Peer Review

Review of: "Collective Pareidolia"

Richard Coss[1]

1. Department of Psychology, University of California, Davis, United States

Review of: Collective Pareidolia

Overall rating

Clarity: 4/5

Novelty: 5/5

Impact: 3/5

Merits: The construct of group pareidolia is innovative

Richard G. Coss

Affiliation: Department of Psychology, University of California, Davis

I found Bednarik's paper quite innovative based on his description of "group pareidolia," due to the appearance of face-like motifs on membrane rubbings of blocks of granite using a coloring agent. Pareidolia was assumed because close inspection of these granite blocks indicated no recognizable visual features. From my perspective, it is truly unfortunate that video recordings were not made of the rubbing actions by the three specialists so that any common sequences in the appearance of face-like features in the motifs could have revealed how pareidolia seemingly influenced image expressions.

Previous reviewers have already critiqued the methodology employed that inspired Bednarik's paper and its pitfalls. What I found fascinating was the similarity of the schematic face-like patterns in Figs. 1 and 2 that resemble children's drawings. Although some reviewers indicated that a neurobiological interpretation of the pareidolia effect was unnecessary, I will argue that Bednarik's description of the pareidolia effect reflects different levels of organization, with the possible contagion of group cognition at the highest level and neurobiological influences at the lowest level. For rock-art enthusiasts, this breadth of Bednarik's discussion is refreshing. For my review, I will focus on the pareidolia effect at the lowest level of organization by emphasizing the role of the subcortical superior colliculus in face recognition.

The primate visual system has two distinct pathways for early visual processing, the superior colliculus (SC) and the primary visual cortex. Based on macaque

neurophysiology, the SC receives approximately 10% of retinal ganglion projections, with the remaining projections going to the primary visual cortex via the lateral geniculate nucleus. In humans, innate face recognition via the SC emerges in late-preterm fetuses well before conscious face recognition is evident with the post-natal maturation of the visual cortex in the first year of life (cf. Johnson, 2005; Reid et al., 2017). The SC is instrumental in generating saccadic eye movements and target selection (Basso and May, 2017), a critical component for initiating the visual tracings of the face-like pareidolia patterns described by Bednarik. In particular, the saliency of the eye patterns that emerged during the rock-surface rubbings shown in Figs. 1 and 2 might involve unintended guidance of the hand by the SC during subtle sensory feedback with rubbing activity. Such hand action might foster the emergence of even more complex face-like features surrounding the schematic eyes. Such unintentional hand movements while rubbing might explain, in part, the convergence of pattern similarity that Bednarik labels as collective or group pareidolia.

It must be noted here that patients with extensive bilateral lesions in the primary visual cortex can still see nonconsciously via the SC, a property called “blindsight.” My personal observations of such a patient noted that she engaged in an uncanny level of eye contact with different hospital staff and friends that persisted irrespective of distance, all of which occurred without conscious visual awareness of their appearances. Like many others with blindsight, this patient engaged in visually guided reaching, object grasping, and obstacle avoidance while walking about.

Most importantly for the SC’s contribution to facial pareidolia, this neural structure appears to differentiate between different facial expressions (Pegna et al., 2005). Neurophysiological recordings of the macaque SC also document the saliency of faces, especially the eye region (Nguyen et al., 2014). Moreover, the potency of two-facing eyes is well documented among different vertebrate taxa. Recognition of this schema is apparently very ancient phylogenetically, extending back in time to the Middle to Late Triassic period with the discovery of fossilized impressions of forewing eyespots on the wings of moth-like cicadas, presumably acting as an antipredator device to deter insectivorous reptilian and early mammalian predators (Shcherbakov, 2022). As such, it is not unreasonable to argue that the innate properties of face perception at the subcortical level might engender the illusory

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emergence of two-facing eyes in stylized faces from randomly arranged rock-surface irregularities. Given that sustained attention likely occurs during rubbings, it is not surprising that face-like illusions would occur as they did during early NASA sensory deprivation experiments when round analog instrument panel dials dissolved into faces.

While nonconscious properties of face perception via the SC might account for some facets of pareidolia, its contribution to face perception is indeed integrated into a higher-order network within the neocortex that leads to conscious awareness. As described briefly by Bednarik, the primary visual cortex engages in considerable visual processing that is indubitably important in perceiving visual images. In particular, area V1 appears to integrate contours with the same orientations as "good continuation" based on the contextual surrounds in receptive fields (Li et al., 2006). Such contour integration is essential for merging short linear segments into longer visual features integrated downstream into a coherent Gestalt. In a similar fashion to presumed pareidolia, shorter contrasting segments appearing incrementally with sequential rubbing might coalesce into a meaningful feature that would guide the repositioning of the next rubbing action. This could occur consciously without a preconceived mental-image overlay on drawing paper, as typically occurs during the contour drawing of a model posing in a beginning art studio class.

Electrical stimulation of the inferior temporal area of the neocortex revealed short action scenes that were consciously apparent to patients in early studies of patients awaiting epilepsy surgery. More recent human brain imaging and electrophysiological studies of macaques have shown that recognition of facial features is mediated by face patches within the fusiform gyrus in humans and in the inferotemporal lobe of macaques (Gilbert and Wu, 2013; Tsao, Moeller, and Freiwald, 2008). In light of these aforementioned findings, the question is still unanswered as to whether the three specialists conducting the rubbings described by Bednarik were consciously aware of the emerging face-like motifs during their initial stages of rubbing or whether the nonconscious properties of face perception set the stage for a progressively conscious recognition of the emerging motifs.

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Declarations

Potential competing interests: No potential competing interests to declare.