

# Distinct neural patterns underlying ingroup and outgroup conformity

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Group membership shapes how we interact with others. Individuals tend to conform more to ingroup members than to outgroup members (1, 2). In PNAS, Lin et al. (3) report an intergroup conformity neural network that tracked the social influence of ingroup over outgroup members. However, we question the researchers' interpretation of the findings.

Lin et al. (3) report "ingroup > outgroup conformity" activity, but not neural tracking of ingroup conformity and outgroup activity separately. The parametric design allowed us to reexamine the brain regions that were positively or negatively correlated with ingroup and outgroup conformity scores independently, before contrasting the two conditions. This is an important point because, as shown in our schematic illustration (Fig. 1), even when a region such as the ventral striatum (VS) tracks the degree of outgroup conformity in the opposite direction, the ingroup > outgroup contrast can still result in similar positive activity. The different patterns speak to a critical question regarding intergroup interactions: Is the way we interact with outgroup members quantitatively or qualitatively different from how we react to ingroup members? A quantitative difference would predict similar neural patterns (4), but the degree of activity would differ between ingroup and outgroup (Fig. 1A) (i.e., an ordinal interaction in which both slopes have the same sign but differ significantly in strength). However, a qualitative difference would predict fundamentally different or even opposite neural activity patterns in ingroup and outgroup (Fig. 1B and C) (5) (i.e., a disordinal interaction in which the slopes have opposite signs).

In the Lin et al. (3) paper, degree of ingroup conformity is positively correlated with activity in the dorsolateral prefrontal cortex (Fig. 2A), and outgroup conformity is not positively associated with activity in any brain regions. Surprisingly, degree of outgroup conformity is negatively associated with activity in brain regions that

are claimed to be the neural signatures of the ingroup > outgroup conformity effect (Fig. 2B and C). The explanations regarding the specific functions of brain regions involved in intergroup conformity need substantial revision. For example, VS activity is interpreted as reflecting increased rewarding experience when conforming with others. However, the VS is negatively correlated with outgroup conformity, which contradicts the literature showing that VS is activated by consensus vs. conflicts (6, 7). Such activity pattern may suggest outgroup derogation rather than ingroup favoritism at the neural level. For instance, when deviating more from outgroup opinions, individuals may feel more rewarded, engage higher levels of mentalizing, and be more aroused.

It is noteworthy that one feature of Lin et al.'s (3) study is that it does not include participants' initial ratings in the same session as the group ratings. This may cause the social conflicts elicited by the discrepancy between personal attitudes and group attitudes to be less salient than in previous studies (7, 8) and may explain the lack of brain activity that is positively correlated with conformity in both conditions.

Intergroup discrimination can be the result of ingroup favoritism, outgroup derogation, or some combination of both (9). Given the widespread use of difference scores in behavioral and neuroscience research, we emphasize that difference scores can mask important mechanisms. Response patterns in each condition need to be reported and explained (10).

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