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## **Adults recognize pain in cries when currently involved in babies' care: investigations from behavior to brain responses**

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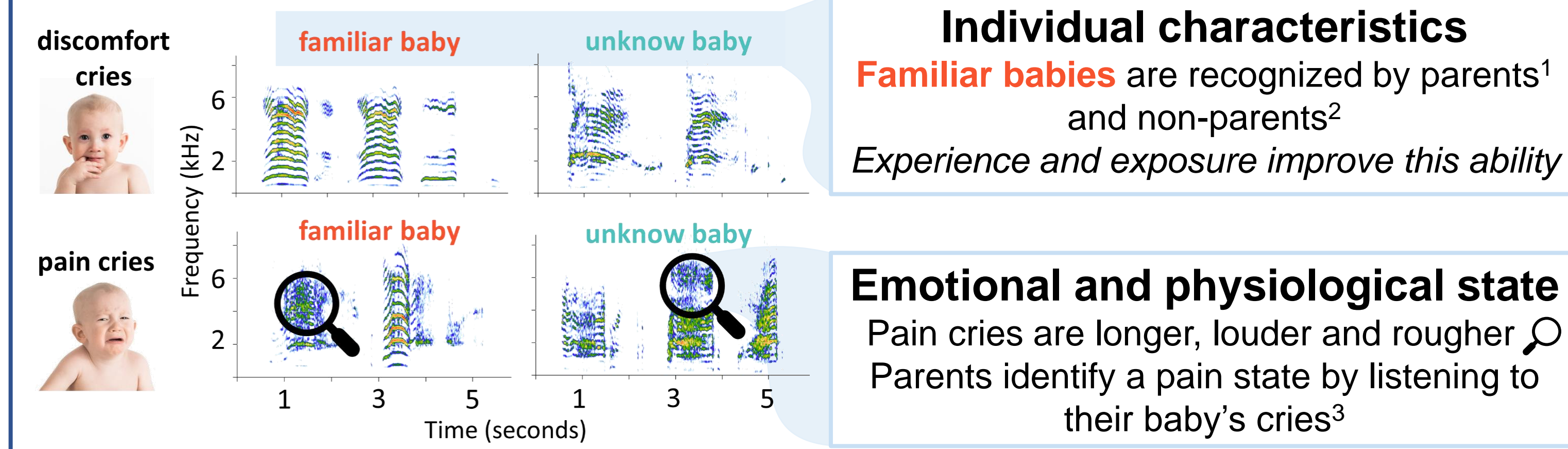
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## Background: babies cries convey information through acoustic differences



Spectrograms (graphical representations) of cries from two different babies. Cries were recorded during bathing (discomfort cries) or during routine vaccination (pain cries).

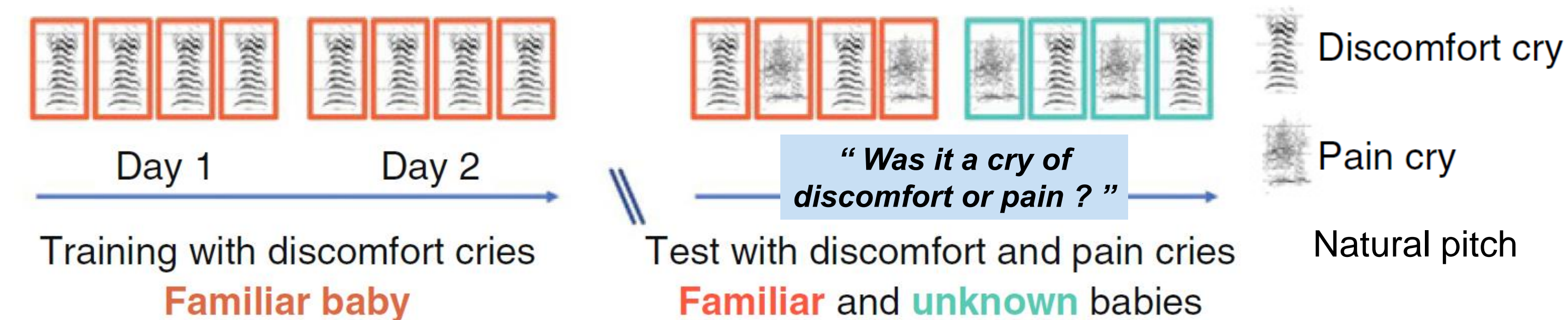
Is the ability to recognize pain in cries shared between every adult or acquired with experience at caring for babies?  
Can adults generalize and recognize pain in cries from every child?

Which brain areas are involved for pain recognition in cries?

## Methods

**Psychoacoustic experiment:** 234 participants (133 women, 101 men) with various experience in babies care

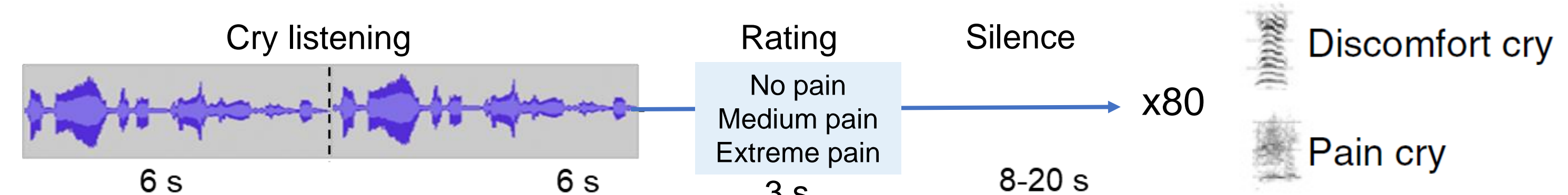
- Non parents with no experience, a moderate or a professional experience with babies
- Parents having a child younger than 2 years-old or older than 5 years-old



Adult subjects began by hearing discomfort cries from an assigned baby in two successive sessions. In a second step, subjects listened to successive sequences of cries from either their familiar baby or an unknown baby. The cries were either discomfort cries or pain cries. Subjects were asked to classify each cry as either « discomfort » or « pain » cry.

Bayesian mixed model

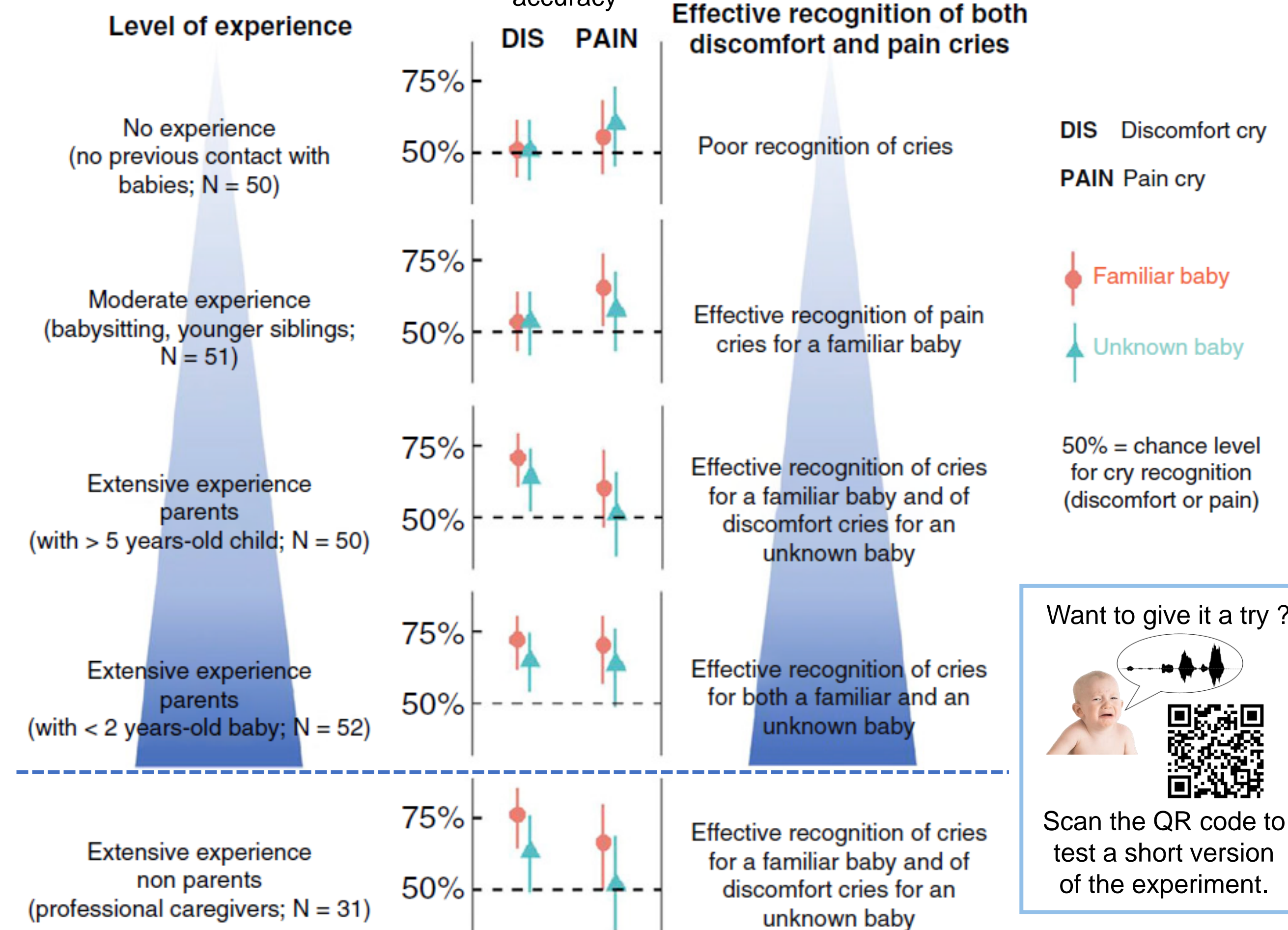
**fMRI experiment:** 80 participants (40 women, 40 men) parents and non-parents



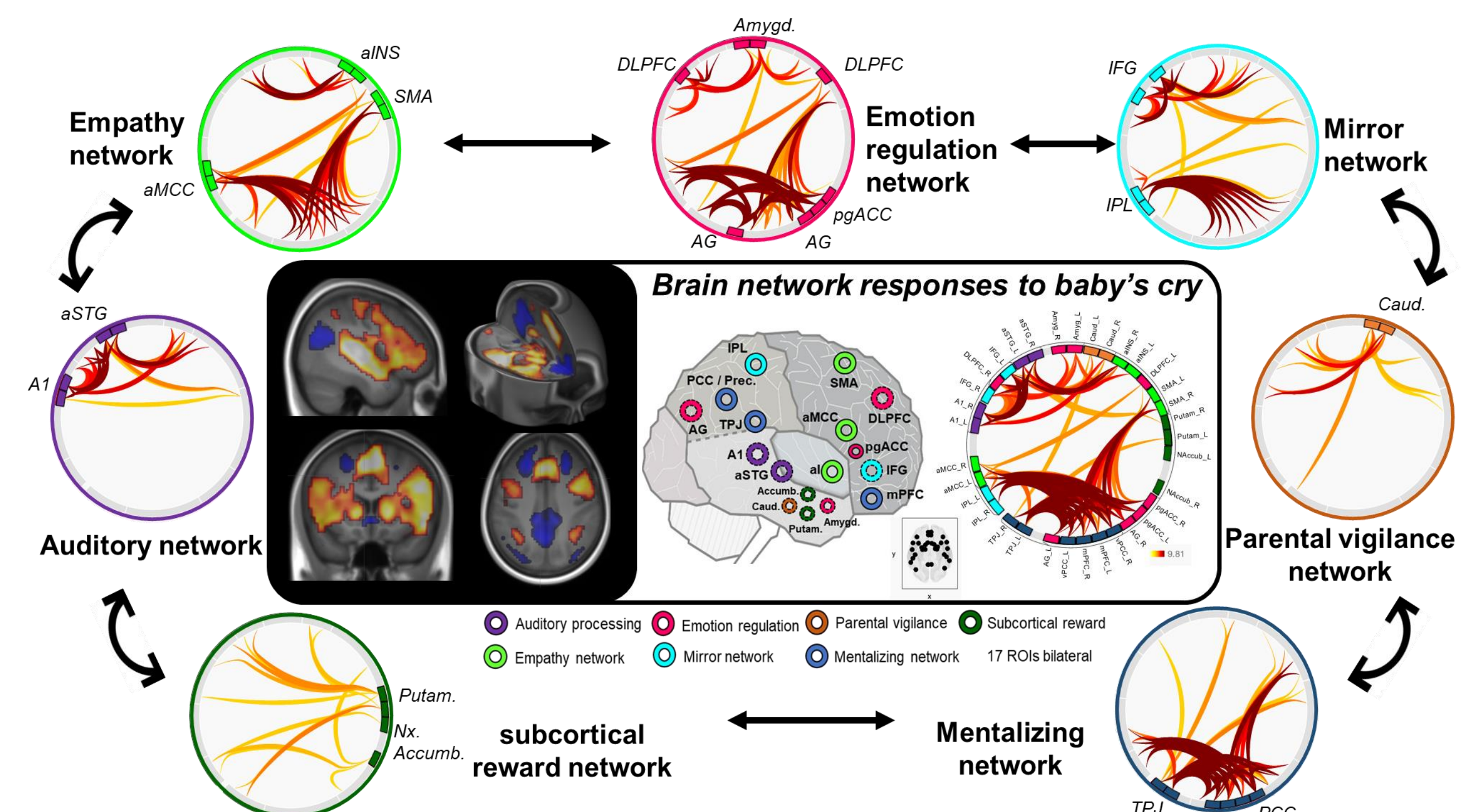
Brain activity and functional connectivity between nodes of the 'parental caregiving' connectome

At two pitch level 360 & 500 Hz

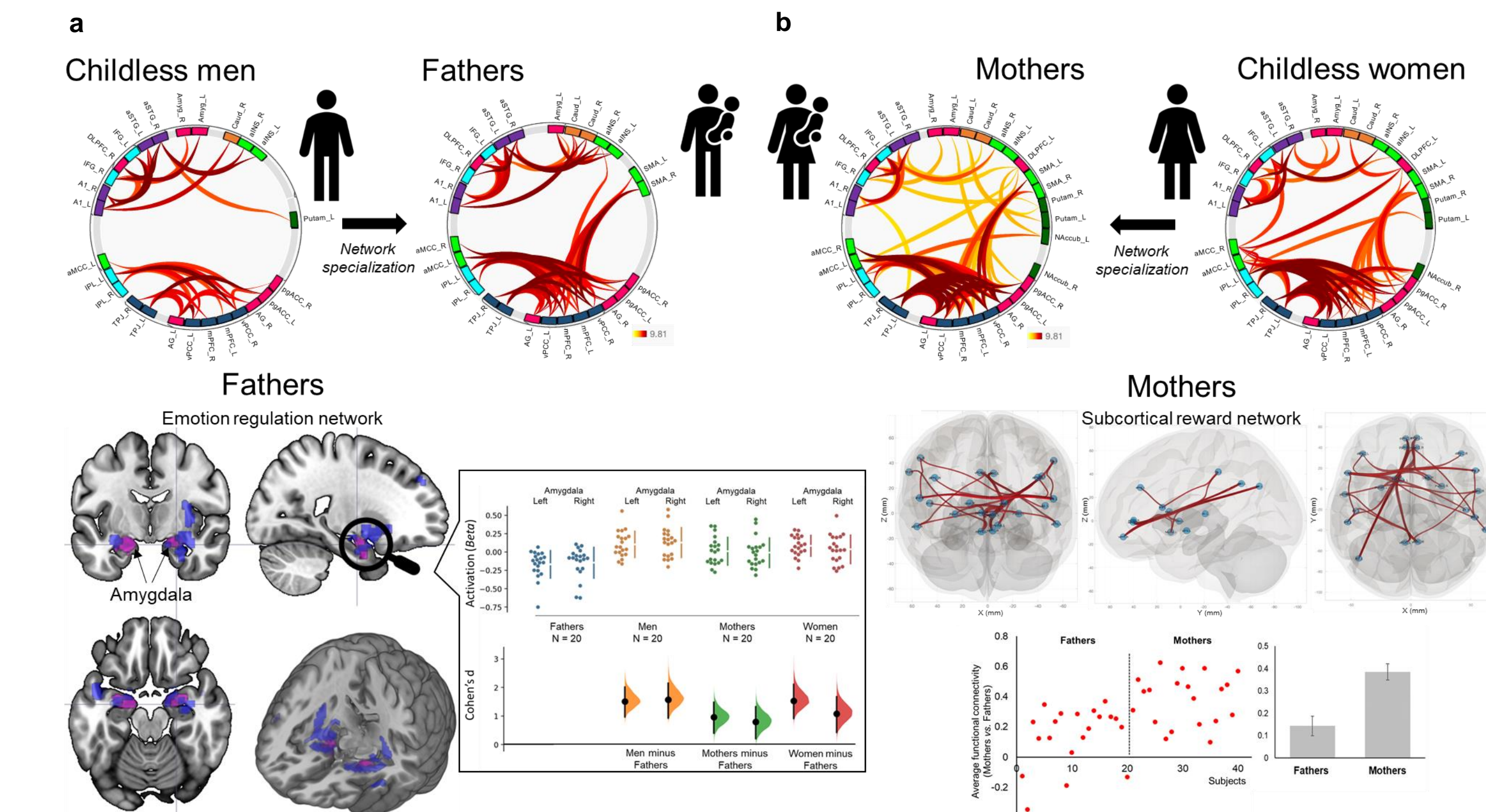
## Results



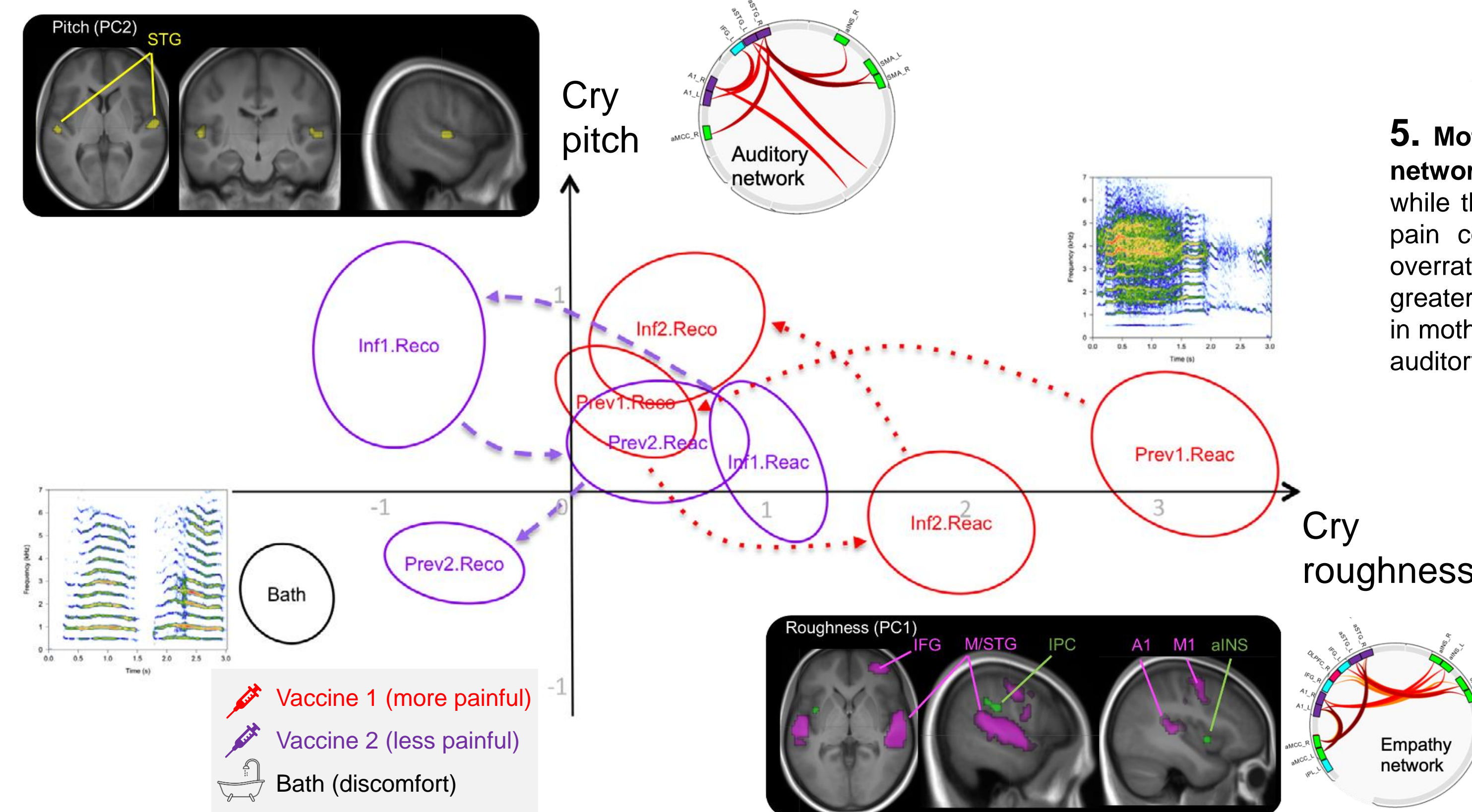
**1. The ability of tested adults to recognize cries as cries of "discomfort" or "pain" depended on their experience with babies<sup>4</sup>.** Inexperienced individuals randomly categorized both the familiar and unknown baby's cries, whereas parents currently raising a baby correctly identified the cries in both cases. Overall, the ability to identify cry is improved by prior and current experience with babies.



**2. Brain responses to baby cries.** Listening to cries results in the activation of extensive brain regions distributed according to seven functional brain networks: auditory, empathic, emotion regulation, mirroring, parental vigilance, subcortical reward and mentalization.

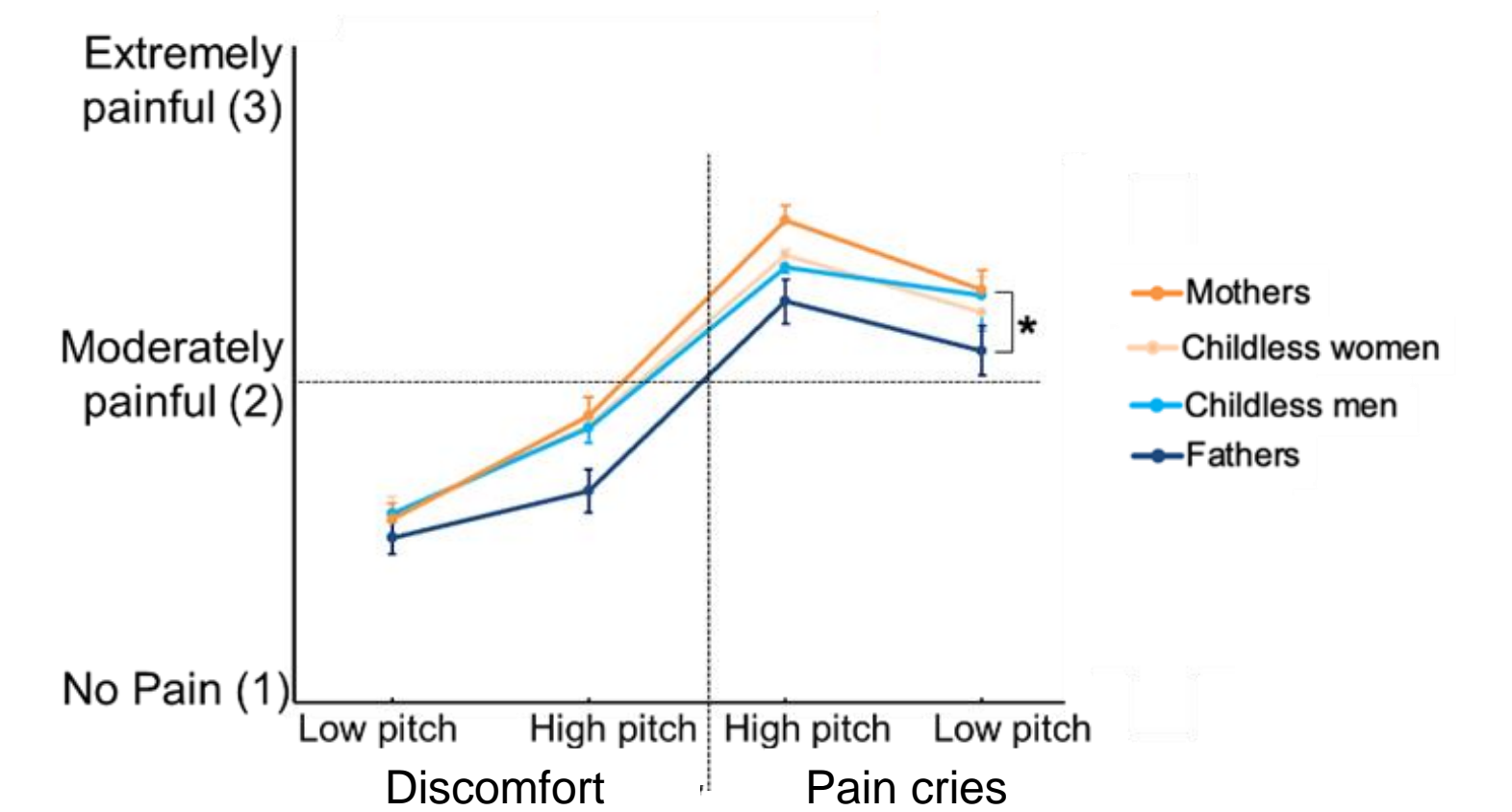


**3. Parental specialisation of the brain functional networks in response to cries.** Childless adults show higher connectivity in the empathy network than parents. **a.** Fathers' brain show lower activity in the amygdala, the aINS and the IFG, and stronger functional connectivity in the emotion regulation network. **b.** Mothers' brain have higher activity and functional connectivity in the subcortical reward network (including the putamen, amygdala, and hippocampus).



## References

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- Bouchet *et al.* Baby cry recognition is independent of motherhood but improved by experience and exposure. *Proc. R. Soc. B* (2020).
- Koutseff, A. *et al.* The acoustic space of pain: cries as indicators of distress recovering dynamics in pre-verbal infants. *Bioacoustics* (2018).
- Corvin *et al.* Adults learn to identify pain in babies' cries. *Current Biology* (2022).



## Conclusion

Previous experience in babies' care is necessary to recognize pain in cries<sup>4</sup>. Pain information encoded in the cries are decoded by empathic brain regions. Parenthood shapes the brain organisation and makes parents able to assess the pain conveyed by the cries of unknown babies. **Extensive experience is required to distinguish between pain and distress in babies' cries, and involves an adaptation of brain circuits.**

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