





Human Brain Project

DOMINO: Development of cortical multisensory integration mechanisms at micro- and macro- scales during normal and pathophysiological conditions









Panteion University

Multisensory integration in autism spectrum disorders





Baum et al., 2015

Impaired ability to properly integrate multiple sensory modalities has been hypothesized to underlie many of the symptoms in autism spectrum disorders (**ASD**).

However, how multisensory integration develops and how it is expressed in ASD is poorly understood.

Multisensory integration in autism spectrum disorders



Foss-Feig et al., 2010

The temporal window for multisensory integration (**MI**) is extended in ASD.

Understanding how MI develops, and its disruptions in ASD is key to improve diagnosis and develop new treatments.



The DOMINO paradigm





Mouse experiments

- Multi-area microcircuit-
- level characterization of MI development
- WT and ASD mice
- From birth to adulthood



Modeling experiments

- Spiking neural networks with biologically plausible plasticity
- A model of MI development



Human experiments

- EEG and psychophysics experiments
- TD and ASD subjects
- From childhood to adulthood

Project structure and interactions with HBP DOWINO WP4: UNIVERSITY Management & ١Ň OF AMSTERDAM Dissemination Model of cortical WP2: **WP1**: multisensory plasticity UNIVERSITY Human Mouse OF AMSTERDAM experiments Consiglio Nazionale delle Reerche experiments Panteion P Use of EBRAINS Infrastructure Human Brain Project WP3: Modeling CerCo

Our team





WP1: Mouse experiments



WP1: Mouse experiments



Response to flash (L: low, M: medium, H: high intensity)

Response to sound (white noise)

Sound-flash overlap as a function of SOA (in ms, black: visual response)

Example V1 responses

How do the temporal aspects of multisensory integration vary across development and in ASD?







WP2: Development of MI in TD and ASD individuals

• Aim: Observe how MI processes arise in TD and ASD children and adolescents by combining psychophysics and EEG.



- Ongoing activities:Data collection for McGurk & SIFI experiments
- Linguistic aspects of the McGurk effect: aim to explore the influence of place and manner of articulation in the McGurk illusion
- > Pairs of mismatching AV components with:
 - \circ $\$ the same place and different manner of articulation
 - \circ $\,$ the same manner and different place of articulation
 - \circ $\,$ different manner and different place of articulation $\,$





WP2: Development of MI in TD and ASD individuals

Development of a McGurk task for the Greek language \rightarrow A potential new test for ASD





VvaAva









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VthaAva



 \checkmark Example tha va AV combinations

- ✓ Multiple choice responses
- ✓ Response options
 - tha, fa, va, da, ba, ga, nta, pa, ka, other
- \checkmark N = 90 participants, aged between 13-79 years of age,
- 88 native Greek speakers
- ✓ Significant relationship between stimuli and responses

Count Expected Count

WP2: Development of MI in TD and ASD individuals

manipulate

 Aim: Uncover the rules governing data integration in the visual system





Consiglio

Nazionale delle

WP4: Computational model of MI development





CerCo

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WP4: Computational model of MI development





Next: *audio-visual integration, normal and abnormal development*



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Progress and next steps



	2020		2021				2022				2023			
	III	IV	I	Π	III	IV	Ι	Ш	III	IV	Ι	Π	III	IV
WP1: Animal experiments	Preparatory activities Data collection										Analysis			
WP2: Human Experiments	Prepara	tory act	Data collection						Analysis					
WP3: Modeling	Visual m	Auditory model						Audiovisual model						

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