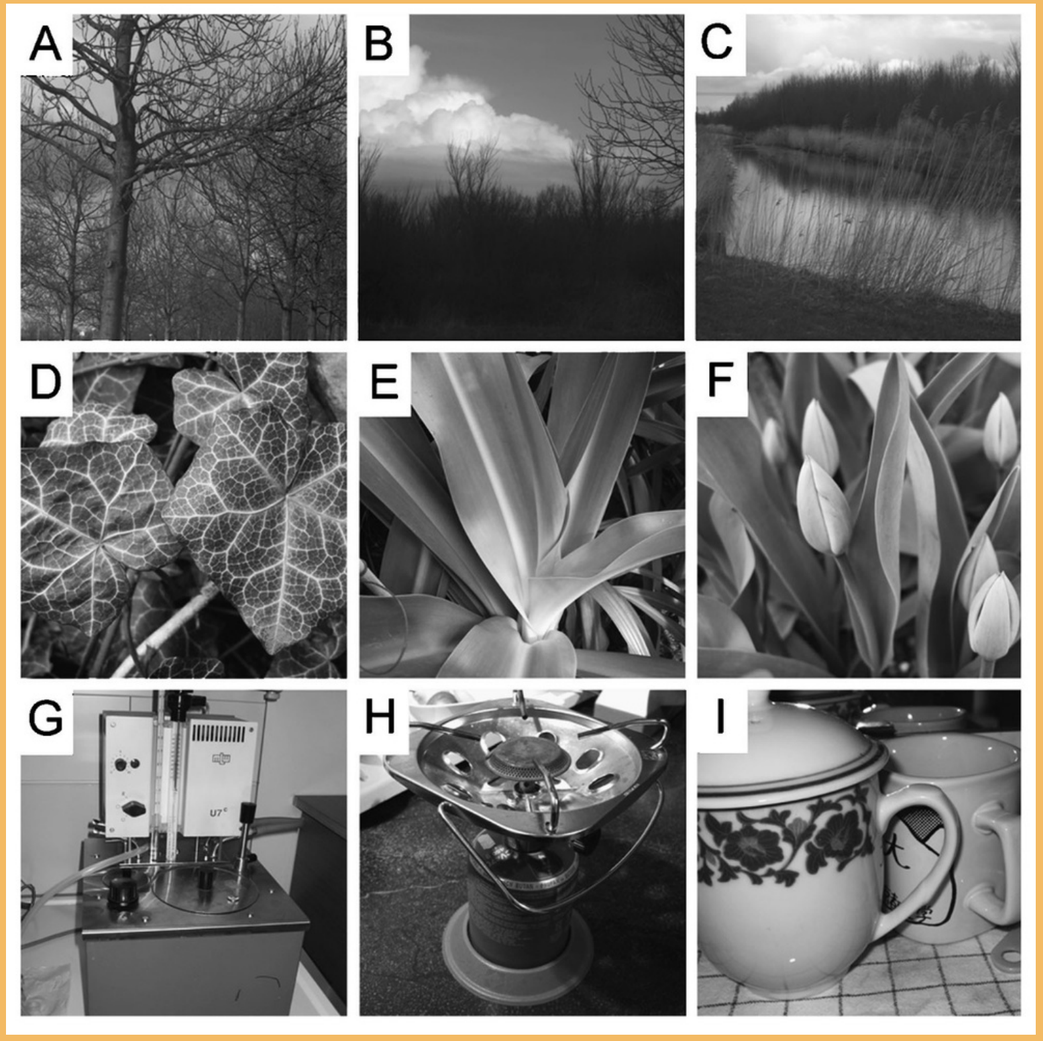
NATURALE/DIGITALE E IL POTERE DELLE COSE BELLE

Irene Ronga - irene.ronga@unito.it

ATTENTION AND THE DIGITAL CONTEXT

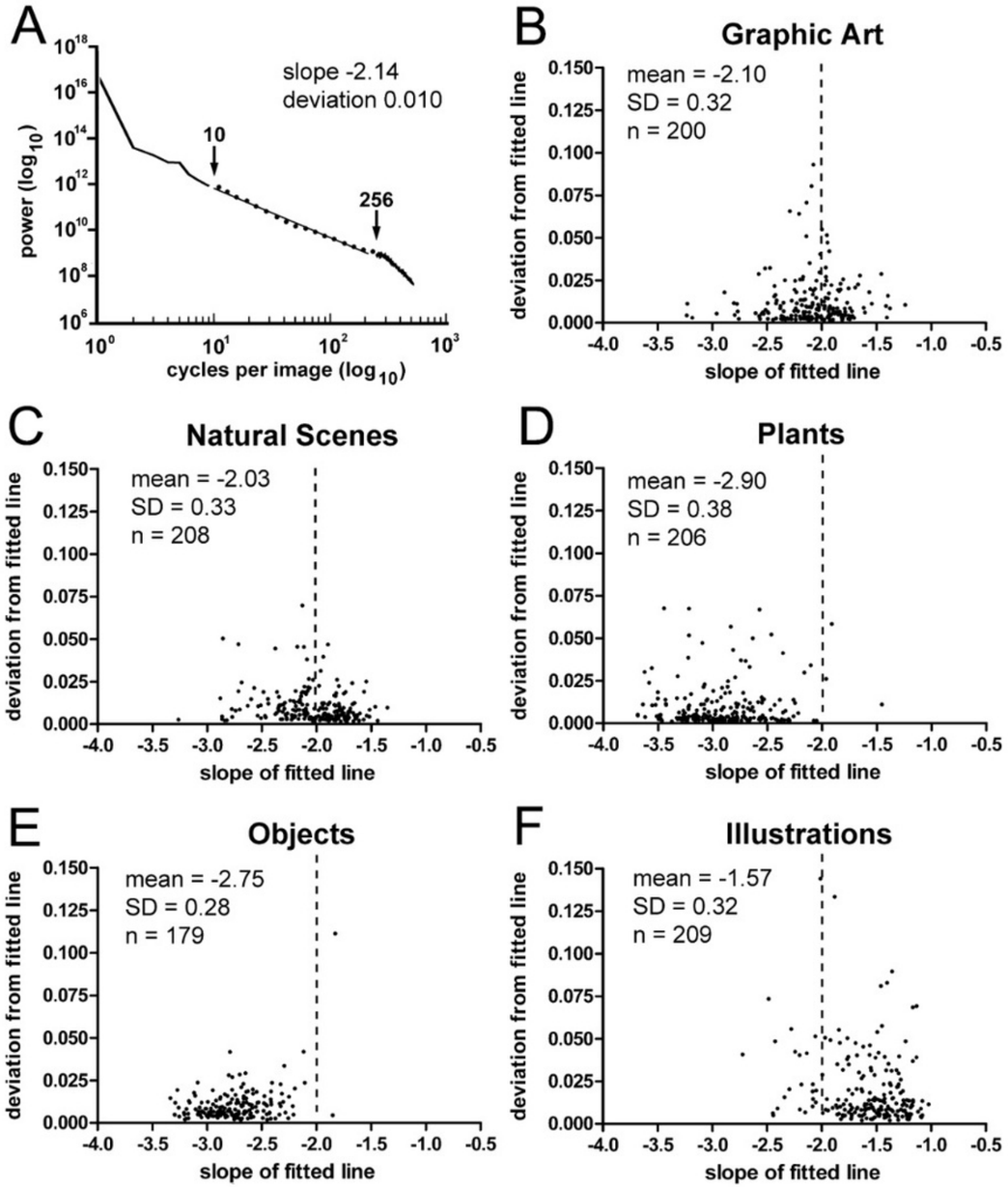
Natural vs synthetic



NATURAL STIMULI

Redies et al. 2008

- Natural scene images are considered more beautiful than the pictures of artificial objects
- When examined, statistical properties of natural scenes appear similar to those of graphic arts

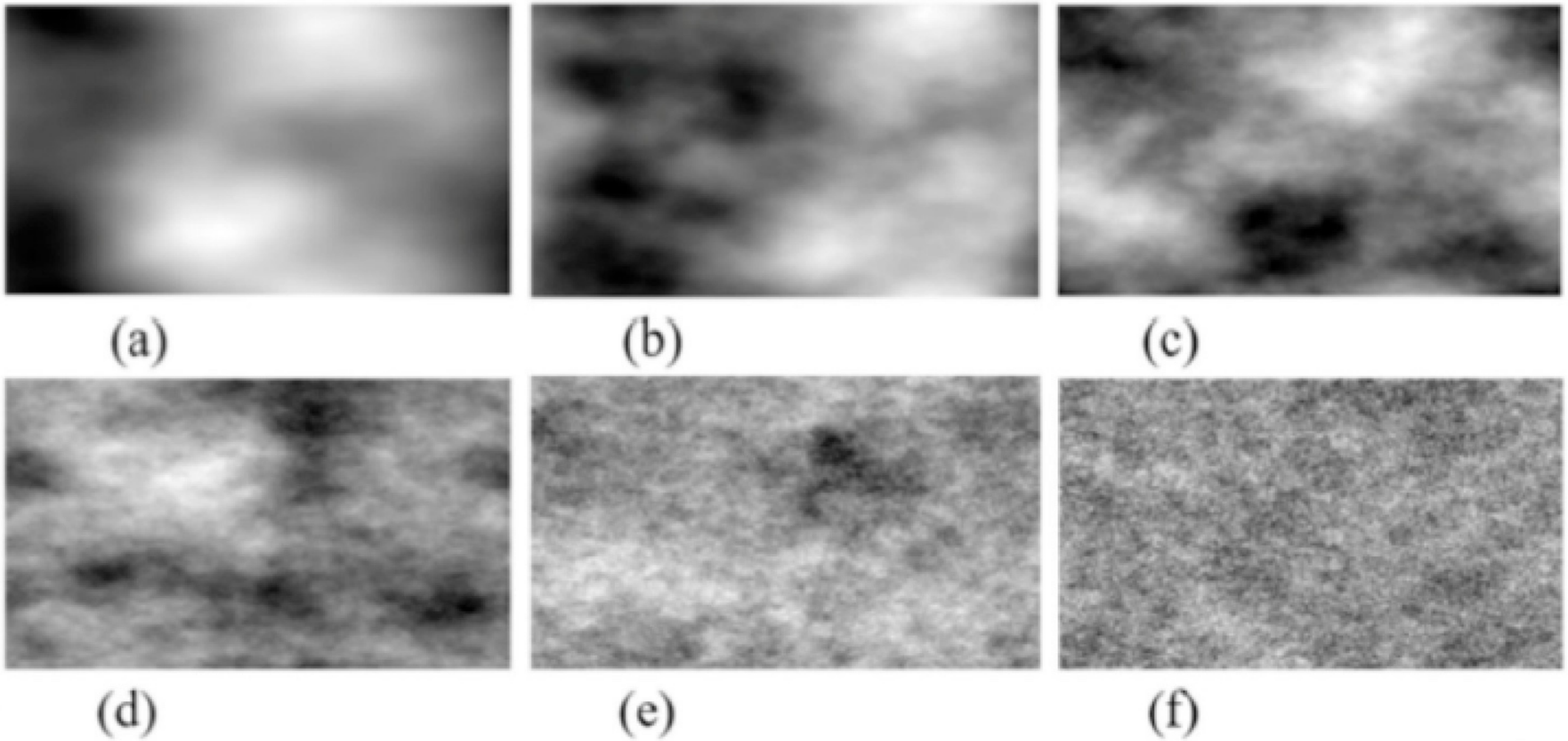


Redies et al. 2008

NATURAL SCENE IMAGES AND ATTENTION

A matter of statistical properties?

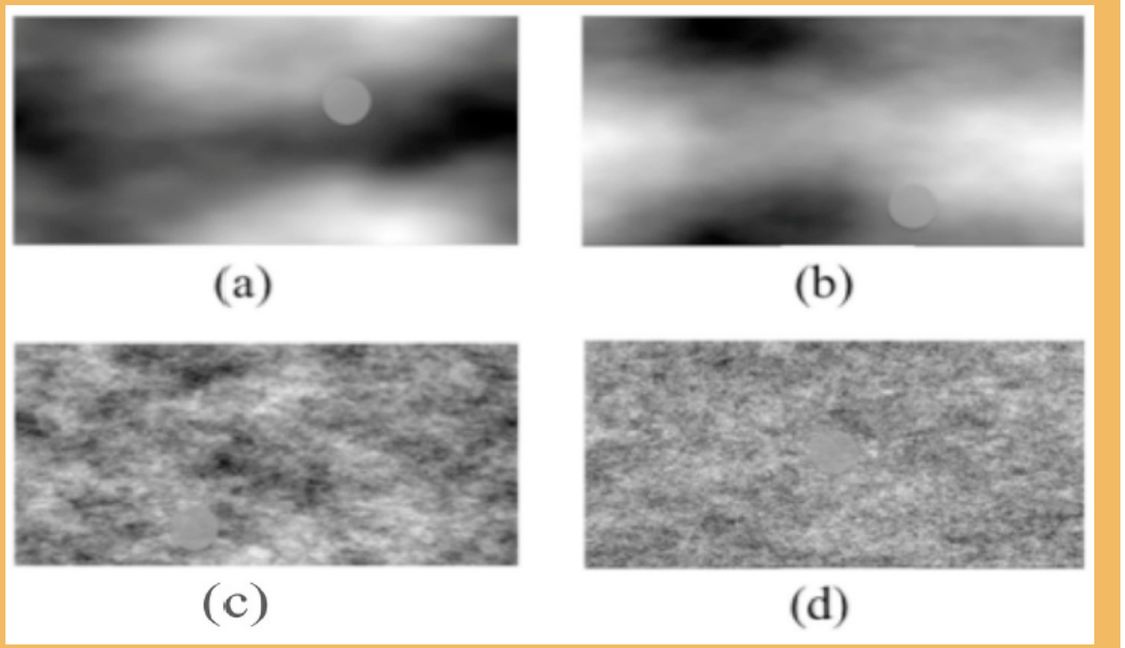
SYNTHETIC IMAGES



Can we reproduce the statistical properties of natural scenes in synthetic stimuli?

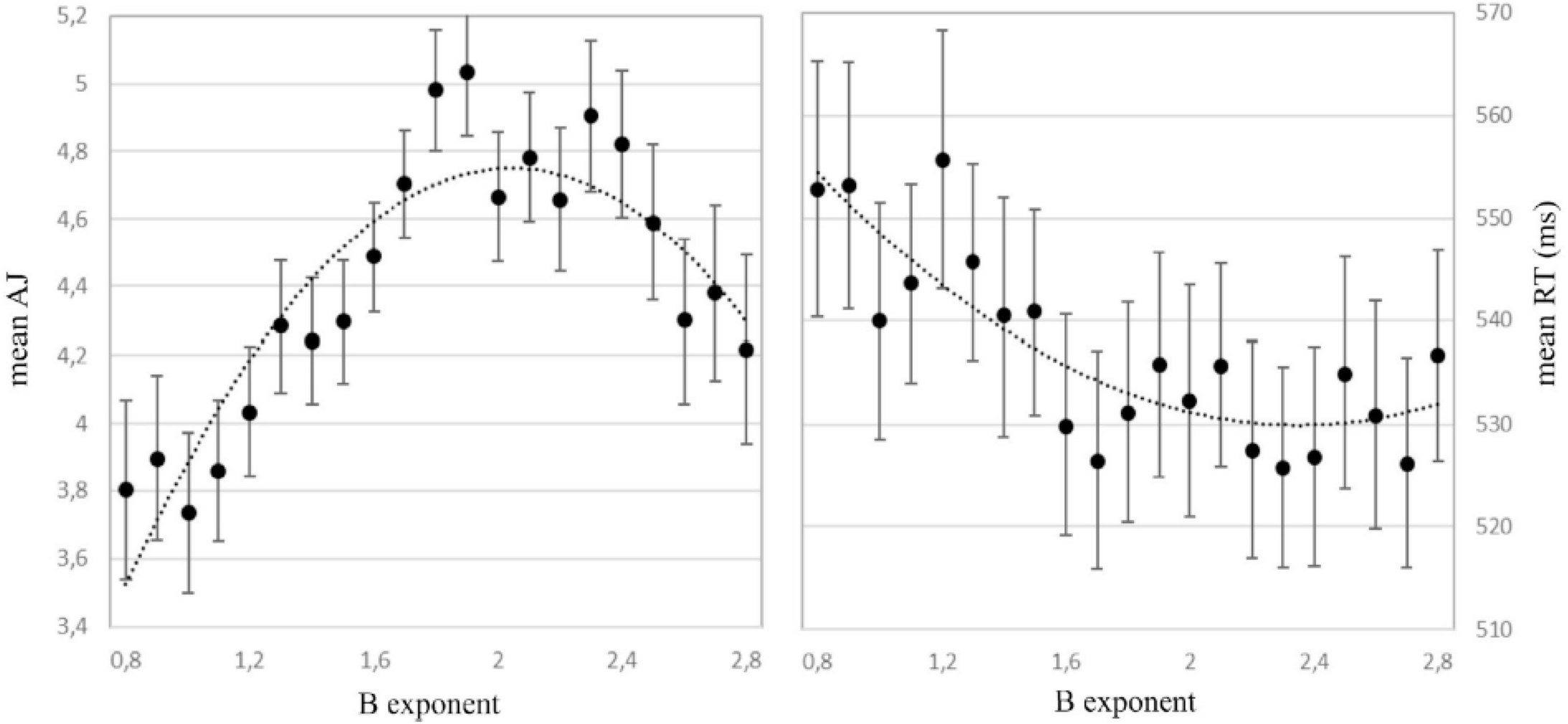
Sarasso et al. 2020

SYNTHETIC STIMULI



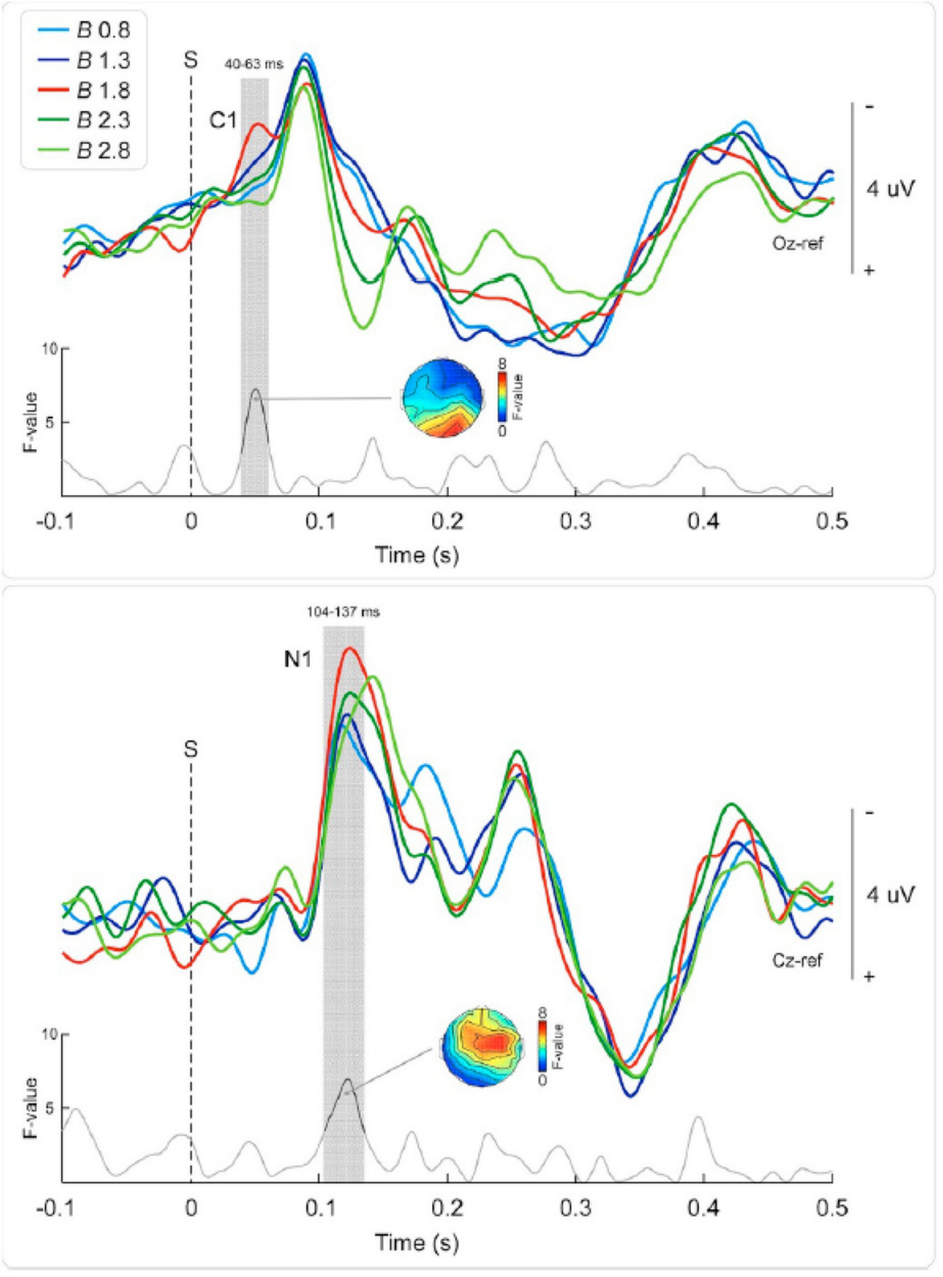
Sarasso et al. 2020

- Attention search task to be performed on backgrounds with different statistical properties
- Participants we asked to press a button as soon as they saw the grey dot
- Images with "beta" exponent around 2 showed higher aesthetic preference
- Participants were better in finding the grey dot in images with beta around 2
- Images with beta around 2 have similar statistical properties to natural scene images



AJ= Aesthetic judgement; B (beta) exponent; RT= response time; ms= millisecond

Sarasso et al. 2020



Sarasso et al. 2020

SYNTHETIC/NATURAL SOUNDS

Neuron
Article

Sound Texture Perception via Statistics of the Auditory Periphery: Evidence from Sound Synthesis

Josh H. McDermott[1,2,*] and Eero P. Simoncelli[1,2,3]
[1]Howard Hughes Medical Institute
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DOI 10.1016/j.neuron.2011.06.032

iScience

Article

Interactions between auditory statistics processing and visual experience emerge only in late development

Martina Berto,[1,*] Emiliano Ricciardi,[1] Pietro Pietrini,[1] and Davide Bottari[1,2,*]

Artificially made sound envelope

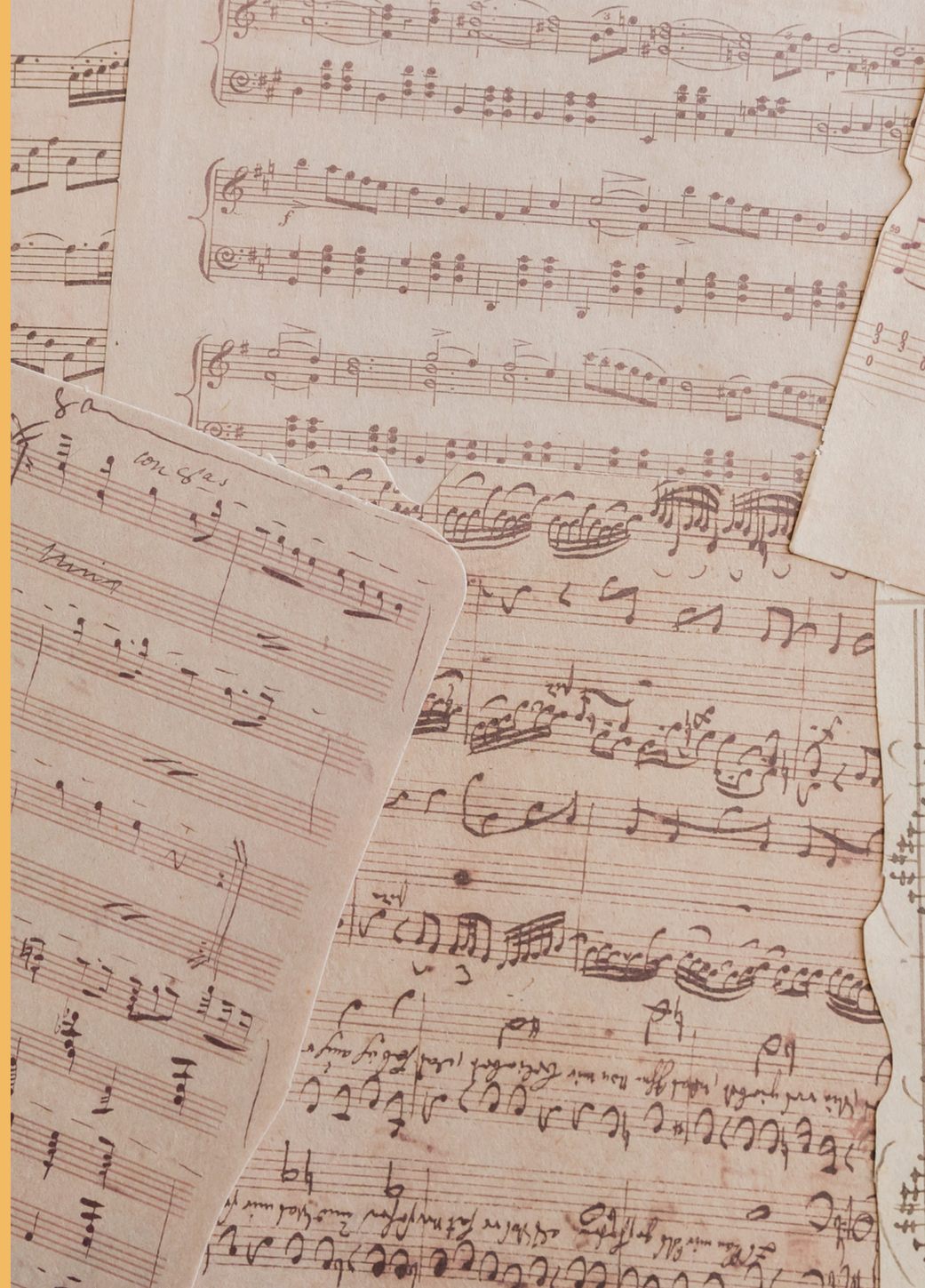
WHAT ABOUT MUSIC AND ATTENTION?

The Mozart effect

Rauscher et al. 1993

IS THERE SOMETHING AS A MOZART EFFECT?

Is this real?
Which are the factors enhancing memory and attention?



Psychonomic Bulletin & Review
https://doi.org/10.3758/s13423-022-02127-8

BRIEF REPORT

Preferred music listening is associated with perceptual learning enhancement at the expense of self-focused attention

Pietro Sarasso[1] · Paolo Barbieri[1] · Elena Del Fante[1] · Ludovico Bechis[1] · Marco Neppi-Modona[1] · Katiuscia Sacco[1] · Irene Ronga[1]

Accepted: 16 May 2022
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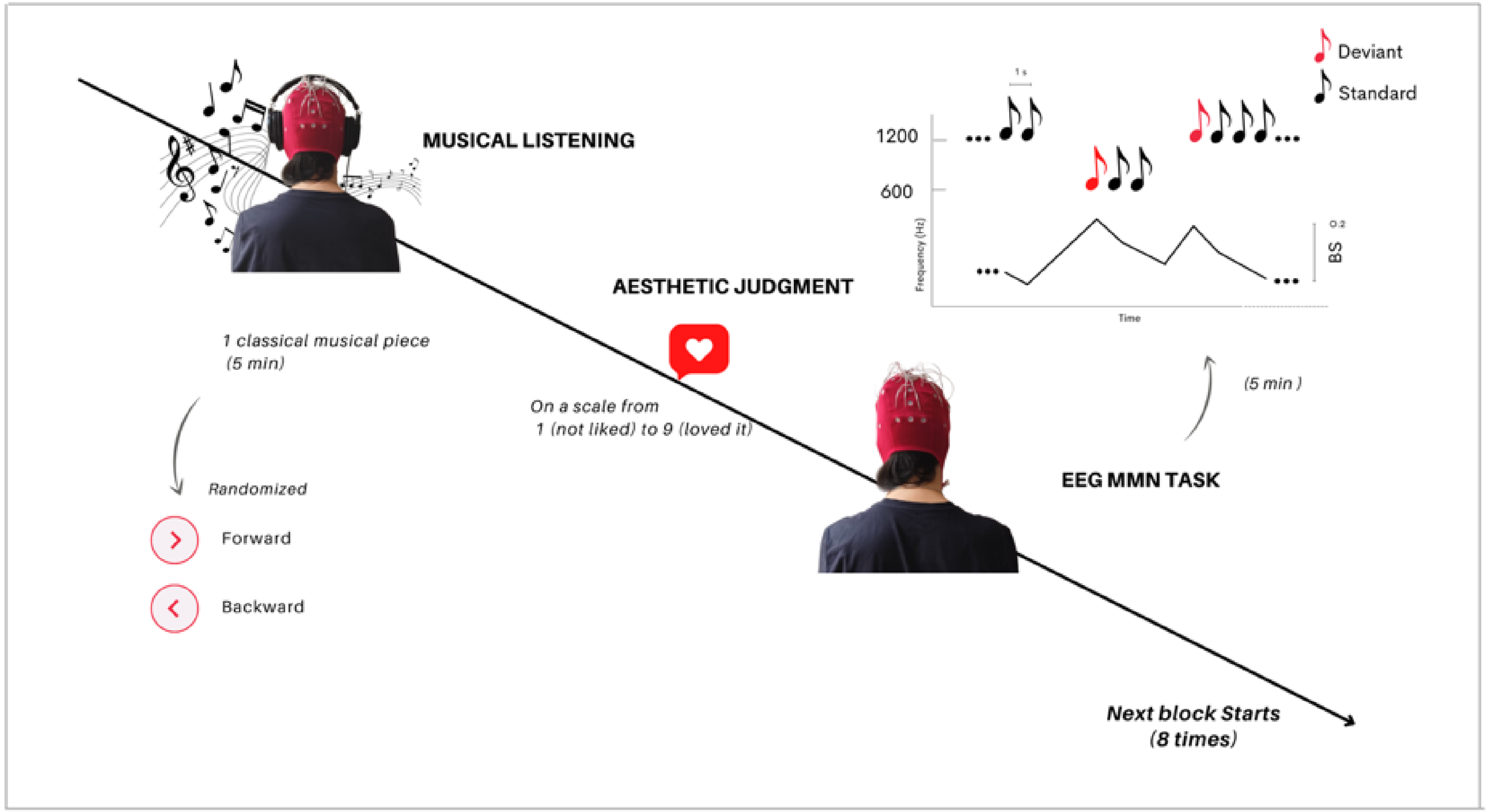
Abstract

Can preferred music listening improve following attentional and learning performances? Here we suggest that this may be the case. In Experiment 1, following preferred and non-preferred musical-piece listening, we recorded electrophysiological responses to an auditory roving-paradigm. We computed the mismatch negativity (MMN – the difference between responses to novel and repeated stimulation), as an index of perceptual learning, and we measured the correlation between trial-by-trial EEG responses and the fluctuations in Bayesian Surprise, as a quantification of the neural attunement with stimulus informational value. Furthermore, during music listening, we recorded oscillatory cortical activity. MMN and trial-by-trial correlation with Bayesian surprise were significantly larger after subjectively preferred versus non-preferred music, indicat-

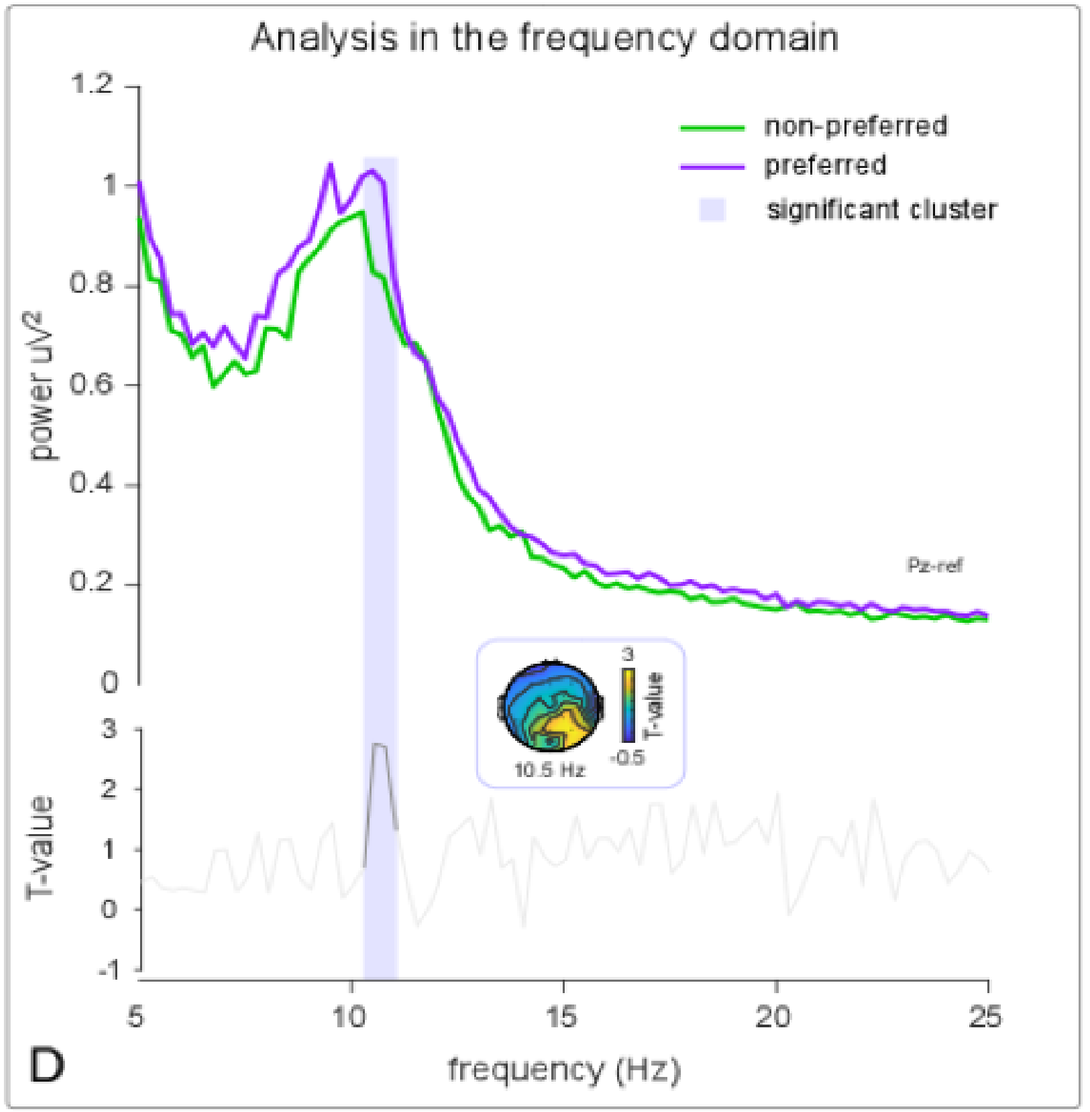
MUSIC LISTENING

Sarasso et al. 2022

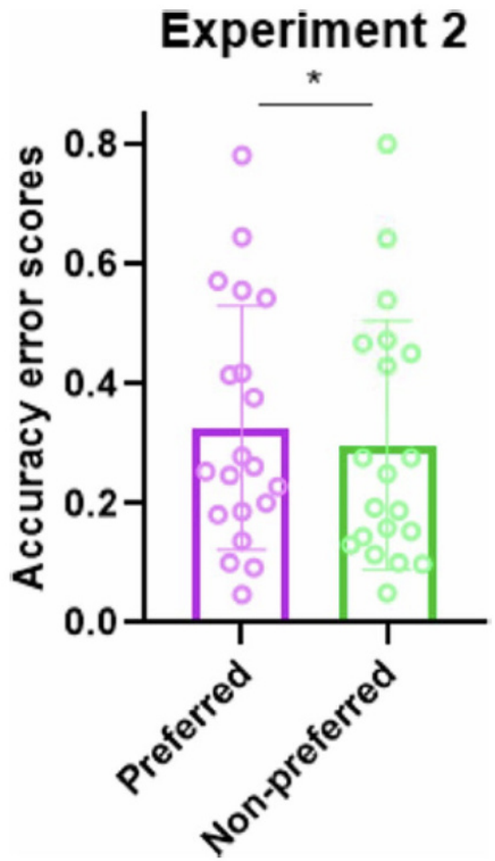
- We propose that preferred music listening (even for 5 minutes) is able to enhance implicit learning and attention as compared to non-preferred music listening
- Attention enhancement was explored by tracking neural oscillation in the alpha frequency band
- Greater power in the alpha frequency range was observed following preferred music listening
- We believe that rather than a specifical musical compositions, attentional improvements may be obtained by listening to preferred music



Sarasso et al. 2022



Sarasso et al. 2022



SHIFITING ATTENTION?

Sarasso et al. 2022

- Preferred music listening enhances attention toward external stimuli
- What about internal stimuli?
- Linking preferred music listening to interoceptive accuracy (heart beat)
- Following preferred music listening interoceptive accuracy significantly worsens
- Preferred music seems to shift attention from internal to external states
- Could be helpful for anxiety????

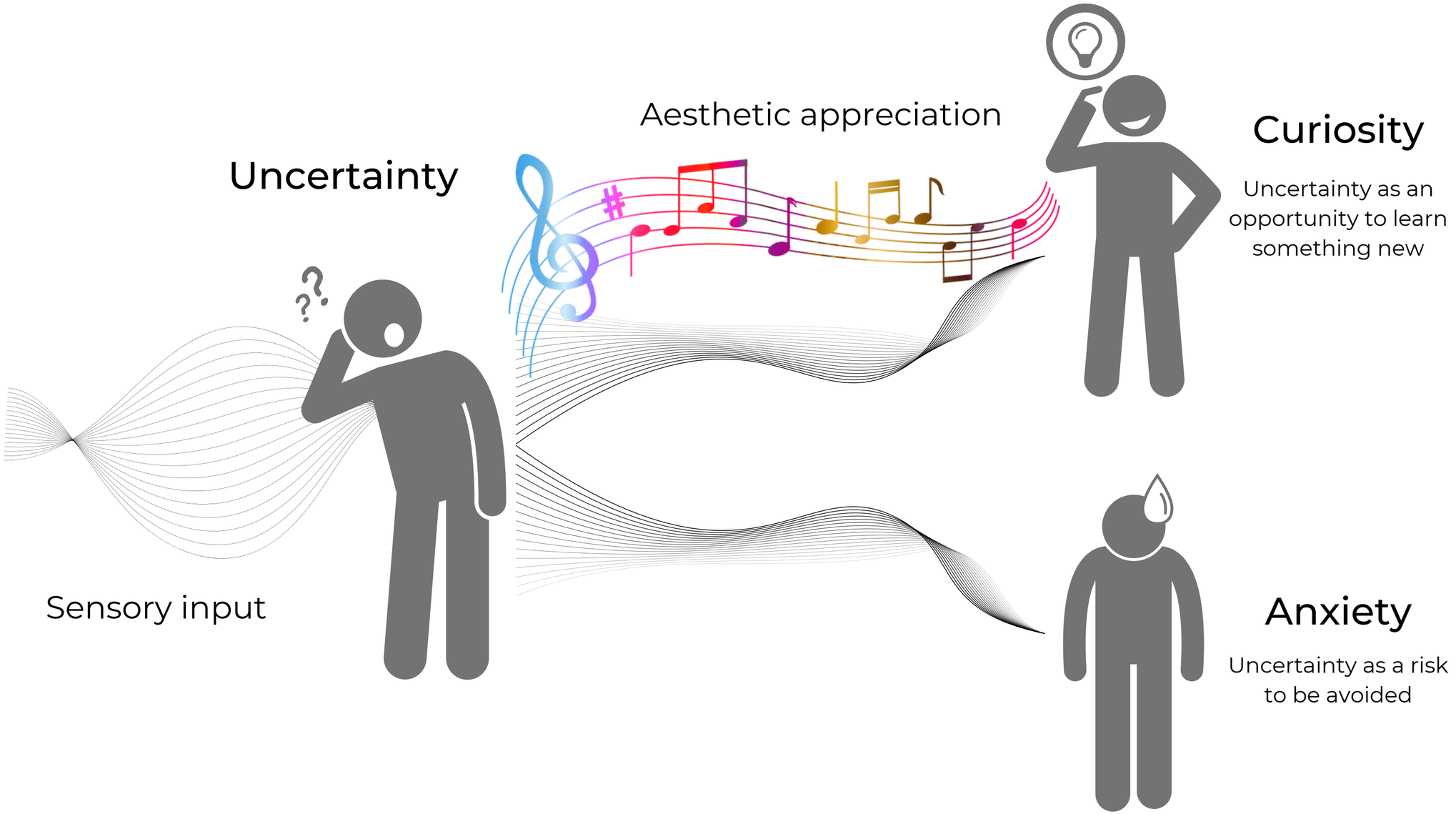
Take home message

THE AESTHETIC ATTITUDE

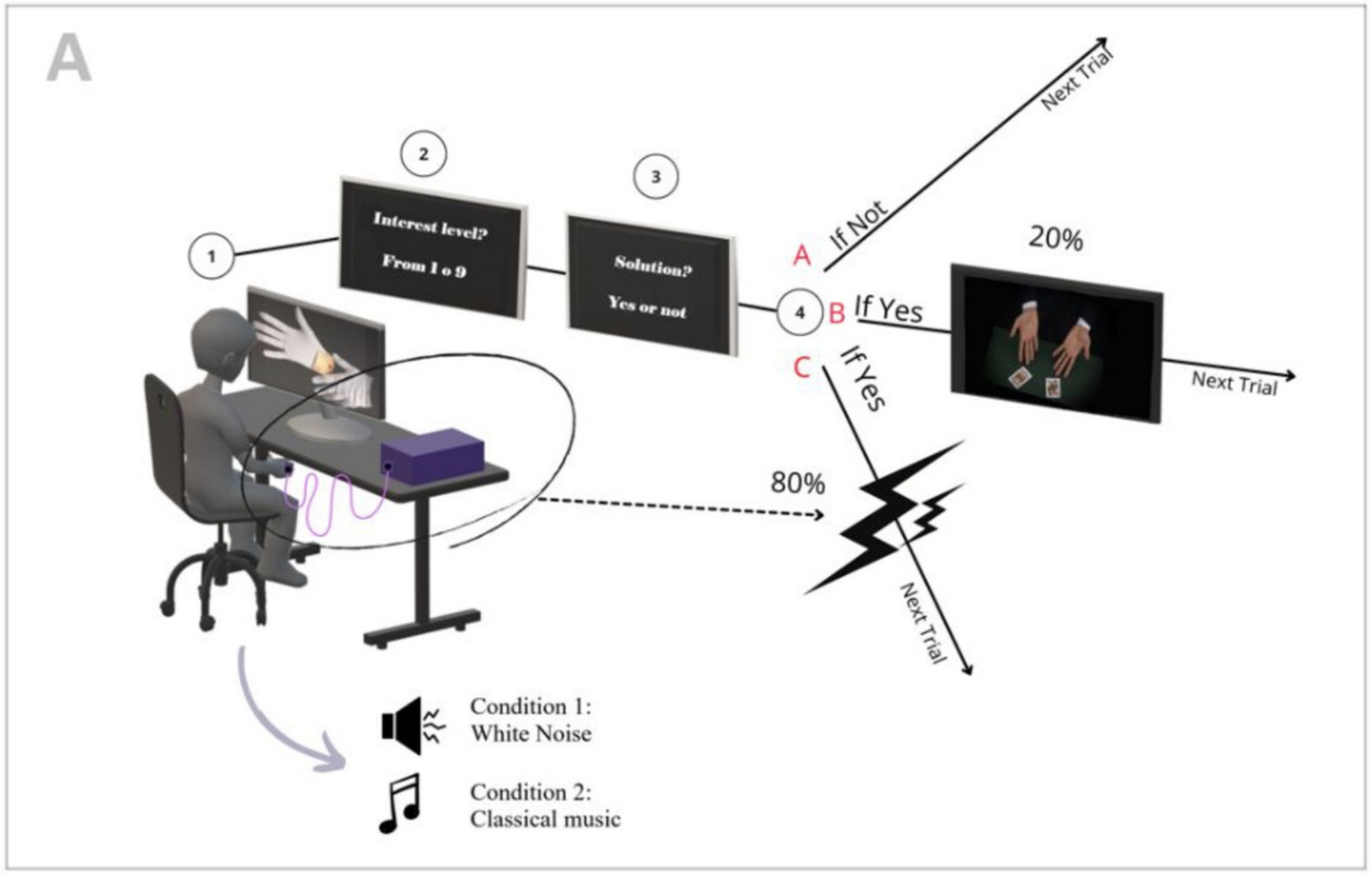
Ascoltare la musica che preferiamo induce l'aesthetic attitude

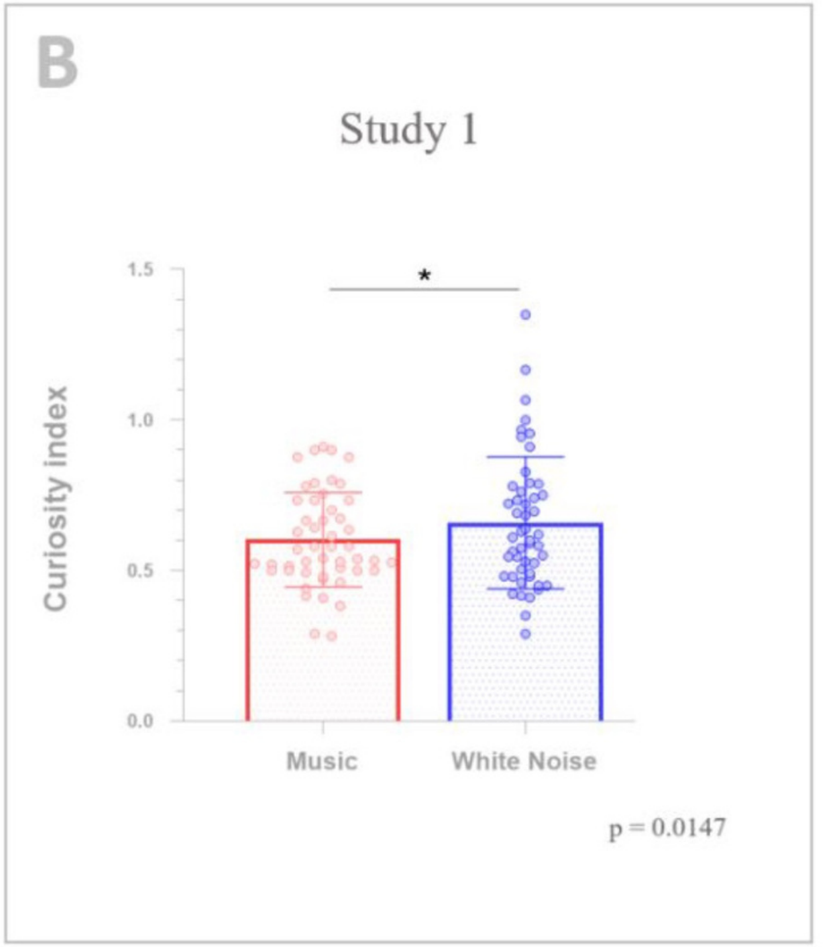
Dopo l'ascolto della musica preferita osserviamo maggiore attenzione

Prospettive future per studi in ambito riabilitativo e per gli stati ansiosi?



Barbieri et al. 2023





Barbieri et al. 2023

Take home message

THE AESTHETIC ATTITUDE

Ascoltare la musica che preferiamo limita l’ansia

Dopo l'ascolto della musica preferita osserviamo curiosità (maggiore interesse verso la nuova informazione)

Sfruttare i benefici della relazione fra estetica e curiosità

AESTHETICS AND LEARNING

A matter of subjective preferences?

In breve

UNA VECCHIA STORIA

Legami fra bellezza e conoscenza fin dalla filosofia antica. Recentemente simili parallelismi sono emersi nei modelli teorici delle neuroscienze computazionali

EXP. 1

Pochi minuti di esposizione alla gratificazione estetica ci permettono di osservare una successiva amplificazione dei fenomeni attenzionali ("aesthetic attitude")

EXP. 1

Ricordiamo meglio quello che ci piace di più.
Un fenomeno attenzionale generico o specifico per l'apprendimento?

EXP. 2

Ciò che preferiamo esteticamente e anche ciò che siamo in grado di apprendere meglio. Il cervello si sintonizza maggiormente con ciò che si preferisce esteticamente

Psychonomic Bulletin & Review
https://doi.org/10.3758/s13423-021-01922-z

BRIEF REPORT

Memorisation and implicit perceptual learning are enhanced for preferred musical intervals and chords

Pietro Sarasso[1] · Pasqualina Perna[1] · Paolo Barbieri[1] · Marco Neppi-Modona[1] · Katiuscia Sacco[1] · Irene Ronga[1]

Accepted: 23 March 2021
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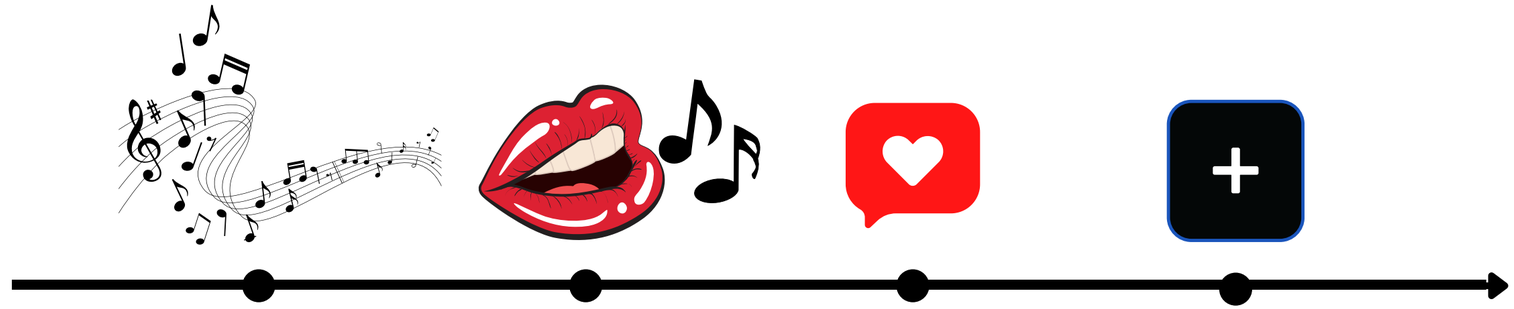
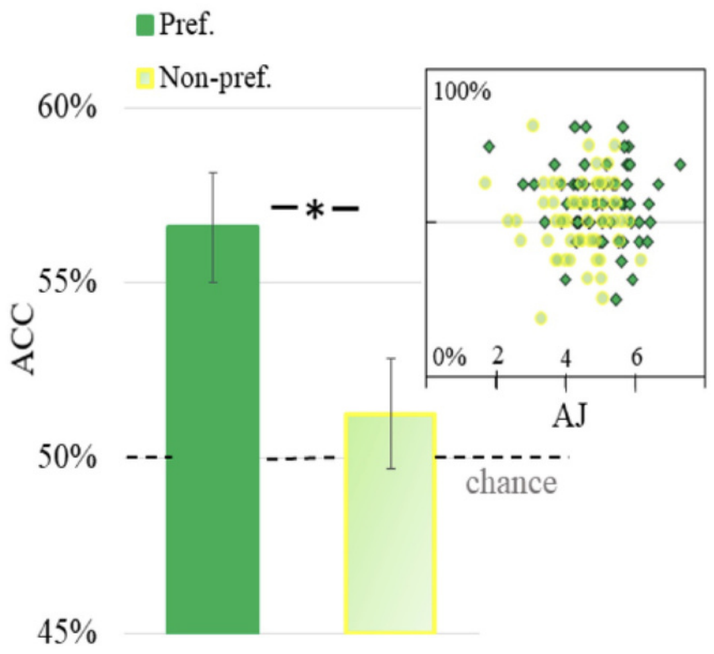
Abstract

Is it true that we learn better what we like? Current neuroaesthetic and neurocomputational models of aesthetic appreciation postulate the existence of a correlation between aesthetic appreciation and learning. However, even though aesthetic appreciation has been associated with attentional enhancements, systematic evidence demonstrating its influence on learning processes is still lacking. Here, in two experiments, we investigated the relationship between aesthetic preferences for consonance versus dissonance and the memorisation of musical intervals and chords. In Experiment 1, 60 participants were first asked to memorise and evaluate arpeggiated triad chords (*memorisation phase*), then, following a distraction task, chords' memorisation accuracy was measured (*recognition phase*). Memorisation resulted to be significantly enhanced for subjectively preferred as compared with non-preferred chords. To explore the possible neural mechanisms underlying these results, we performed an EEG study, directed to investigate implicit perceptual learning dynamics (Experiment 2). Through an auditory mismatch detection paradigm, elec-



ACCURATEZZA

Riconosciamo meglio gli accordi che preferiamo



TAKE HOME MESSAGGE

Le cose che ricordiamo meglio sono anche quelle che ci piacciono di più.

Ma stiamo osservando un vero fenomeno di apprendimento oppure un generico aumento dell'attenione?

AMERICAN PSYCHOLOGICAL ASSOCIATION

Journal of Experimental Psychology: General

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Nice and Easy: Mismatch Negativity Responses Reveal a Significant Correlation Between Aesthetic Appreciation and Perceptual Learning

Pietro Sarasso[1], Marco Neppi-Modona[1], Nicola Rosaia[2], Pasqualina Perna[1], Paolo Barbieri[1], Elena Del Fante[1], Raffaella Ricci[3], Katiuscia Sacco[1], and Irene Ronga[1]

[1] BIP (BraIn Plasticity and Behavior Changes) Research Group, Department of Psychology, University of Turin

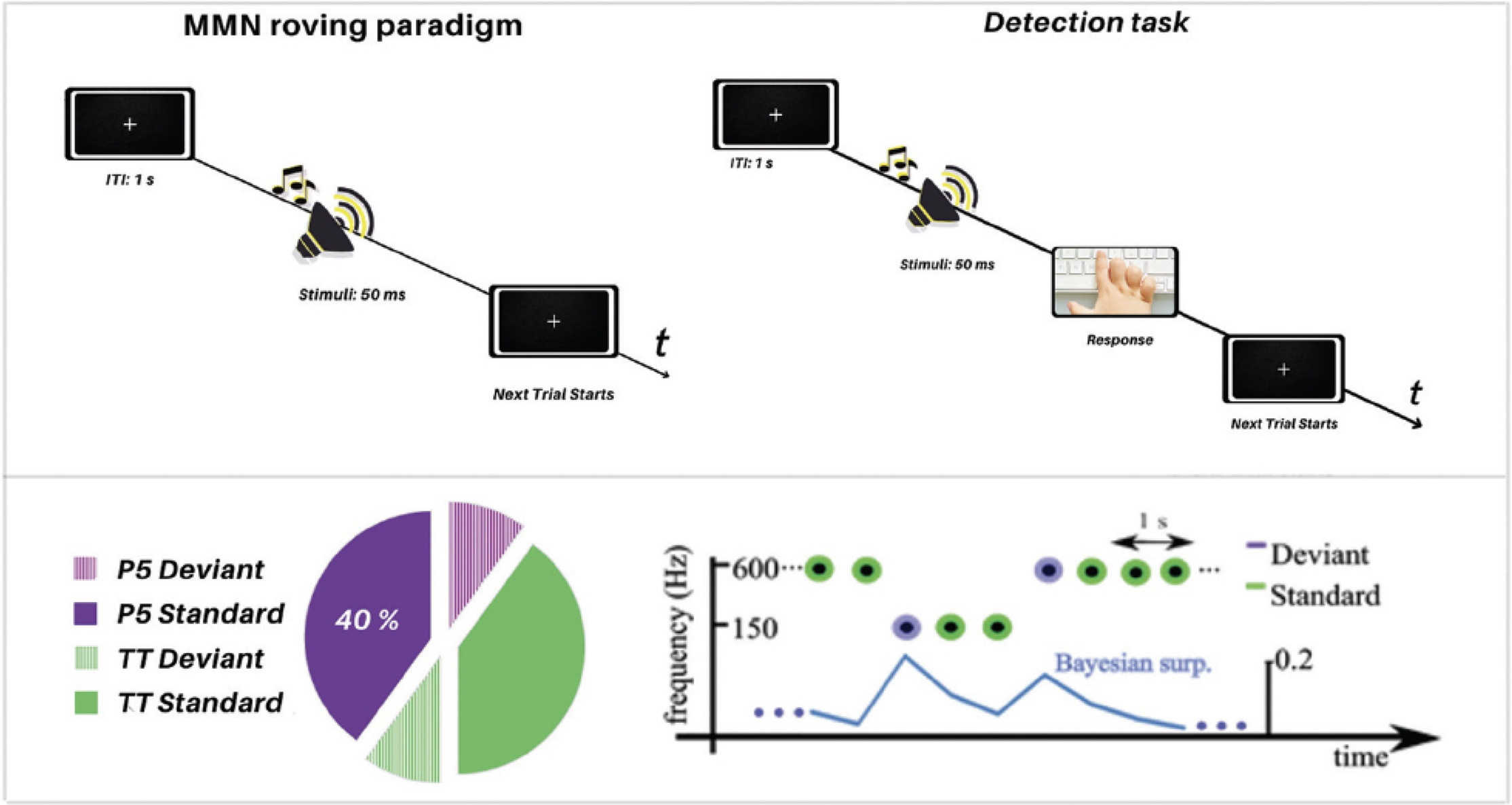
[2] Department of Economics, Harvard University

[3] SAMBA (SpAtial, Motor and Bodily Awareness) Research Group, Department of Psychology, University of Turin

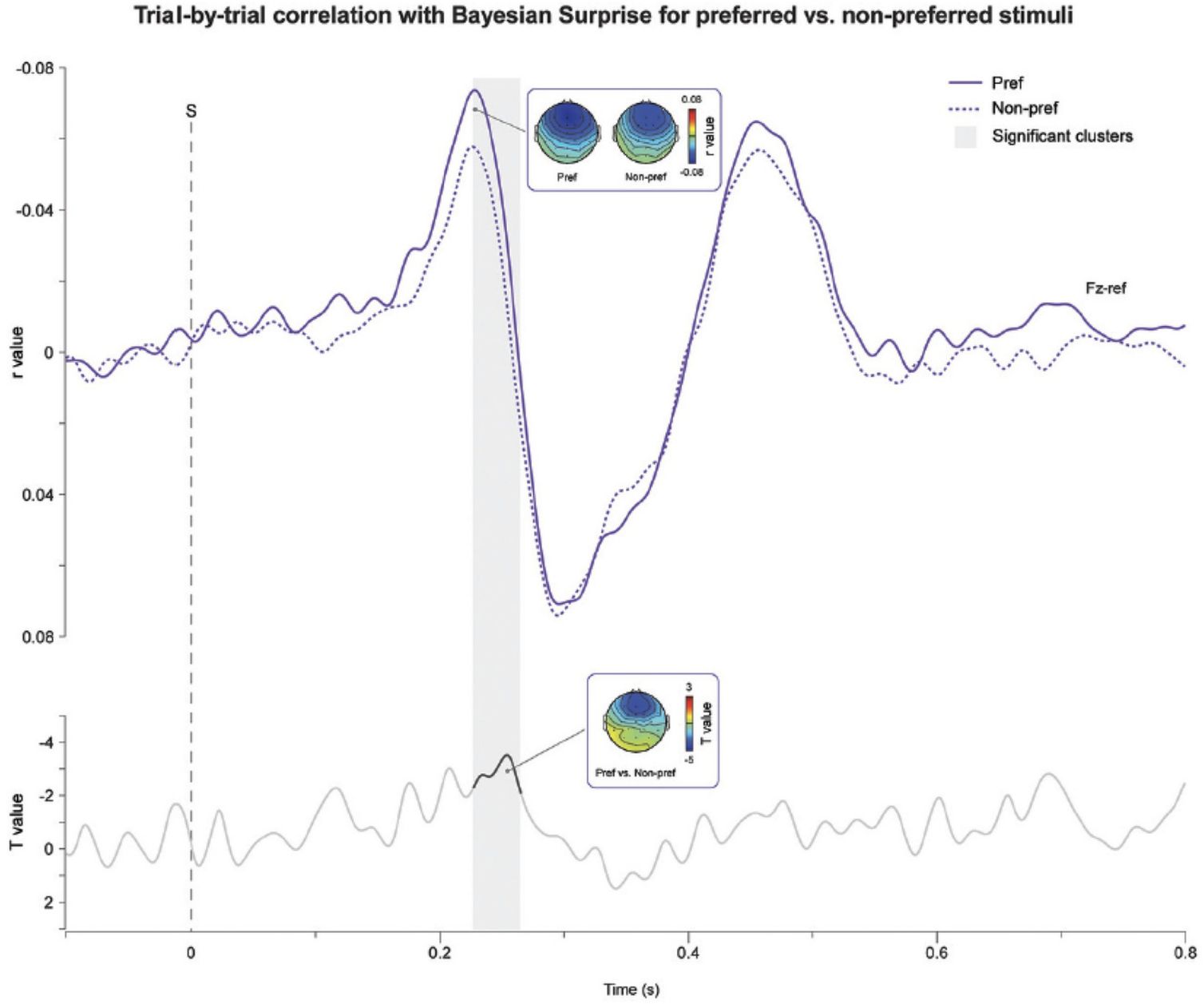
Neurocomputational models of cognition have framed aesthetic appreciation within the domain of knowledge acquisition and learning, suggesting that aesthetic appreciation might be considered as a hedonic feedback on successful perceptual learning dynamics. Such hypothesis, however, has never been empirically demonstrated yet. In order to investigate the relationship between aesthetic appreciation and learning, we measured the EEG mismatch negativity (MMN) response to more or less appreciated musical intervals, which is considered as a reliable index of perceptual learning. To this end, we measured the MMN to frequency (Hz) standard and frequency deviant musical intervals (Experiment 1) while participants were asked to judge their beauty. For each single stimulus, we also computed an information-theoretic index of perceptual learning (Bayesian surprise). We found that more appreciated musical intervals were associated with a

COME MISURARE L'APPRENDIMENTO

Con un algoritmo di bayesian surprise



SARASSO ET AL. 2022



SARASSO ET AL. 2022

Take home message

MEMORIA, APPRENDIMENTO E BELLEZZA

Ciò che preferiamo si ricorda più facilmente

Osserviamo maggiore apprendimento per gli stimoli preferiti soggettivamente

La bellezza come feedback di dinamiche di apprendimento di successo

BELLEZZA E CONOSCENZA

This is a wrap up

Neuroscience and Biobehavioral Reviews 118 (2020) 723–738

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/neubiorev

Review article

"Stopping for knowledge": The sense of beauty in the perception-action cycle

P. Sarasso, M. Neppi-Modona, K. Sacco, I. Ronga *

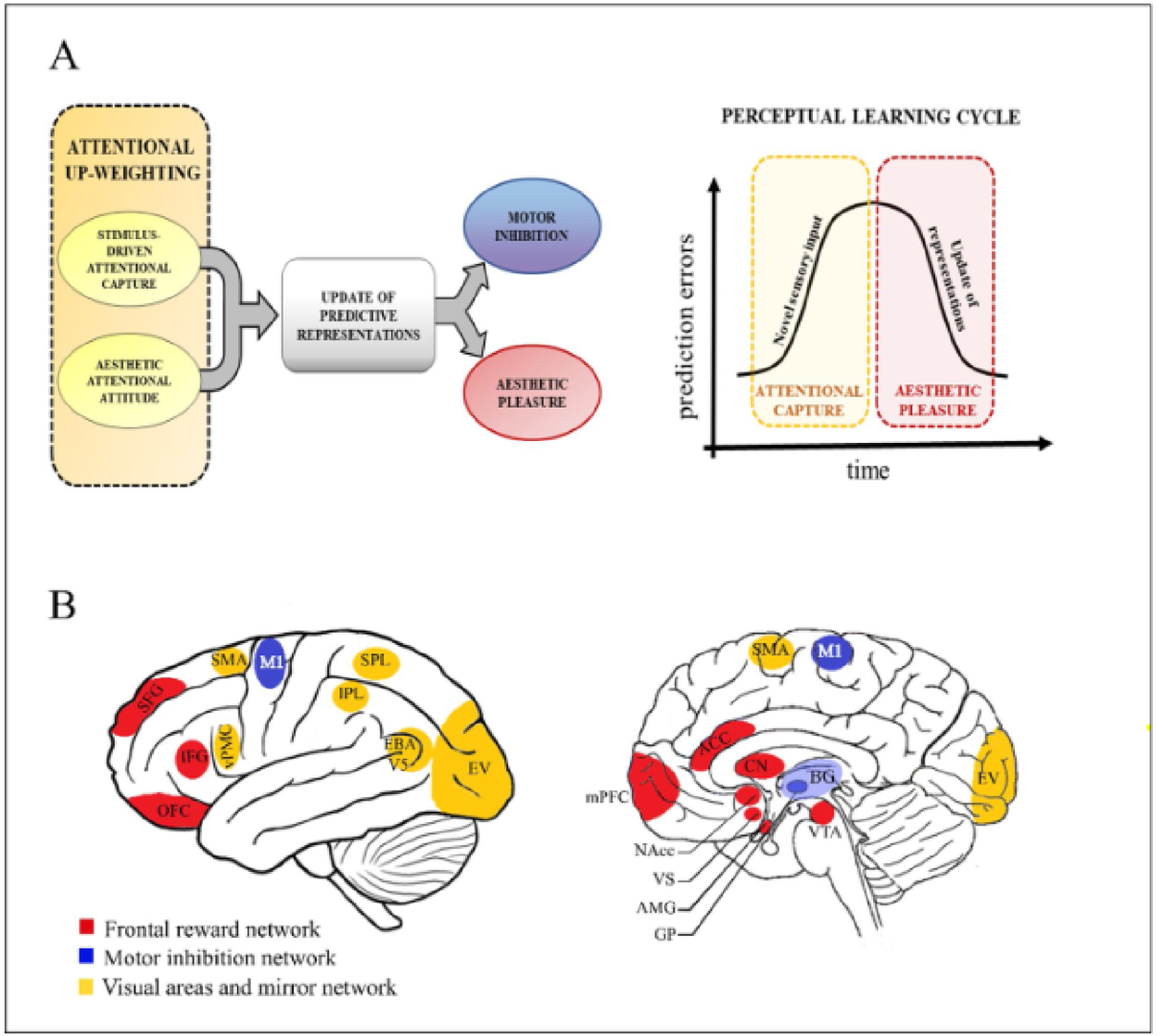
BIP (BraIn Plasticity and Behaviour Changes) Research Group, Department of Psychology, University of Turin, Italy

ARTICLE INFO

Keywords:
Aesthetic appreciation
Neuroaesthetics
Learning
Attention
Processing enhancement
motor inhibition
Intrinsic motivation
Predictive coding

ABSTRACT

According to a millennial-old philosophical debate, aesthetic emotions have been connected to knowledge acquisition. Recent scientific evidence, collected across different disciplinary domains, confirms this link, but also reveals that motor inhibition plays a crucial role in the process. In this review, we discuss multidisciplinary results and propose an original account of aesthetic appreciation (the *stopping for knowledge hypothesis*) framed within the predictive coding theory. We discuss evidence showing that aesthetic emotions emerge in correspondence with an inhibition of motor behavior (i.e., minimizing action), promoting a simultaneous perceptual processing enhancement, at the level of sensory cortices (i.e., optimizing learning). Accordingly, we suggest that aesthetic appreciation may represent a hedonic feedback over learning progresses, motivating the individual to inhibit motor routines to seek further knowledge acquisition. Furthermore, the neuroimaging and neuropsychological studies we review reveal the presence of a strong association between aesthetic appreciation and the activation of the dopaminergic reward-related circuits. Finally, we propose a number of possible applications of the *stopping for knowledge hypothesis* in the clinical and education domains.


A
ATTENTIONAL UP-WEIGHTING
STIMULUS-DRIVEN ATTENTIONAL CAPTURE
AESTHETIC ATTENTIONAL ATTITUDE
UPDATE OF PREDICTIVE REPRESENTATIONS
MOTOR INHIBITION
AESTHETIC PLEASURE
PERCEPTUAL LEARNING CYCLE
prediction errors
Novel sensory input
Update of representations
ATTENTIONAL CAPTURE
AESTHETIC PLEASURE
time
B
SMA
M1
SPL
IPL
SFG
PMC
IFG
EBA
V5
EV
OFC
ACC
CN
BG
mPFC
VTA
NAcc
VS
AMG
GP
Frontal reward network
Motor inhibition network
Visual areas and mirror network