

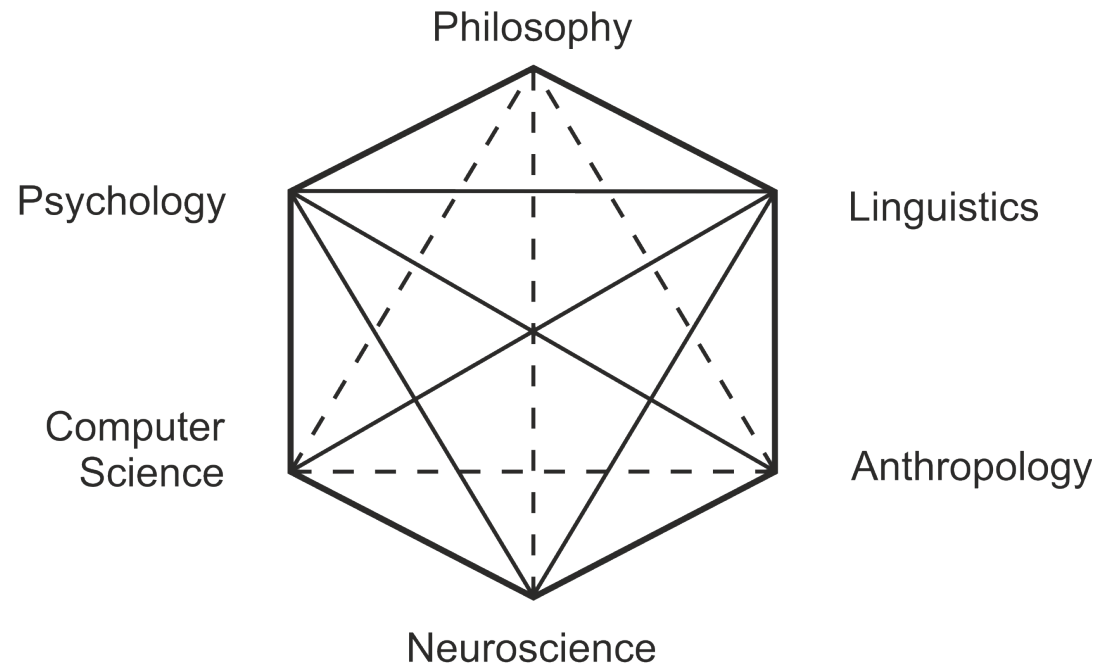


Laboratórium vnímania a kognície

TÉMY DIPLOMOVÝCH PRÁC 2018

(kogneuro@gmail.com)

Kognitívne vedy



Adapted from Gardner, Howard (1985).
The mind's new science: A history of the cognitive revolution.
New York: Basic Books, Inc.

Náš výskum

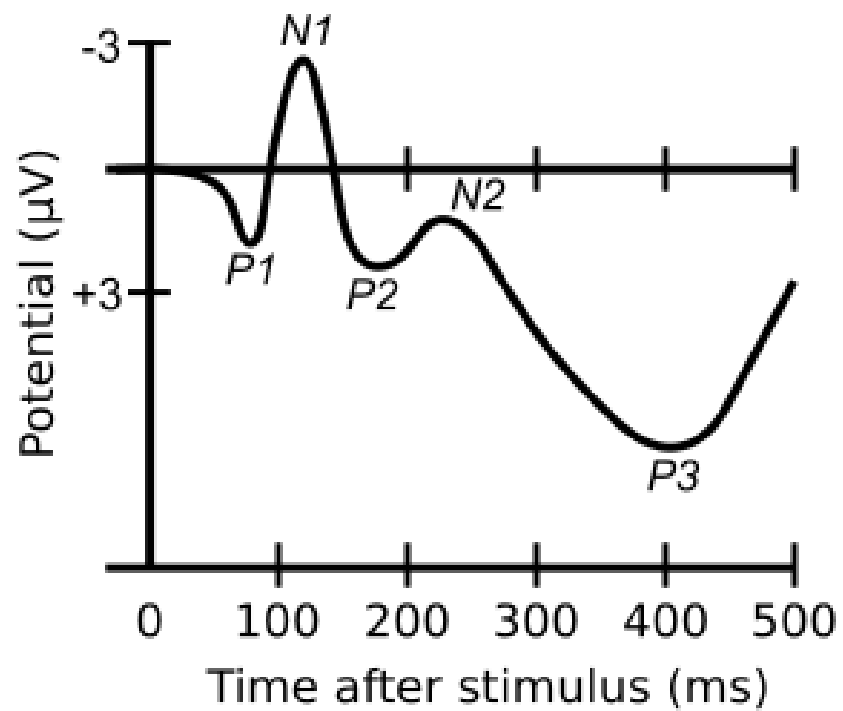
- ▶ **sluchové vnímanie**
(hlavne priestorové počutie)
 - ▶ Lokalizácia zvukov
 - ▶ Súvisiace témy: vnímanie reči, audiovizuálne interakcie, atď.



Metódy: 1) behaviorálne experimenty



Metódy: 2) EEG

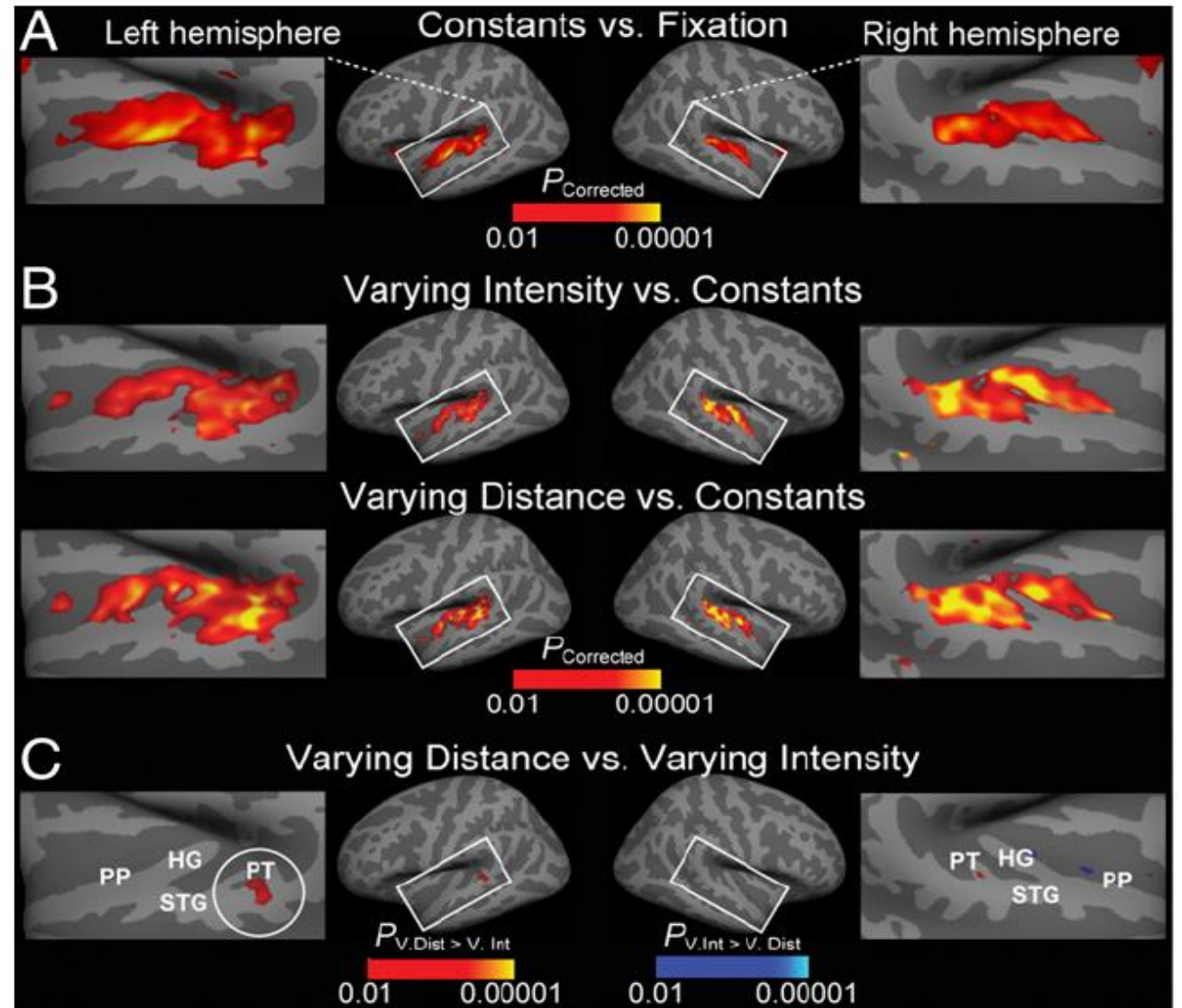


Metódy: 3) fMRI



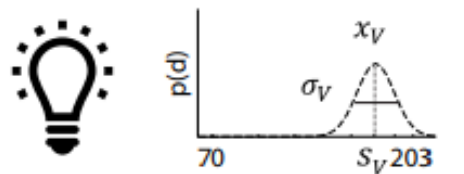
Image: By EconomicsUZH [CC BY-SA 4.0
(<https://creativecommons.org/licenses/by-sa/4.0/>)], from Wikimedia Commons

Kopco N, Huang S, Belliveau JW, Raji T, Tengshe C, Ahveninen J (2012). Neuron Representations of Distance in Human Auditory Cortex. Proceedings of the National Academy of Sciences of USA, 109 (27), 11019-11024.



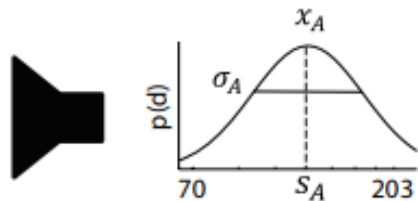
Metódy: 4) modelovanie

Model Structure



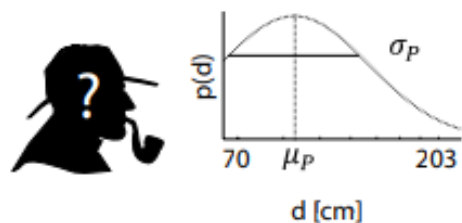
+

X

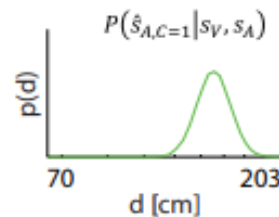


+

X



C=1

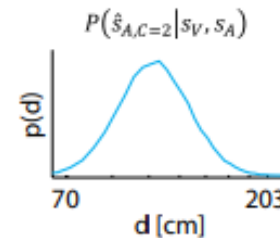


$$\hat{s}_{A,C=1} = \frac{\frac{x_V}{\sigma_V^2} + \frac{x_A}{\sigma_A^2} + \frac{\mu_P}{\sigma_P^2}}{\frac{1}{\sigma_V^2} + \frac{1}{\sigma_A^2} + \frac{1}{\sigma_P^2}}$$

C=?



C=2



$$\hat{s}_{A,C=2} = \frac{\frac{x_A}{\sigma_A^2} + \frac{\mu_P}{\sigma_P^2}}{\frac{1}{\sigma_A^2} + \frac{1}{\sigma_P^2}}$$

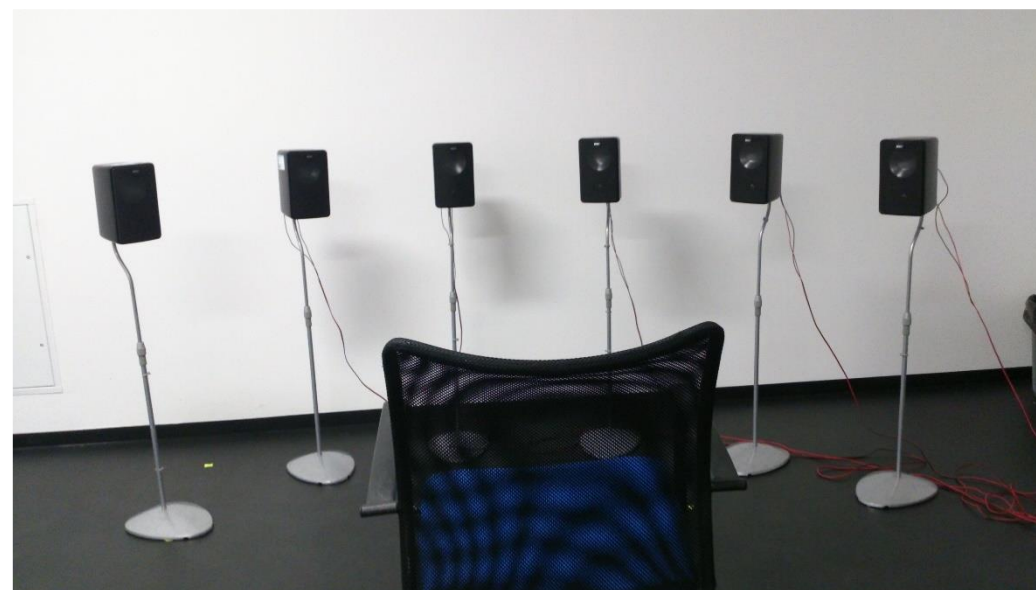
Aplikácie

- ▶ Sluchová protetika
- ▶ Virtuálna realita



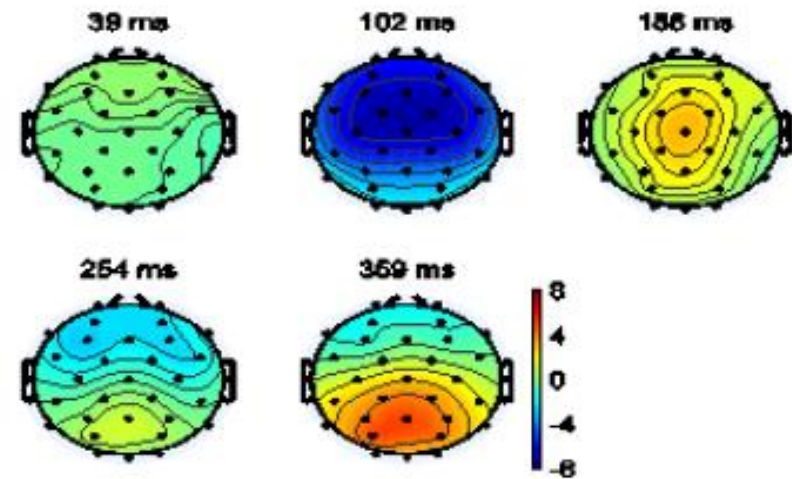
Čo vás čaká..

- ▶ Príprava experimentálneho setupu (technické zručnosti sú výhodou..)
 - ▶ Zapájanie audiotechniky, rozbehávanie nových výskumných zariadení, ...
- ▶ Programovanie experimentálnej procedúry (MATLAB)
- ▶ Zber dát
- ▶ Analýza dáta (MATLAB)
- ▶ (modelovanie)



Téma č. 1) Riadenie priestorovej sluchovej pozornosti

- ▶ Pomáha nám pri priestorovom vnímaní zameranie pozornosti na nejakú časť priestoru?
 - ▶ Lepšia rozlišovacia schopnosť?
 - ▶ Závisí na tom, či pozornosť na dané miesto upriamime vizuálne alebo sluchovo?
- ▶ EEG experiment

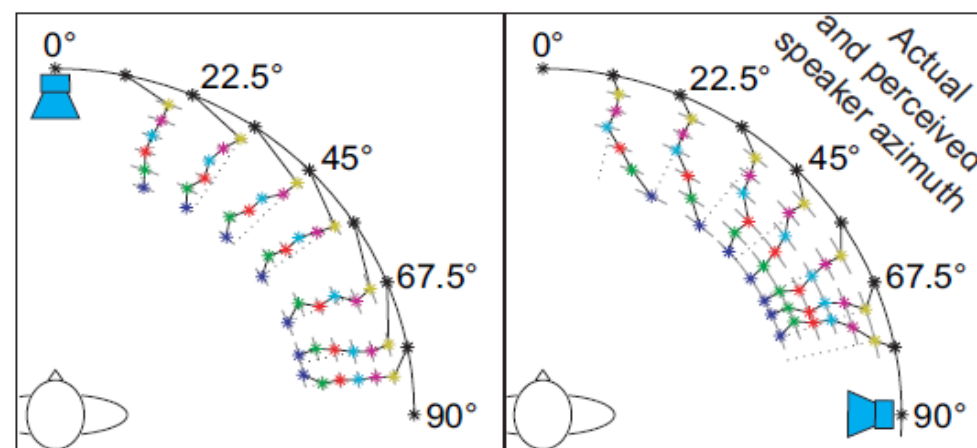


Šebeňa, R., & Kopčo, N. (2018): **Auditory spatial discrimination with visual vs. auditory attentional cueing**. In: Proceedings of the conference Cognition and artificial life 2018, 30. 5. - 1. 6. 2018, Brno, pp. 65-66, ISBN 978-80-88123-24-8.

Téma č. 2) Adaptácia v lokalizácii zvukov

- ▶ Skúmame, ako je lokalizácia zvuku ovplyvnená predchádzajúcimi zvukmi
- ▶ Predošlá štúdia ukázala neočakávané posuny v lokalizácii zvukov, snažíme sa tento jav vysvetliť
- ▶ Behaviorálny experiment

Hládek, L., Tomoriová, B., and Kopčo, N. (2017). **Temporal characteristics of contextual effects in sound localization.** Journal of the Acoustical Society of America, 142, 3288–3296.

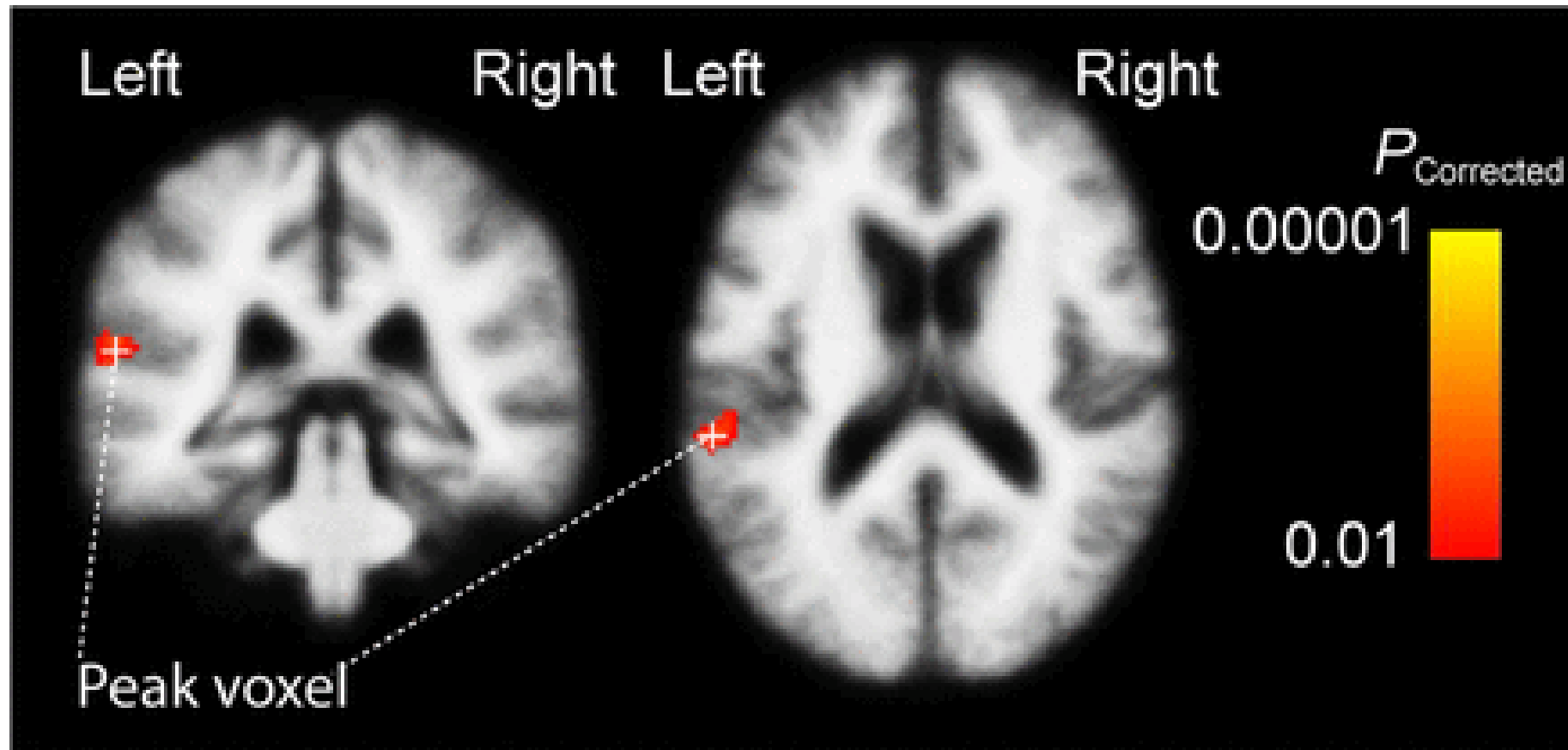


- resps. on no-distr. trials
- * resps. on distr. trials for different SOAs
- ▶ distractor location
- * actual target location

Figure (modified) from: N Kopčo, V Best, and BG Shinn-Cunningham. Sound localization with a preceding distractor, Journal of the Acoustical Society of America, 121 (2007), 420-432.

Background

- ▶ Determining the distance of objects is of key value in many everyday situations.
- ▶ Neuronal mechanisms of auditory distance perception are poorly understood.
- ▶ To study and understand how we perceive distance using auditory signals.
- ▶ We combine behavioral experiments, fMRI measurements, and computational analyses to identify the neural representation of distance.



Kopco N, Huang S, Belliveau JW, Raji T, Tengshe C, Ahveninen J (2012). Neuronal Representations of Distance in Human Auditory Cortex. Proceedings of the National Academy of Sciences of USA, 109 (27), 11019-11024.

Fig. 1. Volume-based fMRI analysis of activations during varying distance vs. intensity. Significant activation cluster extends from the left PT to the left posterior STG.

Tasks

- ▶ Conducting and participation in the behavioral experiments.
- ▶ Modelling and analyzing the data.
- ▶ Making scientific figures and writing articles.
- ▶ Active participation in the PCL activities (Fun activities too !!)

Why you should consider this project

- ▶ Because you like to do research, data science, challenges, solve real problems
- ▶ Interdisciplinary projects
- ▶ International collaborators
- ▶ Networking

References

- ▶ Kopco N, Huang S, Belliveau JW, Raij T, Tengshe C, Ahveninen J (2012). **Neuronal Representations of Distance in Human Auditory Cortex**. Proceedings of the National Academy of Sciences of USA, 109 (27), 11019-11024.
- ▶ <https://pcl.upjs.sk/grants/alt/>
- ▶ <https://pcl.upjs.sk/publications/>



Thank you for your attention

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