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Case Report

Collective Pareidolia

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This paper discusses a case of apparent collective pareidolia where a group of people perceived non-existent petroglyphs on undecorated rock surfaces, leading to an investigation into the mechanics of shared perception. A university team had recorded thousands of what were believed to be petroglyphs. An invited team of three rock art specialists found no actual grooves corresponding to the recorded intricate images. The study suggests that the visual system's expectation of seeing certain patterns, influenced by social and cognitive factors, can lead to collective pareidolia, reinforced by peer pressure. This case highlights the limitations of the human visual system and persistence of pareidolic perceptions, which can even become shared beliefs among a group despite evidence to the contrary. It also brings into focus the need of scepticism towards all attempted rock art motif identifications by cultural aliens, as they are always derived via pareidolia.

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Introduction

Pareidolia defines the experience of meaningful patterns in random visual or auditory stimuli, of detecting meaning where there is, in fact, none. It serves the brain by rapidly identifying sensory data before the visual centre can fully process them. Natural selection favoured the rapid identification of threats, achieved by matching initial visual clues with information stored and retrieved in the brain's "internal model"[1]. In visual pareidolia (as in Rorschach blots), a figurative pattern is conjured up, forming a two-dimensional or three-dimensional image, while auditory pareidolia might perceive hidden messages in sound recordings[2]. Pareidolia and apophenia (or "patternicity"[3]) define the human propensity to detect meaningful patterns within what are, in reality, random data[4]. The "abnormal meaningfulness"[4]defining them reflects the brain's sifting through sensory information to detect significant signals. In the human brain, this mental priming effect of interpreting stimuli according to an expected model "lacks an error-detection governor to modulate the pattern-recognition engine"[3]. Natural selection has not selected against generating such essentially erroneous beliefs because the cost of failing to detect a real pattern can be significantly greater than the cost of detecting an imagined pattern. Pareidolia is, therefore, a phenomenon of considerable psychological interest: it shows that incorrect causal associations can be preferred by natural selection. Face pareidolia is the most common form in humans[5] and has also been demonstrated in rhesus monkeys[6].

In this paper, we will analyse the phenomenon of collective or group pareidolia, when pareidolic vision is shared by a relatively large group of interacting individuals. Individual pareidolia is extremely common, has been investigated and can be explained. Shared pareidolia of perceiving non-existent entities is more difficult to account for. In individual pareidolia, we essentially recognise what our visual system causes us to expect to see. Pareidolia is part of the visual system's shortcut to facilitate decisions on how to respond to visual stimuli. It takes hundreds of milliseconds to process visual data, and the thalamus provides only a quickly gathered approximation to the visual cortex. Moreover, the amount of information the thalamus sends to the visual centre is only about one-sixth of that travelling in the opposite direction[7]. Up to 95% of modulatory, excitatory and inhibitory input in the lateral geniculate nucleus (LGN) can derive from such projections as the visual cortex, thalamic reticular nuclei, pretectum, superior colliculus and local LGN interneurons[8]. Visual memory/imagery occurs in the higher areas of the visual cortex of the inferotemporal cortex, with feedback projections back to the visual cortex (V1, V2 and V4)[9]. Before conscious recognition occurs, early redirected pathways emanate from the thalamus region to the amygdala[10][11]. Reaction times can define survival odds at existentially crucial moments in an organism's life. Paradoxically, it was an ambiguity of perception that offered a survival advantage to hominins[12]. Switching to a flight response had survival value even when the perceived carnivore turned out to be a harmless rock.

The initial response of any human visual system to seeing rock art (non-utilitarian anthropogenic markings on natural rock surfaces) is to attempt to detect evidence of iconicity in such an arrangement and then endeavour to interpret that iconicity. This process is neurologically similar to the 'decoding' of a Rorschach blot, the only difference being that the blot has no inherent meaning. The rock art motif is imbued with emic meaning, which is not accessible to the present-day beholder. The etic meanings we impose on a rock art motif are as relevant as those we foist on Rorschach blots because we lack access to the cognition or perception of the producer of the rock art[13]. The brains of the beholder and the creator of the ancient image differ in their respective structure, arrangement and chemistry[14][15][16][17]. Moreover, it has been shown unambiguously that a modern Westerner is incapable of correctly interpreting rock art made by indigenes[18][19]. Similarly, the interpretation of entirely natural rock markings as rock art, which is quite common in archaeology[20], is also attributable to pareidolia. Another archaeological relevance is that some form of pareidolia is involved in the issue of eoliths (or geofacts) vs lithic artefacts and their respective identification[21][22].

The empirical evidence

The interpretations of a Rorschach blot (or any other random arrangement) and a rock art motif are both based on pareidolic reactions: the sensory data processed by the lateral geniculate nucleus of the thalamus is interpreted as an image derived from the visual system of the occipital cortex. The purpose of the present paper is not, however, to explore the derivation of pareidolia, but to add to its understanding by reporting and discussing a puzzling case of collective or group pareidolia in which numerous individuals perceived and recorded the same visual experiences of entirely non-existing patterns, and could do so without communicating with one another. This phenomenon may help explore pareidolia's mechanics.

The director of a large university college, an avid student of ancient rock art, discovered in the vicinity of his summerhouse a corpus of thousands of what he thought were petroglyphs, ancient images pounded into rock surfaces with stone tools. He engaged a large team of staff and students in the recording of the thousands of rock art motifs he had discovered. Because the body of petroglyphs they recorded was spectacular by international standards, its nomination to the UNESCO World Heritage List was considered. To garner support for this proposal and to secure credible age estimates for some of the petroglyphs, the team leader invited three leading rock art specialists from three countries to his institute in October 2015. The sequence of the assessment of the proposal is important for understanding the issue, so it is described in some detail.

In the months leading up to the visit, twenty people recorded hundreds of petroglyphs by taking full-size 'rubbings' of them. An exhibition of these recordings was assembled at the college. At the cost of hundreds of thousands of dollars, about 350 blocks of granite, some up to 20 tons in weight, were salvaged from locations where they were under threat of damage. Most were stored at the summerhouse; a few were moved to the university. On the first day after the arrival of the three specialists (including the author), the exhibition was examined, and numerous lectures and expositions informed them of the details of the discovery. The specialists agreed that it represented an extraordinary find. The petroglyphs were dominated by hundreds of large, stylised faces, resembling those known from other northern-central Asian regions but executed in a distinctive local style. These were accompanied by thousands of smaller motifs, many of which were interpreted as schematic animal images (Fig. 1).

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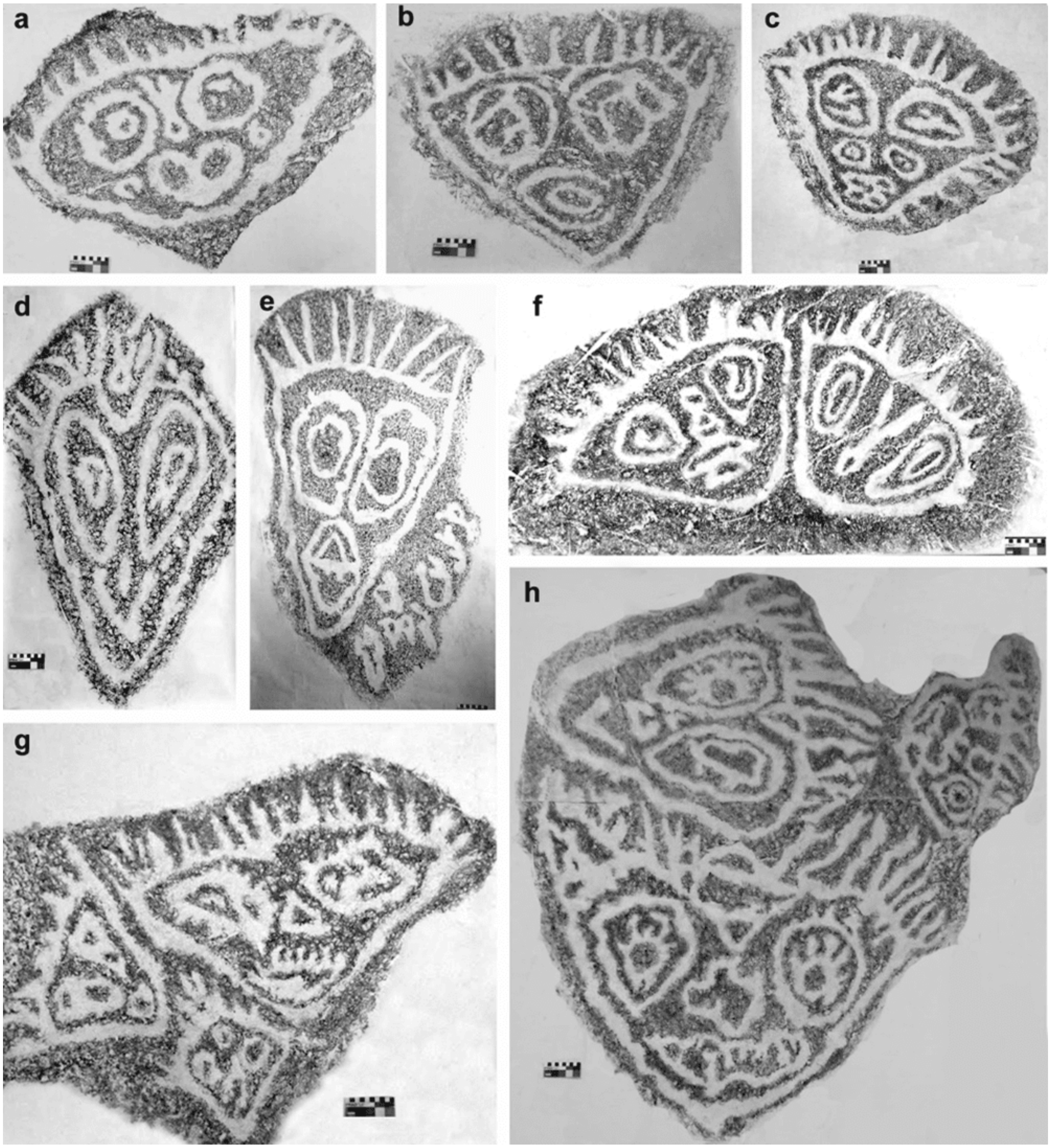

Figure 1. *Sample of the hundreds of 'rubbings' made of Xiaojinggou boulders.*

On the second day, the specialists were taken to a valley with several sites of these petroglyphs, but despite all efforts, they could not detect any of the dozens of motifs they were shown. This led to the examination of the hundreds of blocks in the salvage yard. On many of them, the perceived petroglyph grooves had been traced in black, but again, the three specialists failed to see any of them. Whenever they placed a recorded image next to the block on which it was obtained, no trace of any of the grooves was evident; any surface markings present were typical impact pits derived from fluvial or glacial transport or other random damage (Fig. 2). This presented a truly perplexing conundrum: rubbings are made by affixing a membrane to the rock surface and rubbing it vigorously with a colouring agent. Therefore, they are a relatively objective form of

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documentation (although this practice has been widely discontinued because it can damage the rock's surface). The method could not possibly yield the images recorded from surfaces completely bereft of any rock art.

Figure 2. *Recording taken from one boulder in the Xiaojinggou salvage yard, and view of the same panel in identical orientation.*

Therefore, the specialists requested that the recording procedure be demonstrated. Two members of the recording team obliged, placing thick paper over a rock, spraying it lightly with water, covering it with a thick cloth and stamping the paper mâché into position with stiff brushes (Fig. 3). The cloth was then removed and the paper allowed to dry for an hour. Rather than by rubbing, the black pigment was then applied by stamping with small brushes, each of the two operators commencing from a different part of the panel. This is obviously much gentler than rubbing, and the objective was to emphasise rises in the surface and avoid depressions, as would be the case in rubbing. After several minutes, the recorders were asked to pause, and the specialists examined their work closely. There was no correspondence between depressions on the rock and blank areas in the pigment; the pigment had been applied independent of the surface topography. Amazingly, it had begun to outline blank areas, forming grooves that allowed a single design to emerge. All this had taken place without verbal communication between the two operators, who had commenced in unison to produce one of the stylised face arrangements. Other recorders were then asked to show the process of highlighting supposed petroglyphs with black paint, and again, it was entirely clear that their lines were not following any real grooves or depressions on the rock.

Figure 3. *Stamping the paper mâché into place with stiff brushes.*

It needs to be emphasised that all participants of the recording program earnestly believed in seeing the petroglyphs and that they still perceived petroglyph grooves even after their non-existence had been pointed out. Indeed, they were incredulous that the three specialists could not see them, and there was absolutely no collusion among the recorders to mislead deliberately. However, what is most astonishing is that not only did they 'see' the petroglyphs, but they also experienced similar, if not identical, designs. Yet the continuing investigation of the rock art specialists on the following days showed that of the several thousand petroglyphs recorded on the hundreds of blocks in the salvage yard and at other sites, not even one existed. However, because of the intensive search and strenuous endeavour to detect the rock art others saw, after three days, the author began experiencing the sensation of seeing petroglyph grooves where blocks had been traced in black pigment when observing them from about two metres distance, but when he examined the effect closely the grooves 'disappeared'.

Discussion

This last-mentioned observation offers perhaps a clue to solving the puzzle. The intensive preparation of the three specialists, on the first day, to expect to see petroglyphs of stylised faces and the persistent endeavours on the following days to detect what others claimed to see had apparently conditioned the author's visual system to begin yielding to the strenuous habituation. In the case of rock art, the transfer to others of anticipation of seeing a specific design is relatively easy. Many rock art motifs are hard to detect because of weathering or accretionary deposits. When

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viewing a poorly preserved design, the beholder may need to supplement the sensory information derived from it by drawing more than usual on the imagery 'stored' in the visual centre, which renders it comparatively easy to allow the retinal data provided by the optic nerve to be overruled.

Moreover, suppose a beholder regarded as very experienced in detecting faint rock art motifs prompts a less experienced viewer to identify an imagined iconic arrangement on the rock surface. In that case, the latter is likely to make strenuous efforts to do so. This is attributable to the status or prestige bias[23]. Initially unable to discern the pattern, the student's visual system will summon stored imagery of similar petroglyphs, flooding the lateral geniculate nucleus with them in the search for a match. As others succumb to the expert's opinion, peer group pressure and social conformity facilitate acceptance of an unsupported view[24][25][26]. Trying hard to please the senior researcher, the student will detect faint natural markings and pareidolia and then strive to discover patternicity. Stress or anxiety avoidance will be relieved by reporting the detection of an emergent form concurring with the anticipated visual properties. The elation of potentially discovering rock art in this way leads to emotional arousal. Obviously, the process would be more effective in subjects of predominantly compliant disposition.

It is particularly difficult to account for the converging images experienced by two recorders working on a single panel, commencing from different parts of it. In the case of the stylised faces, the principal reference is the outline, and each recorder will endeavour to detect it and explore its course. As the image begins to take shape, each recorder will see the emerging outline and other details produced by the other. This will reinforce the conviction that the outline and facial features are real (the visual system being predisposed towards face detection), and the outline grooves will inevitably meet as the two recorded areas converge and become a seamless, single image. The key question, then, is, why did individual expectancies match one another in the form of shared perceptions of non-existent markings? After all, the two operators could not have previously agreed on a pattern because they could not have predicted which of the many boulders would be selected by the rock art specialists. However, starting from opposite ends of the rock panel, they produced matching parts of a single composition without engaging in detectable communication.

Conclusion

The limitations to the reliability of the human visual system and other cognitive functions are profound, and pareidolia is a case in point. Our convictions of what we see are just as unreliable as those of our memory[27][28][29][7]. The research findings into the rapid malleability of neural functions, such as those of "misinformation false memories"[30], help explain the observations reported here. Implanting false memories[31][32][33][34] shows how easily false information can be transferred, especially to a receptive subject. The autonomy of the human visual system can be subjected to social influences prompting false causal associations, and in extreme cases, such as the one described here, can prompt two similarly conditioned individuals to experience the same sensory pattern without detectably communicating about it. Indeed, in the described instance, more than twenty people experienced such shared 'pareidolia', and its effects can persist even if the error is demonstrated.

The described occurrences also illustrate how inordinate steps may be taken to validate a pareidolic fallacy when it provokes cognitive dissonance, i.e., the need to conciliate anxiety caused by cognitive conflict[35]. Of the numerous examples of this that could be cited in relation to pareidolia, one concerns the belief that a mountain in the Cydonia region of Mars represents a humanoid face and is an artificial structure. First photographed in 1976 by the Viking 1 spacecraft, it was shown by the much better resolution images of 1998 to be a purely geological feature. Yet some of the believers insist that this clarification is a cover-up by a conspiracy[36], thus steadfastly defending their belief—an effort to alleviate their cognitive dissonance. As the example described herein illustrates, the illusions attributable to pareidolia tend to be not only tenaciously defended; they can even become 'memes' that captivate others and may yield *collective pareidolia*.

Ultimately, the observations presented here are not even about pareidolia, which refers to random visual stimuli being interpreted as meaningful. In this case, *no random markings were present on the rocks*. Their perception was contingent upon the expectation that there were meaningful markings present.

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