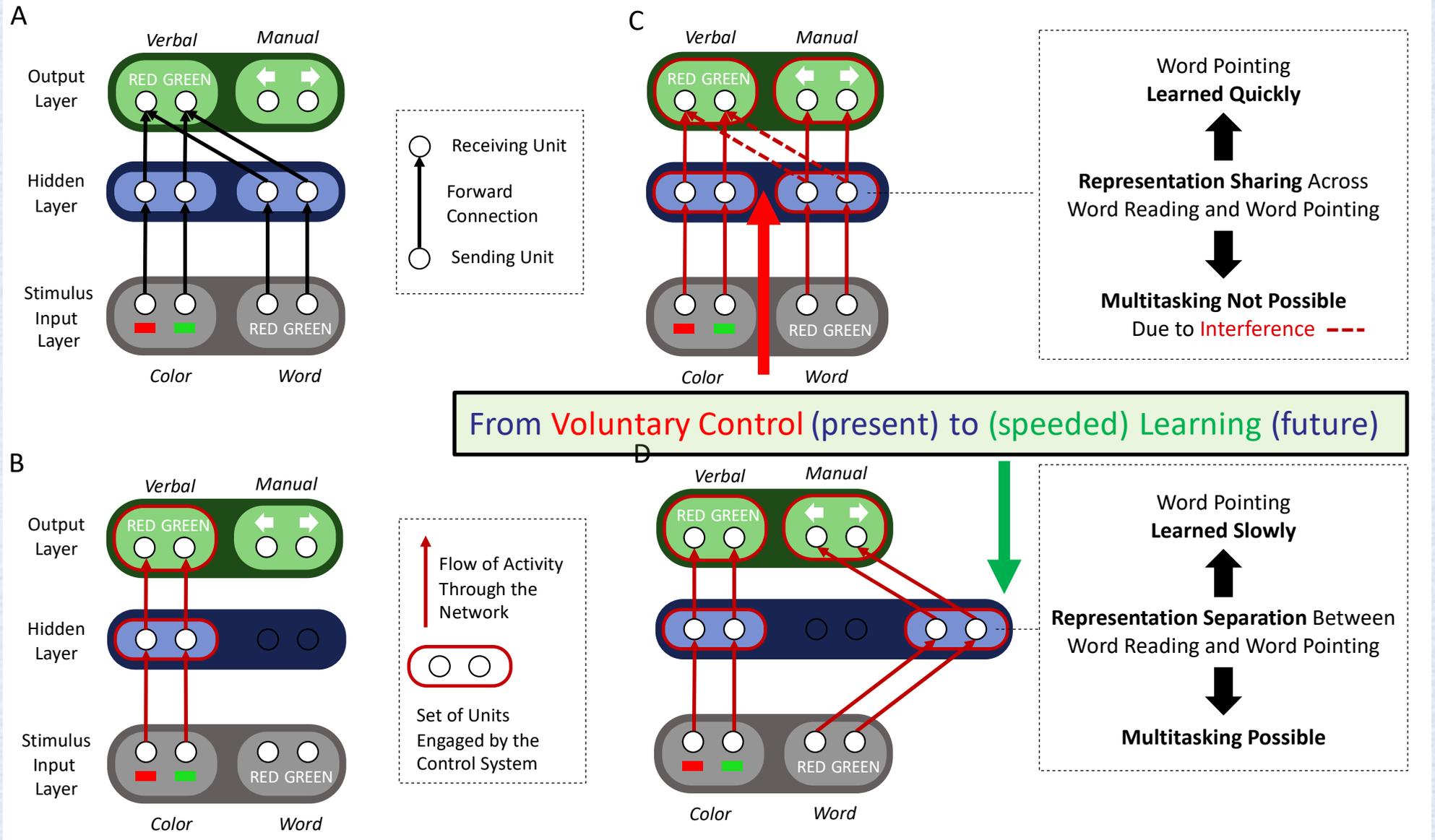
Miguel A. Vadillo¹, Natalie Gold², and Magda Osman³

¹Department of Primary Care and Public Health Sciences, King's College London; ²Department of Philosophy, King's College London; and ³Biological and Experimental Psychology Group, School of Biological and Chemical Sciences, Queen Mary University of London

Psychological Science
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Cognitive Control over Shared representations: Processing Efficiency ↓ Learning Efficacy ↑

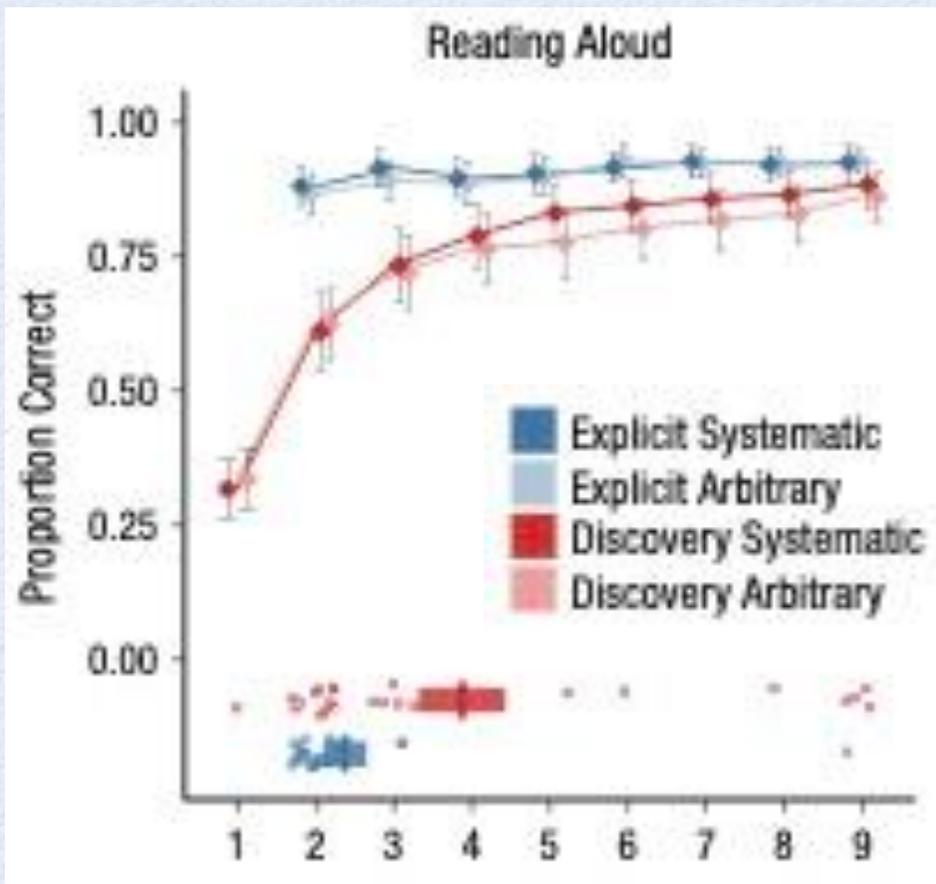


Attention and Learning / Memory

The Dramatic Impact of Explicit Instruction on Learning to Read in a New Writing System



Kathleen Rastle¹, Clare Lally¹, Matthew H. Davis², and J. S. H. Taylor³



Psychological Science, 2021

- ✓ Attention guide learning
- ✓ Memory of **learnt selection** guide Attention (S-R bindings—Hommel-; Selection history/Learnt Value—Theeuwes-; retrieval of inhibited states—Tipper-; Context-Specific attention—Milliken-)

	Voluntary (top down)	Involuntary (stimulus driven)
<i>capacity</i> Activation / Alertness	Tem... ting	Intensity, Reflex, Novelty, Sequential effects, Rhythms, pre... ability
<i>early</i> Selection / Orienting	Info... ing	Peripheral... arrows, Gaze, U... conscious Expectar... sequential effects... text, Learned value... ion History...
<i>late</i> Control	Proactiv... Control	Re... ve Control, Sequential effects, Context specific effects

Interference

Automatization

Flexibility & Efficiency (now)

Voluntary control

- ✓ What is the **power** of cognitive control?
- ✓ Why is it **difficult** (capacity; ability)? Where do **limitations** come from?
 - Resources??? The **virtue/problem** of shared representations (Musslick & Cohen, 2021).
 - Poor processing efficiency / **Learning Efficacy**
- ✓ Why is it **aversive**?

Emotional foundations of cognitive control

Michael Inzlicht^{1,2}, Bruce D. Bartholow³, and Jacob B. Hirsh²

✓ Cognitive control may be inherently costly or aversive

		<i>control</i>	
		Voluntary (top down)	Involuntary (stimulus driven)
<i>capacity</i> Activation / Alertness	Tem	ing	Intensity, Reflex, Novelty, Sequential, Rhythms, Stability
<i>early</i> Selection / Orienting	info	ing	Peripheral, Gaze, Expect, val, learned
<i>late</i> Control	Proactiv	Control	Context specific effects

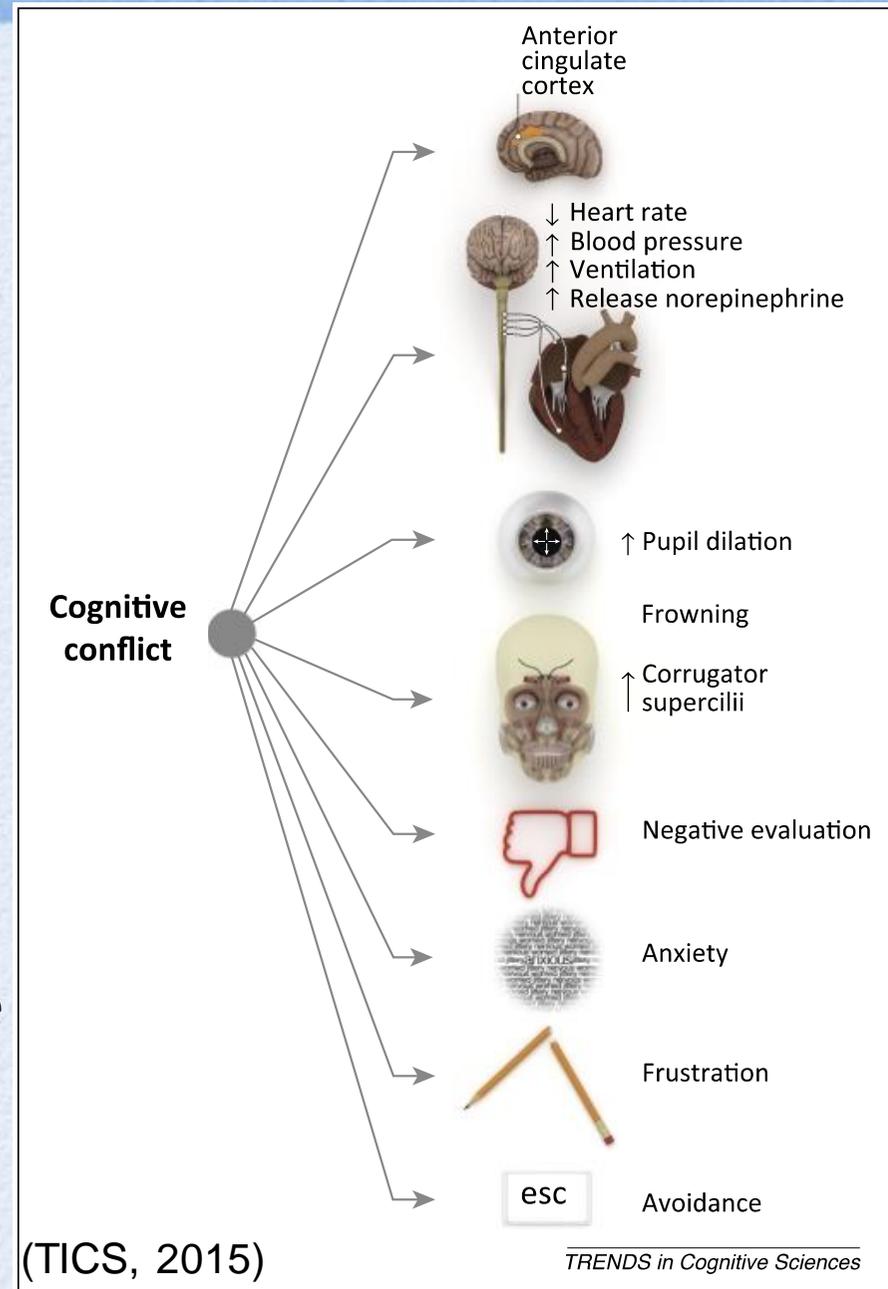
Interference

Automatization

Distraction

✓ The cost of being a human being, of having a body to keep alive: **Distraction** keeps us hooked to the **present**, to achieve this goal.

✓ Allocation of Cognitive control (adaptation to the **future**) needs to be motivated (Botvinick & Braver, 2015)



Excessive attentional focus might not be adaptative

Psychological Research (2021) 85:1–19
<https://doi.org/10.1007/s00426-019-01245-8>

REVIEW



Hyperfocus: the forgotten frontier of attention

Brandon K. Ashinoff^{1,3}  · Ahmad Abu-Akel²

Received: 24 January 2019 / Accepted: 9 September 2019 / Published online: 20 September 2019
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Abstract

‘Hyperfocus’ is a phenomenon that reflects one’s complete absorption in a task, to a point where a person appears to completely ignore or ‘tune out’ everything else. Hyperfocus is most often mentioned in the context of autism, schizophrenia, and attention deficit hyperactivity disorder, but research into its effect on cognitive and neural functioning is limited. We propose that hyperfocus is a critically important aspect of cognition, particularly with regard to clinical populations, and that it warrants significant investigation. Hyperfocus, though ostensibly self-explanatory, is poorly defined within the literature. In many cases, hyperfocus goes undefined, relying on the assumption that the reader inherently knows what it entails. Thus, there is no single consensus to what constitutes hyperfocus. Moreover, some studies do not refer to hyperfocus by name, but describe processes that may be related. In this paper, we review how hyperfocus (as well as possibly related phenomena) has been defined and measured, the challenges associated with hyperfocus research, and assess how hyperfocus affects both neurotypical and clinical populations. Using this foundation, we provide constructive criticism about previously used methods and analyses. We also propose an operational definition of hyperfocus for researchers to use moving forward.

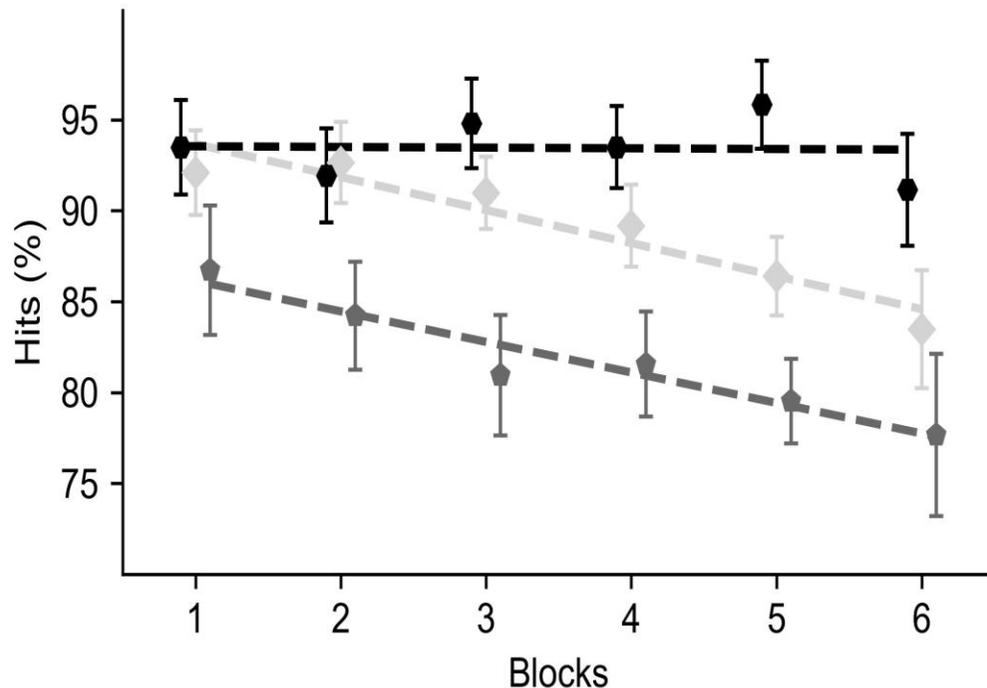
Voluntary control

- ✓ What is the **power** of cognitive control?
- ✓ Why is it **difficult** (capacity; ability)? Where do **limitations** come from?
 - Resources??? The **virtue/problem** of shared representations (Musslick & Cohen, 2021).
 - Poor processing efficiency / **Learning Efficacy**
- ✓ Why is it **aversive** ? The cost of Voluntary Control:
 - It means **dis-adaptation** from the present (to adapt to the future) (motivation).

Vigilance decrement:

(Luna, Barttfeld, Martín-Arévalo & Lupianez, 2021); ANTI-Vea task - <https://www.ugr.es/~neurocog/ANTI/>

Executive Vigilance decrement



- The cost of sustaining attention when it is perceived as unnecessary
- Resource depletion?
- Less decrement by dual tasking.
- Motivational factors related to the decrease in Cognitive Control across time (Thomson, Besner & Smilek, 2015).



◆ EV single

● Dual task

◆ Triple task

Cognitive control (future) must be worth allocating (Botvinick & Braver, 2015); otherwise the mind go into **automaticity** or **distraction (present)**; in the presence of potentially relevant stimuli), or fall into **mindwandering (default state)**; in the absence of stimulation).

Voluntary control: Being able to wait for a future reward



But not satisfying **immediate needs!!!**



the self-imposed delay paradigm (e.g., Mischel, Ebbesen, & Zeiss, 1972) were described more than 10 years later by their parents as adolescents who were significantly more competent (Mischel, Shoda, & Peake, 1988). Specifically, when these children became adolescents, their parents rated them as more academically and socially competent, verbally fluent, rational, attentive, planful, and able to deal well with frustration and stress. The study suggested that long-term prediction may be

In the present study, we attempted to identify the particular psychological conditions in which children's delay of gratification behavior is more likely to predict relevant individual differences in developmental outcomes. The identification of these conditions, which may be considered "diagnostic" (Quattrone & Tversky, 1984; Tversky & Hutchinson, 1986), is derived directly from the theoretical and experimental analyses of the cognitive-attentional delay (e.g., Mischel, 1972). The present study almost doubled the follow-up wave also

Preparation of this article and the research were supported in part by Grants MH45994 and MH39349 to Walter Mischel from the National Institute of Mental Health. We are grateful to Antonette Zeiss for her role in facilitating the

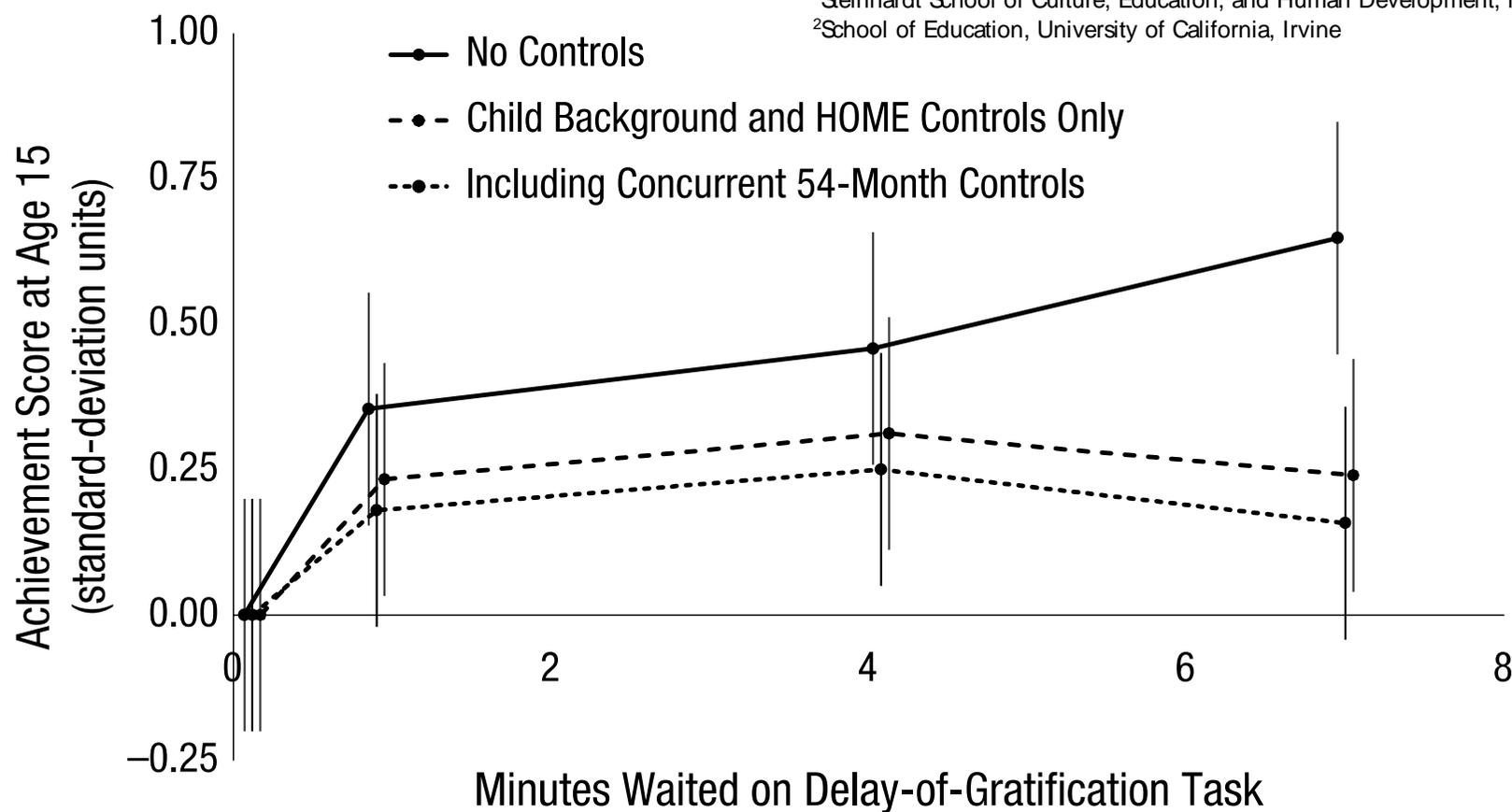
Revisiting the Marshmallow Test: A Conceptual Replication Investigating Links Between Early Delay of Gratification and Later Outcomes



Tyler W. Watts¹, Greg J. Duncan², and Haonan Quan²

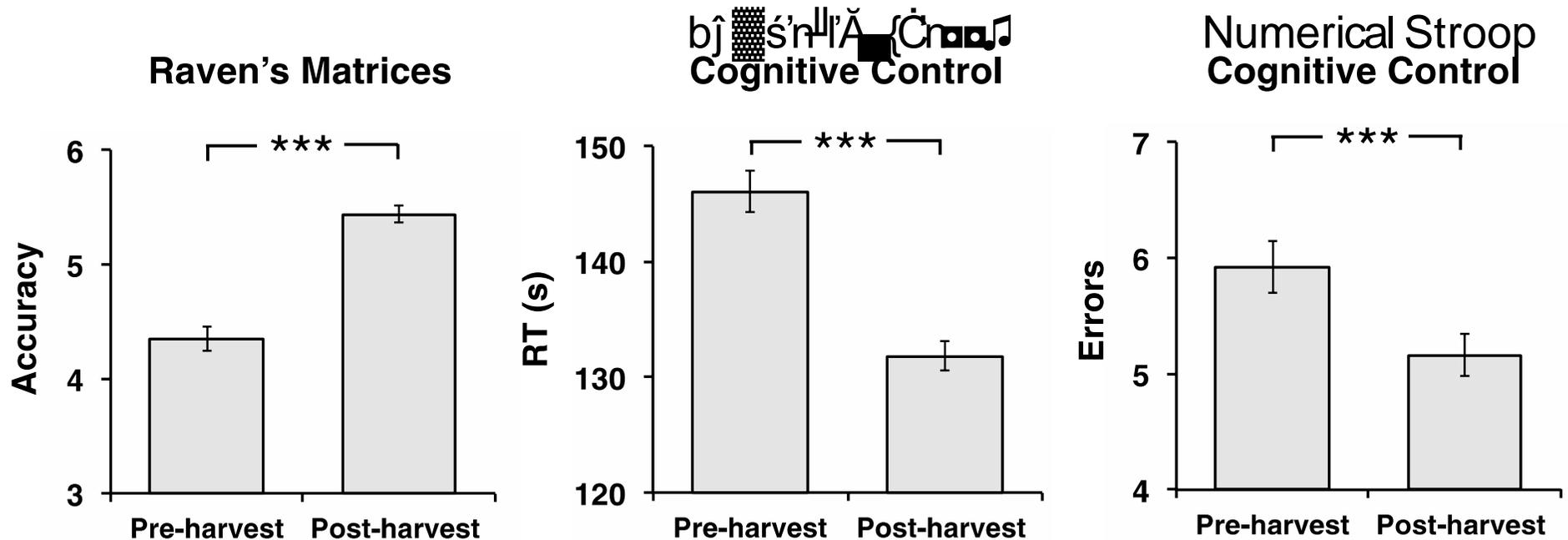
¹Steinhardt School of Culture, Education, and Human Development, New York University, and

²School of Education, University of California, Irvine



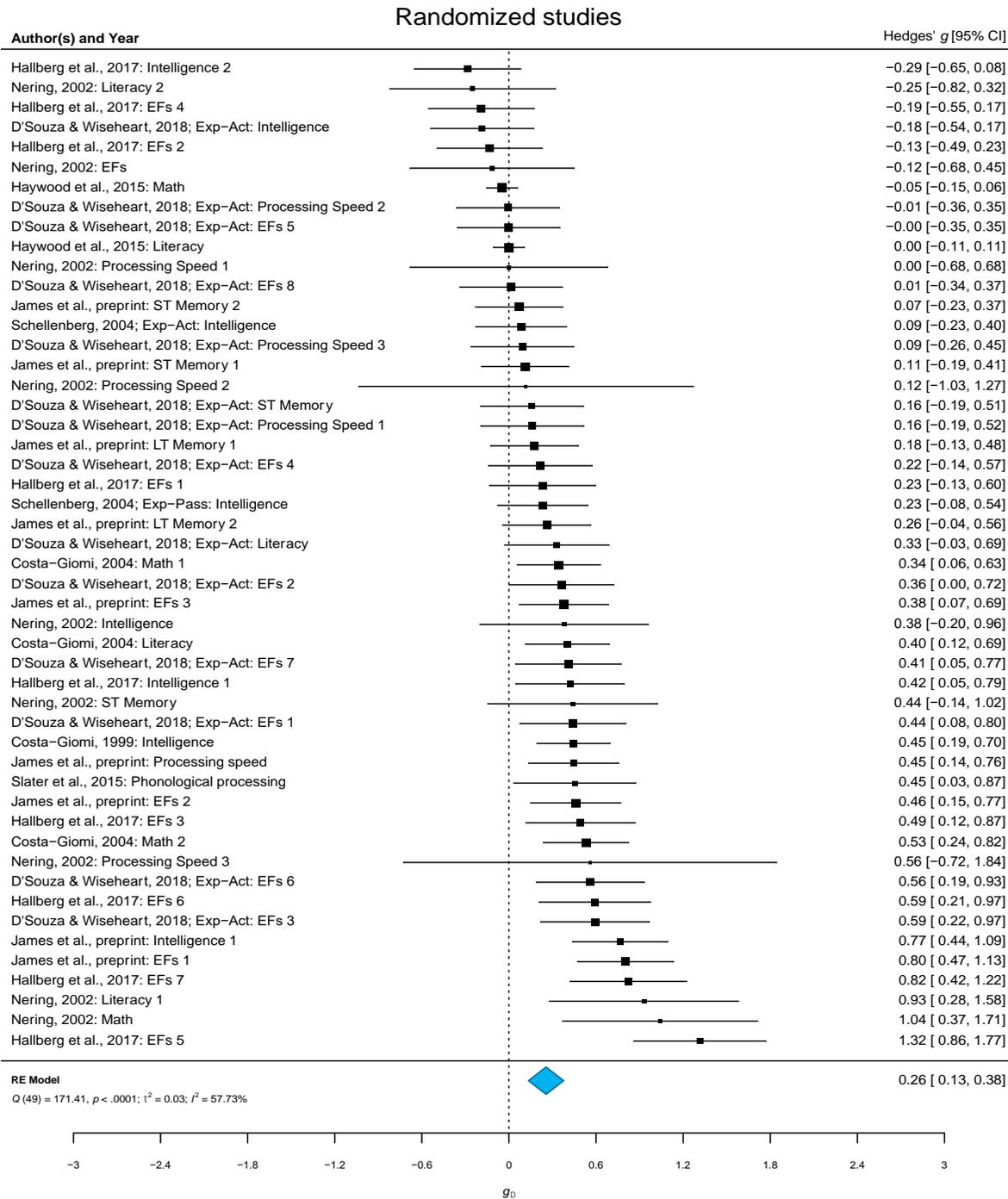
Poverty Impedes Cognitive Function

Anandi Mani,¹ Sendhil Mullainathan,^{2*} Eldar Shafir,^{3*} Jiaying Zhao⁴



- Worries about problems (needs) due to scarcity consumes resources (Mani et al.)
- **Or may be:** Scarcity makes the present most relevant (immediate needs). Reduced motivation about the future (reduced motivation to allocate Cognitive Control).

Training Cognitive Control:



- Near vs. **Far** transfer.
- Current discussion (Sala & Gobet, 2018; Stojanoski, ... & Owen, 2020)
- Training the **ability** of Cognitive Control vs. training to **use** Cognitive Control to achieve long term goals.
- Cognitive Training: Training the Cognitive Control **skill** (to reduce interference)
- More holistic training (musical, sport, structured training): Training (also) on the **use** of Cognitive Control to achieve long-term goals
- The BEST training is **LIFE**, a well structured life

Román-Caballero, Vadillo, Trainor & Lupianez. (under review). Please don't stop the music. A meta-analysis of the benefits of learning to play an instrument on cognitive and academic skills

To summarize

Attention = Selection (in time, in perception & action)

Under Involuntary vs. Voluntary control (equilibrium)

Voluntary control is **difficult**: efficient in guiding learning (for future adaptation; through automatization)

With large **interference** at present (inefficient processing)

Voluntary control is **aversive**: tradeoff...

- Adaptation to the future

- Dis-adaptation from the present (**distraction**)

"enemies" of
focused attention

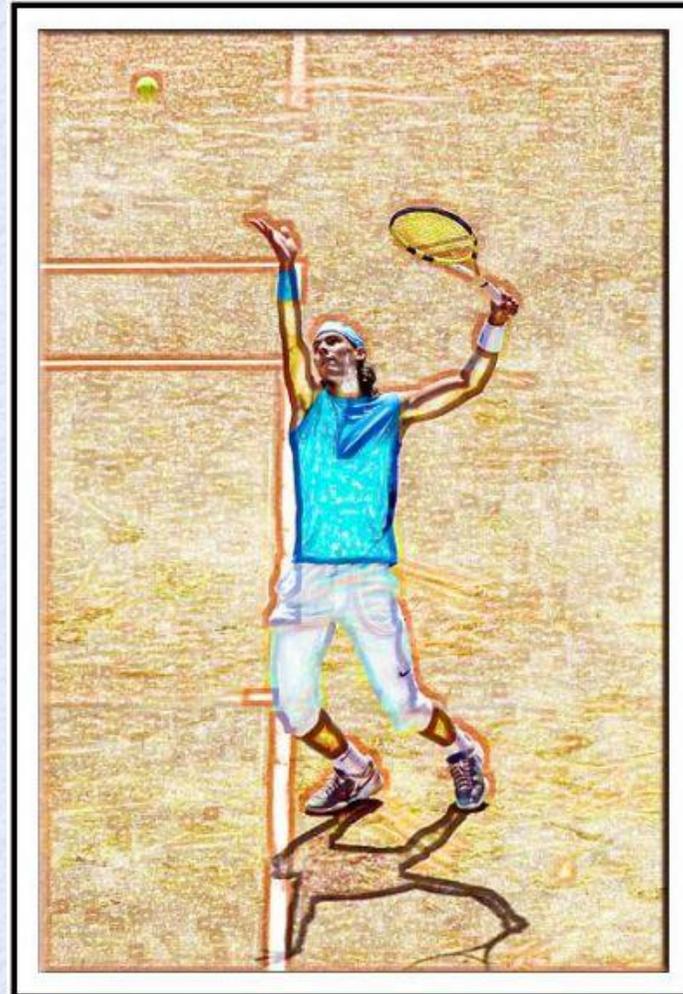
Does not seem a question of energy consumption (resources), but of **motivation** (Botvinick & Braver, 2015)

Poverty/insecurity (distraction reduced motivation for focused attention)

Training: **attentional capacity** (to deal with interference) vs. training attentional **attitude** (motivation) to deal with distraction & automatic (by default) behavior

using voluntary attention to train **automatic control**

Controlling **distraction**
must be worth



training voluntary attention (capacity and attitude, disposition)



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training voluntary attention (**capacity** and attitude, **disposition**)



- Ultimately, **Distraction** needs to be managed (not just avoided)
- Not all environments are worth waiting

*"Si ves a un hambriento
no le des arroz, enséñale
a cultivarlo"*

(Confucio)



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de Granada

Thanks !!

व्या [j]ल्लAşū

*Departamento de Psicología Experimental, CIMCYC
Universidad de Granada (Spain)*

