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Standing out: an atypical salience account of creativity

Madeleine E. Gross[1,*] and
Jonathan W. Schooler[1]

Creativity often entails gaining a novel perspective, yet it remains uncertain how this is accomplished. Atypical salience processing may foster creative thinking by prioritizing putatively irrelevant information, thereby broadening the material accessible for idea generation and inhibiting attentional fixedness; in essence, motivating creative individuals to incorporate information that others overlook.

Extensive research links creativity to a diffuse attention style, often attributed to a failure of the executive system to filter seemingly irrelevant information [1]. Here, we suggest that engagement with unconventional information does not merely reflect passive attentional disinhibition but additionally entails the active role of **incentive salience** (see Glossary) processing, the dopamine-mediated mechanism responsible for determining the motivational relevance of information. Specifically, we argue that an atypical incentive salience (AIS) processing style motivates creative individuals towards novel or unconventional information. While previous theories of attentional breadth in creative individuals may explain why extraneous information is noticed, they fail to explain why such information is actively pursued. By contrast, an AIS perspective clarifies how and why unconventional information is promoted for further processing and refinement by executive processes, in turn enabling the exploration of distant connections and the development of complex creative ideas. Accordingly, certain forms of creativity (Box 1) arise not merely from an inability to disregard extraneous details, but also from the coordination between salience and executive network processes that detect, promote, and refine unconventional inputs into creative outputs.

Individual differences in salience processing

An AIS view complements and clarifies contemporary neuroscientific studies which posit that creativity stems from the interplay between the brain's executive and default mode networks – both critical in generating and assessing ideas. Traditionally, the salience network (SN) is thought to play a supporting role, acting as a switching mechanism between these networks. The AIS view challenges this perspective by emphasizing how the SN determines the range of elements under consideration, both from external sources and internal thoughts, thereby contributing to the diversity of generated ideas. Existing interpretations of SN activity focus on its role as a relevance detector [2], which insufficiently explains how creative ideas are identified. SN activity is typically triggered by learned associations (e.g., reward outcomes) or intrinsically salient features (e.g., brightness). These heuristics selectively guide attention to information with high relevance – the antithesis of the remote and non-obvious ideas characterizing creative solutions. Salience-based heuristics may therefore often be an obstacle to creativity because they explicitly avoid information lacking in evident salience (e.g., remote associations). This leaves open a critical question: how do salience processes flag creative content?

To address this, we consider striking counterexamples in which atypical activation of regions of the SN (e.g., specific subdivisions of the insula) drives attention toward non-rewarding, emotionally neutral, or irrelevant sensory information. Empirical and theoretical advances in clinical and neuroscientific research suggest that the positive symptoms of schizophrenia and subclinical schizotypy entail alterations in incentive salience processing. According to the **aberrant salience model**, characteristic differences in dopaminergic functioning in the midbrain regions of the SN lead to the overattribution of incentive salience to atypical information [3]. In extreme cases, this contributes to the symptoms observed in schizophrenia. However, in its milder forms, these processes are associated with **positive schizotypy** [4], a personality trait characterized by overinclusive thinking styles, which has long-standing associations with creativity [5]. Given the overlap in dopamine characteristics between positive schizotypy and creativity [6], AIS may explain the shared variance between these constructs. In particular, creativity may emerge from an AIS style in the presence of additional synergistic or protective factors (Box 2; note we use the term 'atypical' rather than 'aberrant', as salience patterns in creatives may vary from this context).

Glossary

Aberrant salience model: this model proposes that schizophrenia spectrum symptoms emerge when stochastic dopamine transmission leads to the overattribution of significance to irrelevant stimuli, events, or internal representations.
Incentive salience: the processes responsible for imbuing meaning, value, and motivational relevance to raw sensory information.
Latent inhibition (LI): an effect in which exposure to a stimulus without consequence retards subsequent learning of a stimulus–consequence relation. LI is sometimes considered an experimental measure of aberrant salience in schizophrenia research.
Positive schizotypy: a subclinical personality trait characterized by odd beliefs, eccentric ideation, and unusual perceptual experiences (note 'positive' refers to the presence, rather than absence, of certain characteristics, often in a heightened or distorted form).
Salience maps: visual representations of eye fixations, essentially reflecting the importance or attentional priority individuals assign to a given area of visual space.

Box 1. What types of creativity may be supported by atypical salience?

An atypical salience account may explain both creative states and traits. When an individual is creative, some less commonly noticed aspect of a problem has become sufficiently salient to capture attention and provide a fresh perspective; whereas this same individual is not creative when the usual aspects of a problem are predominately considered due to an inability to ignore its prepotent features (e.g., functional fixedness). Further, individual differences in the functioning of the salience system may enable some individuals to exhibit a general tendency to notice atypical information, thereby driving a general predisposition towards original thinking. However, it is important to specify the type of creativity that is likely associated with aberrant salience. Theorists have noted distinct phenotypes of attention in relation to creativity [1], one that is characterized by attentional control and inhibition, and another that is 'leaky' or diffuse. Creative measures that are associated with this latter style, such as the measures associated with schizotypy (see meta-analysis [5]) and measures of creative behavior in real life [1], are also more likely to be driven by aberrant salience processes. Research examining the atypical salience hypothesis should include assorted creativity measures, with varying dependence on executive functioning, to test this conjecture.

From attention to perception: atypical salience as a unifying framework

Converging evidence for AIS can be found in the attentional, motivational, neurological, and perceptual characteristics of creatives. As noted, creativity can be associated with 'leaky' attention (Box 2), giving rise to reduced **latent inhibition (LI)**, diminished oddball processing [7,8], irrelevance processing, and unfocused attention. Although routinely attributed to lax executive processing, these characteristics may alternatively or additionally be due to heightened attribution of salience to unusual stimuli. Indeed, some of the same attentional characteristics observed in creatives are observed in schizotypes. These phenomena have been interpreted under a salience processing account in schizophrenia spectrum research but have been characterized exclusively at the level of attentional disinhibition in creativity research. Novelty-seeking, curiosity, exploratory behavior, and other motivational characteristics in creatives [8] may reflect a heightened disposition to assign salience to diverse incentive cues, leading to greater approach behaviors. The neurological characteristics of creatives may also be explainable via an AIS account. Creativity is associated with the same genetic regions implicated in aberrant dopamine function in schizophrenic conditions (D2 receptor expression [6]). Further, when comparing both high and low creatives [9] and creatives schizotypes [10], insular activity, a structure involved in multimodal detection of salient stimuli, is a key predictor of creativity.

AIS may further explain several perceptual characteristics of creatives. Hallucinations in schizophrenia spectrum conditions are theorized to arise from abnormally heightened salience to internally generated content, leading to faulty perceptions. This mechanism may similarly explain associations between creativity and apophenia, the tendency to perceive meaningful representations in noise. Indeed, apophenia accounts for shared variance between positive schizotypy and openness a trait tightly linked to creativity [11]. Furthermore, analysis of naturalistic eye movements indicates that distinct **salience maps** are associated with high creatives compared with low [7], and that visual attention to putatively irrelevant information during the execution of a creativity task can influence originality scores [12]. This suggests that differences in salience assignment may not only be associated with creative individuals, but may play a causal role in the development of novel ideas.

Box 2. Future directions: examining atypical salience in creativity.

Future studies in creativity should leverage insights from research on aberrant salience, especially as observed in schizophrenia spectrum conditions, utilizing established paradigms to investigate anomalies in salience processing. This approach should include trait-level analyses to explore the commonalities between salience processing differences in schizotypy and potential similarities in creative individuals. Additionally, research could examine state-level dynamics, such as whether creativity might be temporarily enhanced by factors that encourage atypical salience processing, for instance, through the use of cannabis. It is also crucial to investigate how atypical salience processing may interact with other traits to facilitate creative outputs. Contemporary theories emphasize the role of synergistic traits in harnessing the positive aspects of psychosis-related characteristics while mitigating their detrimental effects. Atypical salience processing might grant unconventional information access to attentional resources, marking a beneficial early phase in the creative process. However, the effective selection of viable ideas likely depends on abilities or strategies underpinned by executive functions, intelligence, or domain-specific expertise. Conversely, the lack of these supportive factors or the presence of cognitive vulnerabilities could, in conjunction with atypical salience processing, contribute to other downstream patterns of thought and behavior, such as those characterizing schizotypy, rather than creativity.

Testing the atypical salience hypothesis

Although direct experimental examination of creativity and salience assignment is missing, Parkinson's disease (PD) and cannabis use represent two promising research areas in which both aberrant salience processing and creativity have been reported. Sudden artistic and creative drives have frequently been reported in PD patients following the introduction of dopamine agonist medication [13]. A parallel line of research suggests that by increasing dopamine levels, PD patients begin to exhibit characteristic symptoms of aberrant salience [14]. Cannabis use represents another area in which aberrant salience and creativity may intersect. Atypical functioning of the salience system mediates the effects of cannabis on schizotypal characteristics [15], which themselves are correlated with creativity [5]. It follows that the effect of cannabis on forms of creativity previously associated with schizotypy would similarly be mediated by its influence on the functioning of the salience system (note, however, that existing cannabis research has not included creativity measures previously linked to schizotypy). Following cannabis consumption, information that

is typically ignored may be assigned an unusually high level of salience, thereby becoming accessible to working memory resources; this may predispose individuals to novel ideas and associations. Given the absence of concurrent investigations of aberrant salience and creativity with medicated PD patients or cannabis users, these areas present an important opportunity for experimental examinations of the AIS hypothesis.

Promising future directions further include examining how distinct attentional phenotypes observed in creatives may relate to AIS (Box 1). AIS in creativity should also be examined both at the trait level by using validated measures of aberrant salience from schizophrenia spectrum research, and at the state level by exploring whether creativity is temporarily fostered by inductions that promote AIS (Box 2).

Concluding remarks

Existing research indicates that the processes responsible for determining the importance or relevance of information, known as incentive salience processing, differ from person to person, significantly affecting their attention, behavior, and cognition. In this discussion, we consider how an atypical approach to salience processing could enable the integration of novel and unexpected elements into creative problem-solving. Our argument is grounded in a specific, neurobiological mechanism associated with the salience processing system, which goes beyond the executive disinhibition account typically offered to explain the 'leaky attention' style of some creatives. Despite growing interest in understanding the biological foundations of creativity, a comprehensive theory linking genetics, neurotransmitter activity, and personality traits is still lacking. The concept of AIS holds the promise of bridging the gap between these disparate levels of analysis while offering a compelling explanation for various creativity-related phenomena and their overlap with psychopathology. Future research is necessary to directly explore how this mechanism may contribute to the generation of novel ideas, associations, and insights, both at a trait and state level.

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Declaration of interests

The authors have no interests to declare.

[1]Department of Psychological and Brain Sciences, University of California, Santa Barbara, Santa Barbara, CA 93106, USA

*Correspondence:
madeleinegross@ucsb.edu (M.E. Gross).

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