

Linking faces to social cognition: The temporal pole as a potential social switch

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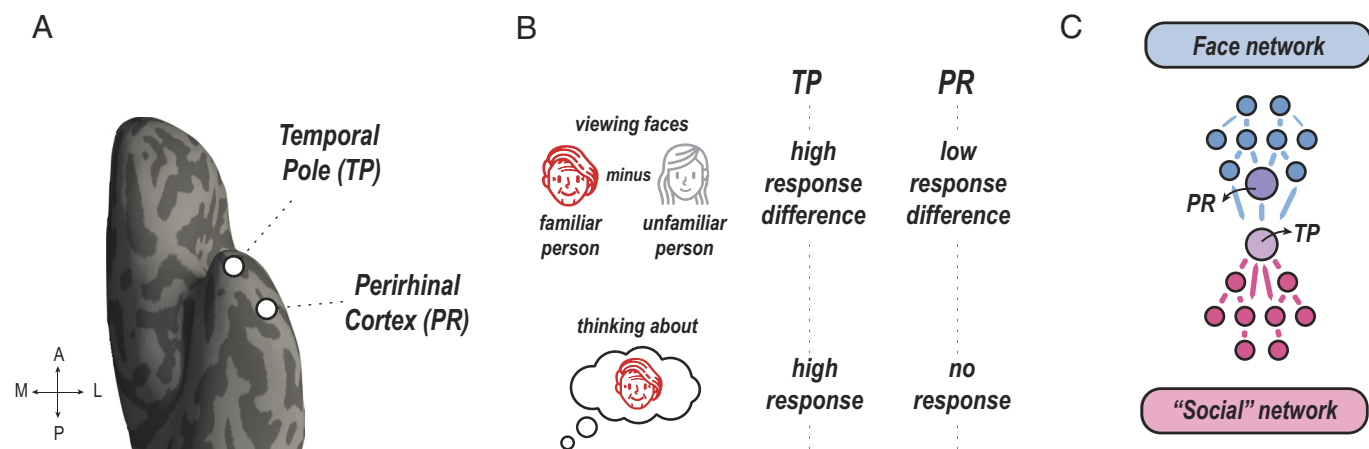


Fig. 1. Key results from Deen et al. (10). (A) Figure shows the bottom view of the brain indicating the anatomical locations of the TP and the PR, regions described in the study. A, P, M, L indicate anterior, posterior, medial, and lateral axes, respectively. (B) Description of the key results. *Top* figure describes the responses when viewing faces of personally familiar persons (red) minus the responses when viewing faces of unfamiliar persons (gray) in TP and PR. *Bottom* figure describes the responses in TP and PR when participants were thinking about personally familiar persons. (C) Schematic of the key results. Nodes in blue are meant to show members of the “face” network and those in pink members of the “social” network in the brain. The results suggest that PR is a part of the face network, and TP is the switch that links the brain’s face and social networks.

From recognizing loved ones in a crowded room to identifying colleagues at a conference, face familiarity guides our social interactions with the world. This ability likely involves the interplay between brain regions dedicated to face processing, memory retrieval, and social understanding. Although the regions involved in face processing have been extensively studied (1–5), how the brain distinguishes between familiar and unfamiliar faces and connects them with social cognition regions remains unclear (6). Recent monkey studies (7–9) have offered intriguing clues about the involvement of two brain regions, the temporal pole (TP) and the perirhinal cortex (PR), in face processing and familiarity. Now, a new study in PNAS by Deen et al. (10) offers an important breakthrough in humans. Overcoming technical hurdles and employing innovative experimental paradigms; they reveal distinct roles of PR and TP (Fig. 1A) in human face recognition and familiar person recognition, respectively. These findings not only shed light on how the brain might recognize familiar faces but also suggest a crucial “social switch” that links the brain’s face processing and social networks.

Face-selective responses in the TP and PR have been previously hypothesized (11–13). However, studying these regions in humans has been challenging due to the limitations of functional MRI. These regions are located near air-filled sinuses, which create significant magnetic field interference and hinder MRI signal clarity. The researchers overcame this hurdle by employing the latest scanning routines and data-denoising methods that improve MRI signals and enable precise targeting of the TP and PR in each participant. These innovations paved the way to address the study’s first question: are there

parts of the TP and PR, like those in monkeys, specialized for faces? To answer this question, participants viewed images of faces, objects, and scenes while undergoing MRI scans. For every participant, regions were localized within the TP and PR that responded significantly more to faces than to objects or everyday scenes.

But what is the functional role of these face-specialized regions in the TP and PR? Do the TP and PR function as dedicated processors within the brain’s “face network” analyzing facial features, or do they fall under the broader “social network” involved in connecting faces with familiarity signals from memory? Both TP and PR make strong connections with the hippocampus, a key memory center, suggesting that both these regions could potentially associate faces with memories, critical for the perception of familiar faces. To explore this possibility, researchers showed participants faces of people they knew personally, alongside unfamiliar faces

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matched for age, race, and gender. The results revealed an important and fascinating difference. Face responses in TP were strongly influenced by familiarity. Responses were much higher for personally familiar faces than unfamiliar faces. On the other hand, responses in PR showed a much weaker modulation by familiarity (Fig. 1B). These results suggest that face responses in TP and PR serve distinct functions. PR might be part of the face network that processes all faces we encounter, while TP prioritizes the faces we know.

These findings not only shed light on how the brain might recognize familiar faces but also suggest a crucial “social switch” that links the brain’s face processing and social networks.

The study goes on to investigate how TP and PR contribute to social cognition beyond face perception. Participants performed tasks related to familiar people such as making personality judgments and mentally simulating conversations. Intriguingly, only the TP, and not PR, exhibited significant activity during these tasks that probed familiarity and social understanding (Fig. 1B). This finding suggests that the functional role of TP may transcend just face perception. To probe this further, the authors directly compare the activity patterns of TP and PR with other established face processing and social cognition networks. TP aligns more closely with other social brain regions, while PR aligns more with the face-processing regions. Together, these results paint a consistent picture: a) there are regions specialized to process faces in the human PR and TP, and b) face responses in PR serve a primary role in face processing, while those in TP act as a possible social switch activated when encountering familiar people, triggering the retrieval of memories, and facilitating social cognition in humans (Fig. 1C).

The data presented in this study shed light on longstanding mysteries and spark new questions. Previous work has shown that recognition for familiar faces is demonstrably more robust than for unfamiliar faces (14). Some case studies have also reported face deficits specifically affecting familiar faces (for instance, patient JS reported in ref. 15, who “refused to let her grandchildren sit on her lap because they looked repulsive.”). Researchers have long hypothesized the existence of “person identity” nodes (16) within the brain’s extended face network in the brain (11, 13). Studies have also examined the anterior temporal lobe (ATL), probably overlapping with the PR region identified by Deen et al. (10), as a face-specialized identity node, yielding mixed results (17–20). Deen et al. (10) revisit this question inspired by face-specialized nodes discovered in the TP of monkeys (7, 8). The face specialized region in the TP is more strongly modulated by personally familiar faces than other regions within the face network, including the PR

(previously ATL). TP is also not strictly linked to facial features, as it is activated even when assessing features about familiar people or mentally simulating a conversation, unlike PR. These data upend the previous theoretical models of face recognition (11–13, 16), replacing PR (previously ATL) with the TP as our current best guess of the person identity node in humans.

Deen et al.’s (10) work also offers intriguing insights into the evolutionary forces that have likely shaped the organization of the brain across species. This study reveals a striking consistency in both the anatomical location and functional role of face processing areas TP and PR across monkeys and humans. This observed homology is particularly remarkable considering the substantial and nonuniform expansion of the human brain since our divergence from a common ancestor (21). This similarity also indicates that the ability to recognize and understand familiar faces is not a human innovation but a fundamental aspect of social interaction with deep evolutionary roots. These findings also pave way for further investigations into the finer-grained representations, the computational mechanisms (for example, ref. 9), and the dynamics of face familiarity in animal models using tools largely unavailable in human neuroscience.

These findings also hold implications for future computational models of the brain. The results in the paper indicate a potential division of labor within the face network. The PR, primarily responsive to visual face stimuli, might be well-suited for modeling with artificial neural networks that excel at capturing image-computable perceptual features (22–25). In contrast, the TP presents a new challenge. Its role in processing familiar faces and integrating social cues suggests a broader range of influences beyond just visual information alone. This highlights the need for future models to incorporate not only visual features but also social and contextual information, potentially leading to more holistic models of face recognition that bridge the gap between perception and cognition.

In conclusion, Deen et al.’s (10) work sheds light on the human TP as a potential social switch, linking familiar faces to the broader social network of the brain. These findings necessitate revisions to our current models of face recognition, provide a glimpse into the evolutionary underpinnings of social cognition and pave way for more sophisticated computational models that link face recognition with a richer social understanding of the world.

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