

# E22

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## Not always the face:

Differences between human and dog neural face- and conspecific-preference



Attila Andics



# Introduction

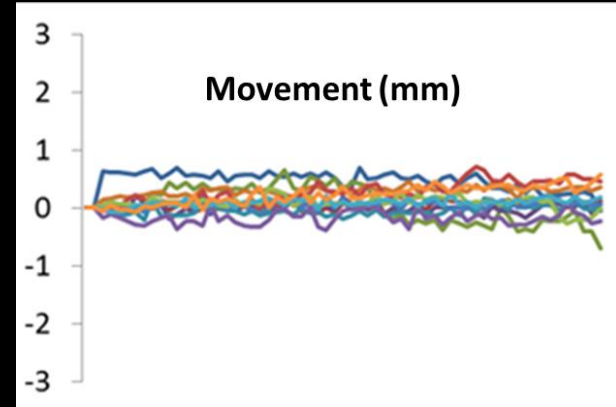
What drives processing preferences when viewing individuals, and how these preferences evolved, are key questions of comparative social neuroscience.

Preference for faces and for same-species stimuli are two well-documented organizing principles.

Yet, the evolutionary origin and the relative role of neural face- and species-sensitivity in visual social processing are largely unknown.

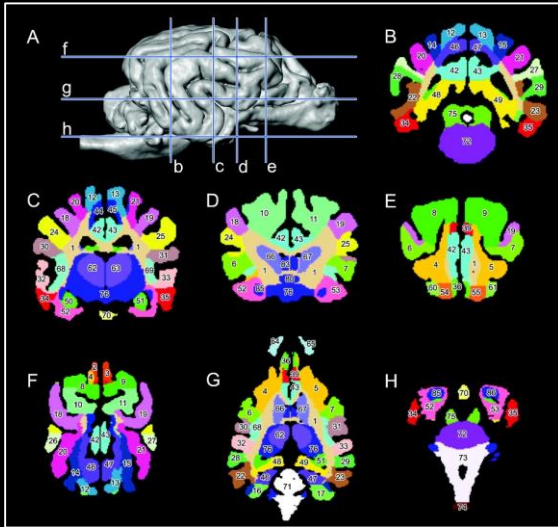
Here we compared neural sensitivity to conspecificity and faceness between two phylogenetically distant mammal species: humans and dogs.

# Dog fMRI in Budapest

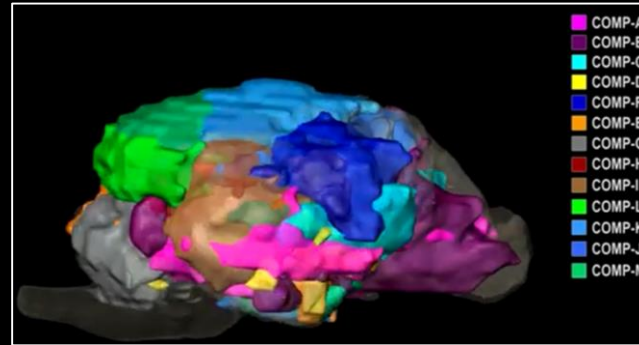


Our lab (at ELTE Department of Ethology) is one of the very few pioneers worldwide of cognitive brain imaging in awake dogs. We developed a training method which enables us to scan dogs as happy volunteers, with no restraints, while they move no more than humans.

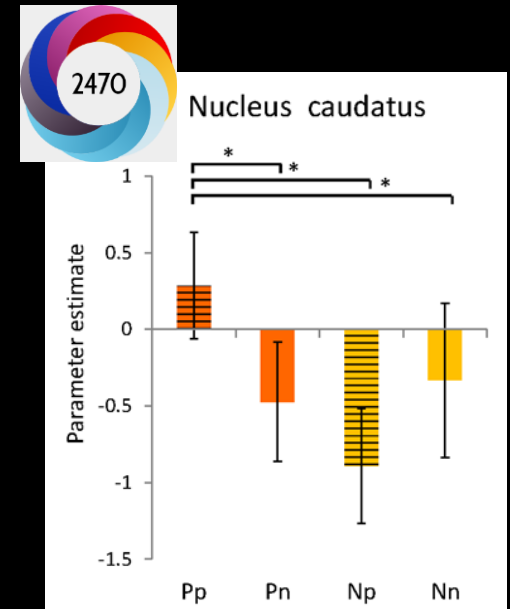
# Our previous work



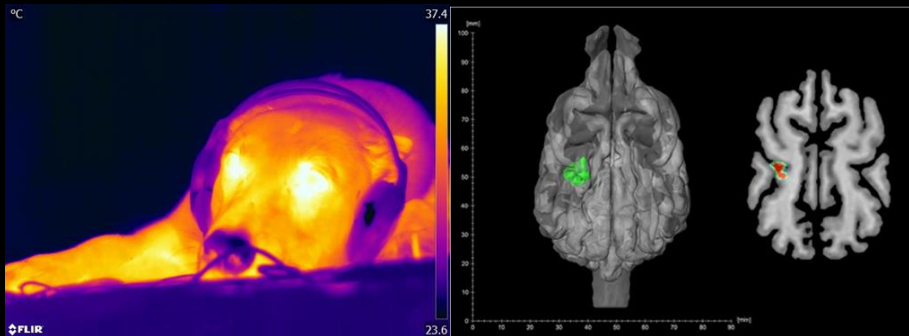
template and label map  
(Czeibert 2019, Biol Fut)



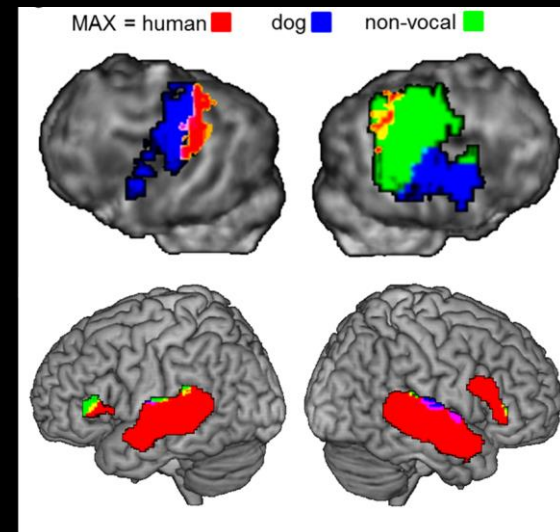
resting-state network  
(Szabó 2019, Sci Rep)



speech processing  
(Andics 2016, Science)



infrared heat sense  
(Bálint 2020, Sci Rep)

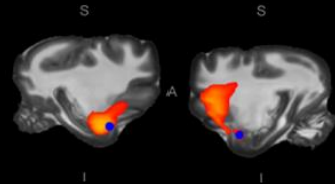


voice areas  
(Andics 2014, Curr Biol)

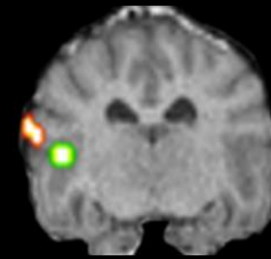
# Face-sensitivity in dogs?



dogs read facial cues  
(Müller 2016)



face > object  
(Dilks 2015, Cuaya 2016)



dog face > human face  
(Thompkins 2018)



nonfacial cues dominate  
(Darwin 1872, Leopold 2010)



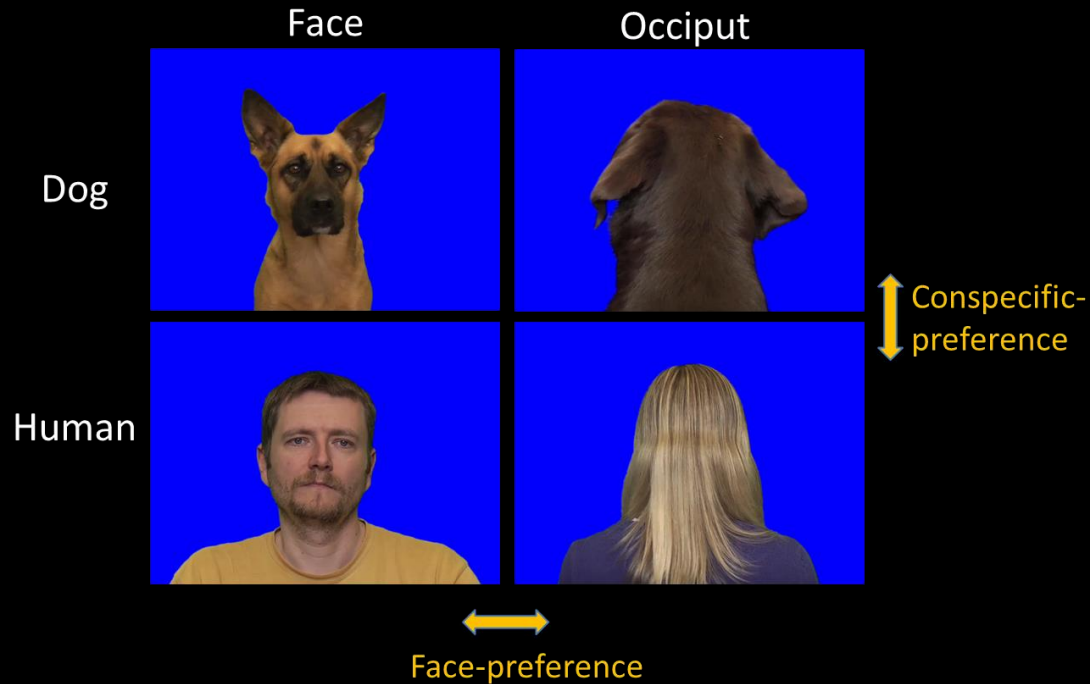
face = scrambled (coarse)  
(Dilks 2015)



face = scrambled (fine)  
(Szabó 2020)

Do dog brains care about faces as much as humans? There are arguments both for and against.

# Methods

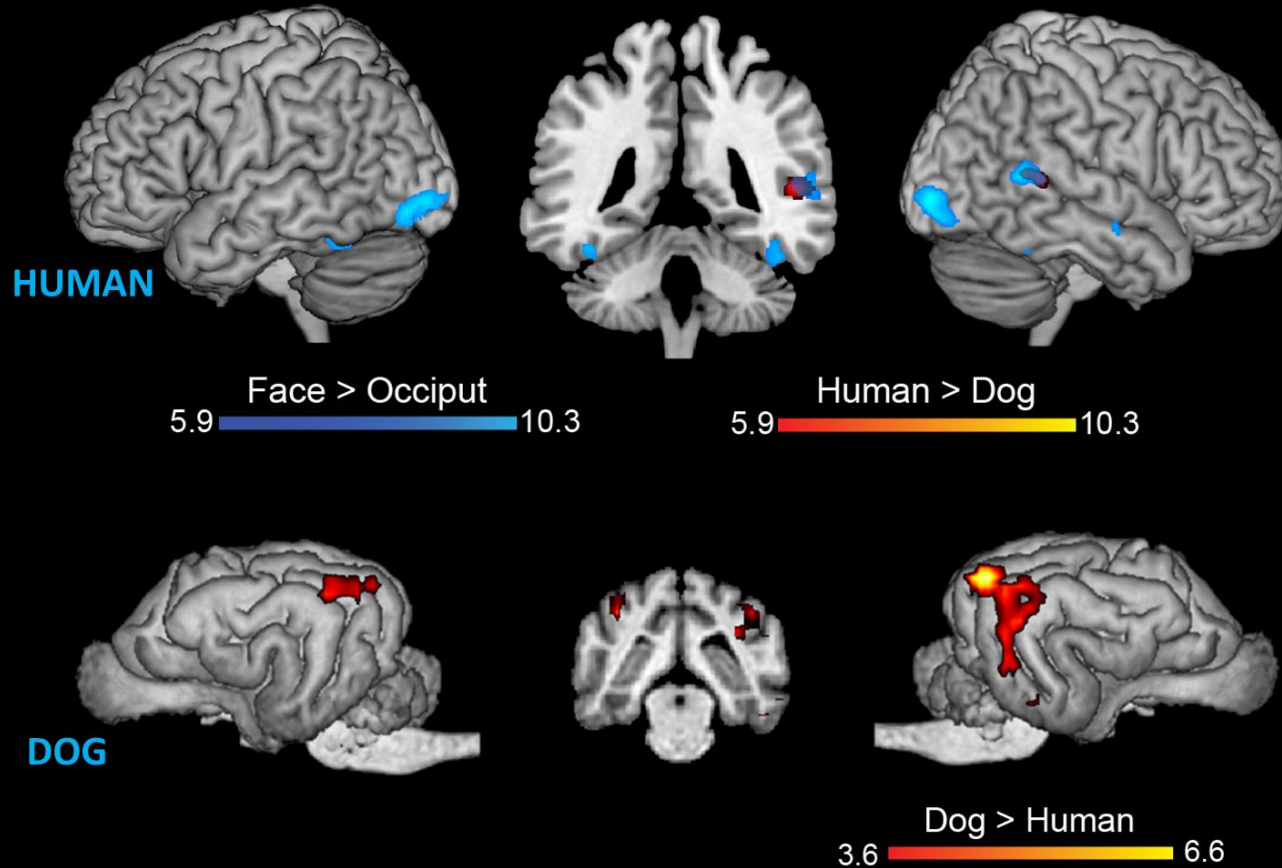


We ran the same fMRI experiment with humans (n=30) and family dogs (n=20).

2 s videos of human and dog faces and occiputs, presented in 8 s long blocks, 10 s fixation cross between blocks, 12 blocks/run (226 s), 6 runs; 3T Philips Ingenia/Achieva TX; standard preprocessing (with in-house tailored adjustments for dogs).

Standard GLM (SPM12), MVPA, across-species RSA; reporting threshold of  $p < .001$  uncorrected and  $p < .05$  cluster-corrected for FWE for dogs, and  $p < .000001$  and  $p < .001$  respectively for humans.

# Face- and conspecific-preference



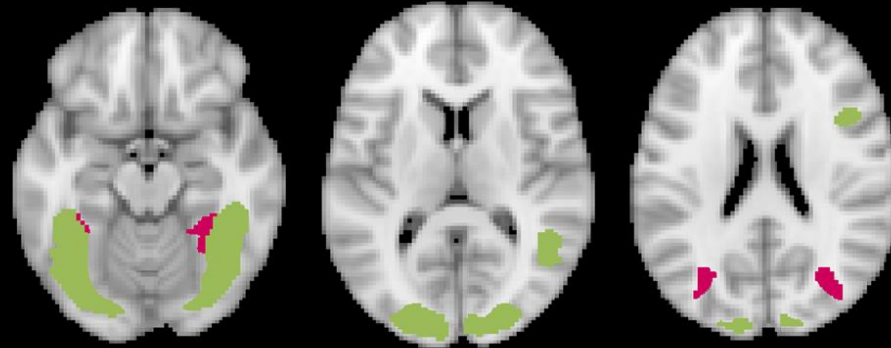
In humans, there was face-preference across regions of the core and extended face network (incl. FuG, IOG, pMTG, aMTG, AMY). Only the face areas involved in processing emotional information (e.g. pMTG) preferred human to dog images.

In dogs, a bilateral temporo-parietal region (mid suprasylvian gyrus) showed robust conspecific-preference, but no regions showed face-preference.

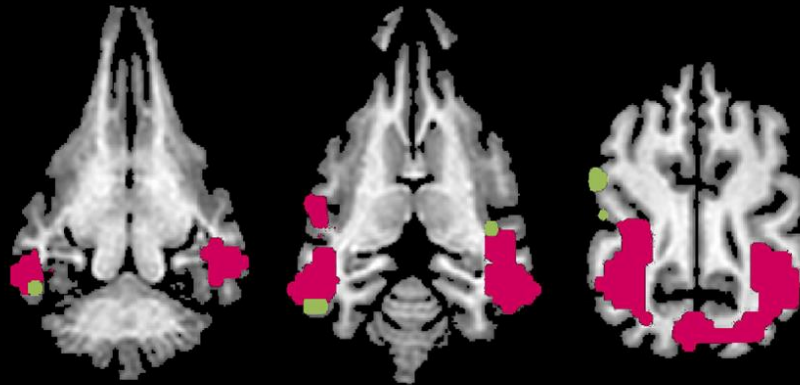
# Comparing preferences

● Face-over-conspecific preference    ● Conspecific-over-face preference

HUMAN



DOG

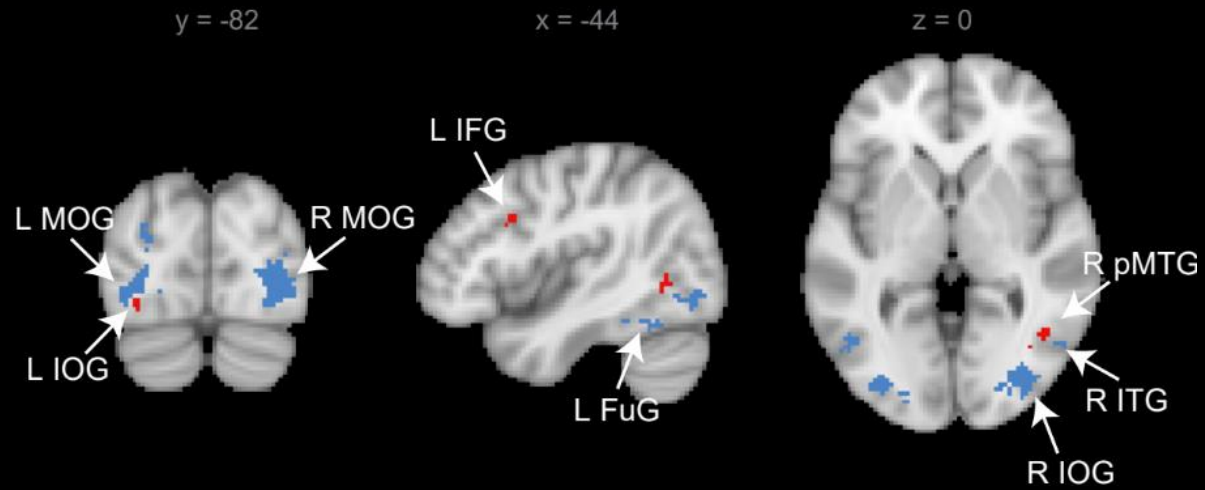


Direct comparisons between the two processing preferences showed a clear primacy of face-preference in humans (89.2% of the visually-responsive cortex), but of conspecific preference in dogs (94.6% of the visually-responsive cortex).

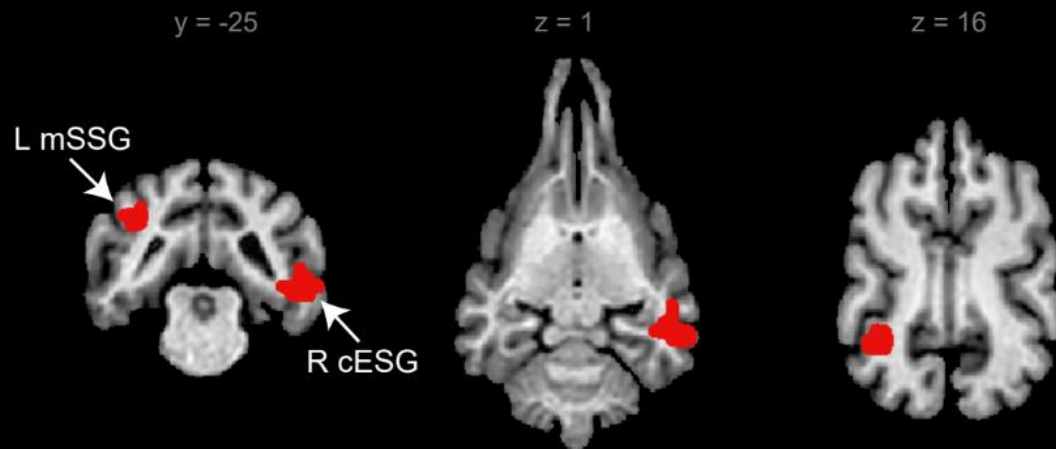


# MVPA

HUMAN



DOG



● Conspecific vs. Heterospecific

● Face vs. Occiput

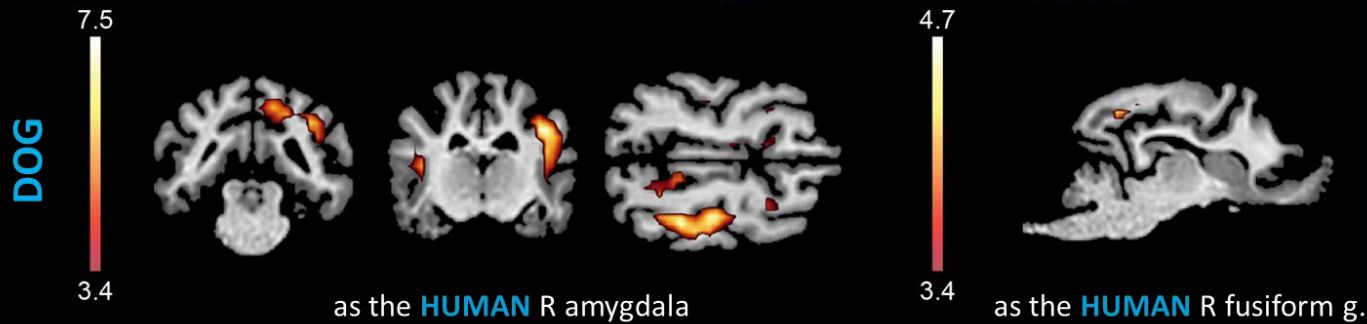
Multivariate pattern analyses identified species-sensitive regions in both species, but face-sensitive regions only in humans.

# Across-species RSA

Physical matching [  $\text{dog face}_{\text{DOG}} \sim \text{dog face}_{\text{HUMAN}}$  ]



Functional matching [  $\text{dog face}_{\text{DOG}} \sim \text{human face}_{\text{HUMAN}}$  ]



Activity pattern similarities were stronger for functional than physical matching.

This indicates that the cortical matches across species reflect functional effects (e.g. conspecificity-preference), and not preferences for some lower-level visual cues.

# Further controls

Differences in basic visual cues or motion across conditions did not explain these results.

None of the 20 tested dogs showed considerable face-sensitive clusters.

Dogs' human face-sensitivity did not covary with either experience (training level) or breeding-related structural parameters (cephalic index).

# Take home

## Visual perception of individuals

in HUMANS: face or not

in DOGS: dog or not

Visual social perception follows different organizing principles in humans and dogs.

Dog brains are more into discriminating conspecific from heterospecific images, than faces from non-faces.

**The central role of face-sensitivity in human (and primate) perception of individuals may not be general across all mammals.**

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Thank you for your interest in this work! Looking forward to talking to you...



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