The Mystery of Trypophobia – Why Clusters of Holes Make Some People's Skin Crawl

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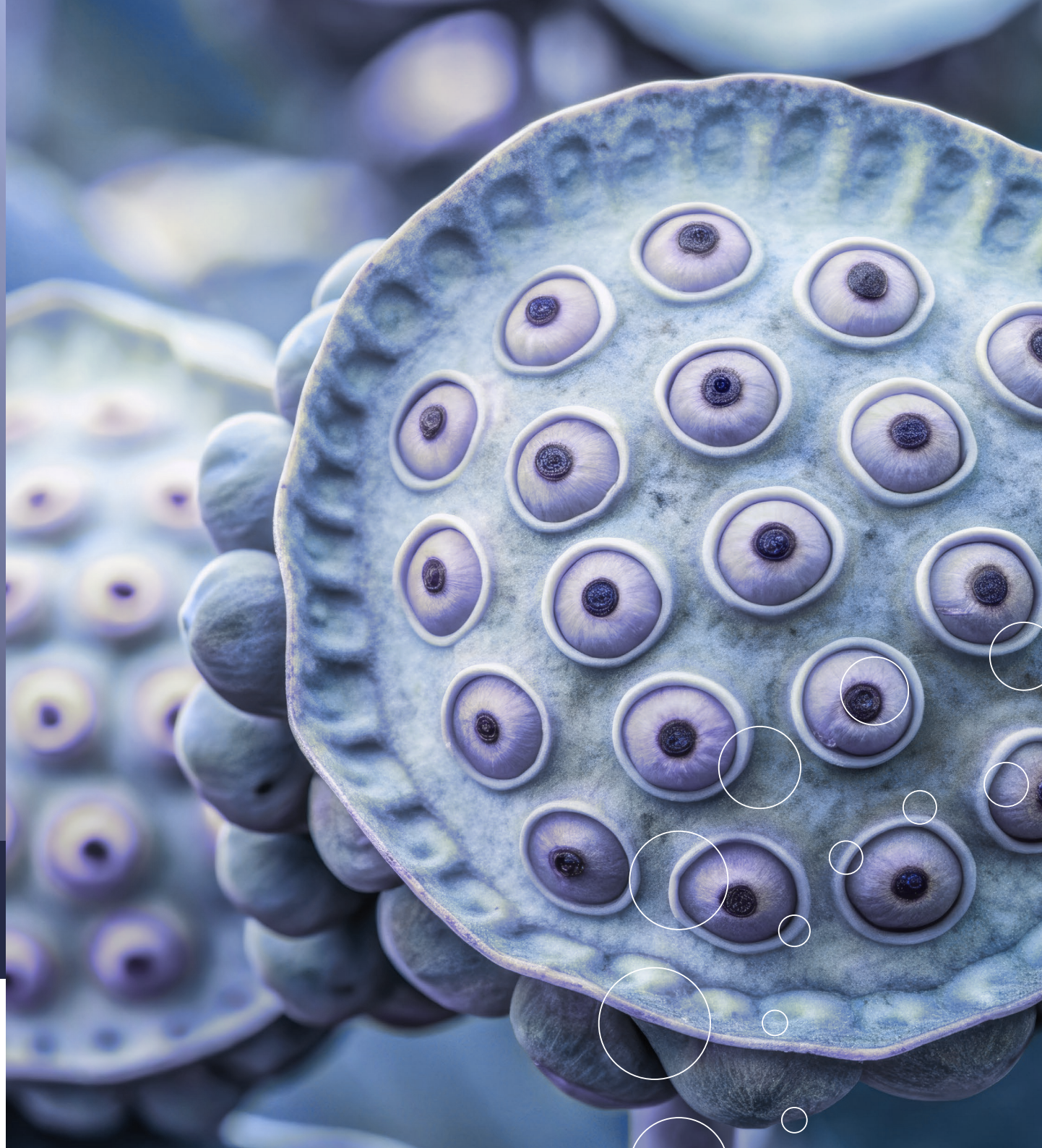

The Mystery of Trypophobia – Why Clusters of Holes Make Some People's Skin Crawl

The discomfort some people feel when looking at clusters of holes or bumps – known as trypophobia – has intrigued scientists for over a decade. New research reveals how this mysterious condition relates to our innate disease-avoidance responses. Dr Christopher DiMattina from Florida Gulf Coast University, together with his departmental colleague Dr R Nathan Pipitone, is leading research to understand why these innocuous patterns can trigger strong aversive responses, revealing important insights about how our brains process visual information and respond to potential threats.

Understanding Our Complex Reactions to Pattern Perception

Most of us have encountered images that make us uncomfortable – perhaps a close-up photo of honeycomb or lotus seed pods. For around 15–25% of people, however, these clustered patterns trigger intense feelings of disgust and discomfort, a phenomenon known as trypophobia. While this might seem like an odd thing to fear, research over the past decade has revealed this response may serve a deeper evolutionary purpose related to our innate disease-avoidance responses.

Dr Christopher DiMattina and his colleague Dr Nate Pipitone at Florida Gulf Coast University have conducted groundbreaking work exploring why certain visual patterns trigger such strong aversive responses in some people. Their research, published in *Scientific Reports*, provides compelling evidence that trypophobia may represent an over-generalised disease avoidance response rather than simply a fear of holes.

Measuring Discomfort Across Different Visual Patterns

To better understand trypophobia, Dr DiMattina's team took an innovative approach by examining how trypophobic and non-trypophobic individuals respond to different visual textures. Rather than just looking at obvious trigger images like lotus seed pods, they included a wide range of natural texture patterns to provide context for understanding what makes certain images particularly disturbing for people with trypophobia. The team designed a comprehensive study comparing how people react to different types of images. They assembled three distinct categories: standard texture patterns (like brick walls or rippling water), trypophobia-inducing patterns (like clusters of holes), and images of skin diseases.

The researchers recruited hundreds of university students and had them complete the Trypophobia Questionnaire (TQ), which measures sensitivity to trypophobic images. Based on their scores, participants were classified as either high-sensitivity (hi-TQ) or low-sensitivity (lo-TQ) to trypophobic patterns. Each participant then rated how comfortable or uncomfortable they felt when viewing images from all three categories. This comprehensive approach allowed the team to examine whether trypophobia represents a unique response or is part of a broader pattern of visual discomfort.

The Role of Texture Processing in Visual Perception

The research team made another fascinating discovery when examining how different people rated various texture patterns. Both high and low trypophobia groups showed remarkable agreement about which standard textures were pleasant or unpleasant to view.

Regular patterns like brick walls and floral prints were consistently rated as comfortable, while dense, irregular patterns with circular clusters were universally less preferred. This suggests that even people without trypophobia have some degree of aversion to patterns that share characteristics with disease-like textures.

Revealing Links Between Disease Avoidance and Visual Discomfort

One of the study's most striking findings was that while everyone found images of skin diseases highly uncomfortable to view, only those scoring high on the TQ found trypophobic images equally

disturbing. This suggests that people with trypophobia may have a heightened sensitivity that causes them to react to hole patterns in the same way that most people react to signs of disease.

The research team noted that this pattern strongly supports the hypothesis that trypophobia represents an over-generalised disease avoidance response. They concluded that the brain's disease-detection system appears to be calibrated differently in these individuals, causing them to react strongly to visual patterns that share some similarities with disease symptoms, even when those patterns are completely harmless.

Complex Brain Processes Behind Visual Discomfort

The team also investigated whether simple properties of the images themselves could explain why certain patterns trigger discomfort. Previous theories suggested that trypophobic images might be unsettling because they contain an unusual amount of detail at certain spatial frequencies – essentially, the sizes and spacing of repeated elements in the image.

However, Dr DiMattina's analysis revealed that these basic image statistics were actually quite similar between comfortable and uncomfortable images. This suggests that more complex visual processing is involved, likely drawing on specialised brain areas that help us recognise different types of surfaces and materials.

The researchers suggest that dedicated regions in the visual cortex that process texture information may be particularly tuned to detect potentially harmful materials like diseased tissue. In people with trypophobia, this detection system appears to be oversensitive, triggering strong emotional responses even to harmless patterns that share only superficial similarities with actual signs of disease.

Understanding How Our Brains Process Visual Information

The team also investigated whether certain mathematical properties of images might explain why some patterns cause more discomfort than others. Previous research has suggested that images with an unusual distribution of spatial frequencies (how often bright and dark regions alternate) might overtax the visual system and cause discomfort.

However, Dr DiMattina's analysis revealed this explanation falls short. While trypophobic images do have some unusual statistical properties, these properties alone do not predict how uncomfortable people find them. Many perfectly comfortable images share similar mathematical characteristics. This suggests that we seem to have specialised systems for recognising potentially harmful textures and materials rather than just responding to simple statistical patterns.

These findings have important implications for understanding how our brains are organised. Rather than visual discomfort being caused simply by certain images overwhelming the visual system, Dr DiMattina's research suggests we may have dedicated neural circuits for recognising potentially harmful materials and triggering appropriate emotional responses.

How Natural Selection Has Shaped Our Visual Responses

The research helps explain why trypophobia exists at all – it appears to be an evolutionary overshooting of an otherwise valuable survival mechanism. Those ancestors who were better at quickly spotting and avoiding signs of disease would have been more likely to survive and pass on their genes.

This selection pressure appears to have shaped specialised brain circuits for detecting potentially harmful visual patterns.

Dr DiMattina's team emphasises that this isn't just about conscious fear. The disgust response triggered by these images appears to tap into very primitive brain circuits that evolved to protect us from disease. In people with trypophobia, these circuits may be calibrated to be especially sensitive. The team found that even people who don't qualify as having trypophobia tend to find these types of clustered patterns somewhat uncomfortable, suggesting that the aversion exists on a spectrum rather than being an all-or-nothing phenomenon.

> Dr DiMattina's research suggests we may have dedicated neural circuits for recognising potentially harmful materials and triggering appropriate emotional responses.

Future Research Directions and Applications for Design

Dr DiMattina and his colleague Dr Pipitone are now planning follow-up studies using brain imaging to explore how these visual patterns are processed in the brain. They hope to identify which specific brain regions show different activity patterns in people with and without trypophobia when viewing trigger images.

This research could have practical applications beyond just understanding trypophobia itself. A better grasp of how our brains process potentially threatening visual patterns could help inform the design of everything from medical facilities to public spaces. It might also lead to more effective treatments for people whose lives are significantly impacted by trypophobia.

The work highlights how studying seemingly unusual phenomena like trypophobia can provide valuable insights into the fundamental ways our brains process visual information and generate emotional responses. What might at first appear to be an irrational fear of holes turns out to be a window into the sophisticated neural mechanisms that evolved to help keep us safe from harm.

Understanding these mechanisms not only helps explain why some people experience trypophobia but also illuminates the broader relationship between visual perception, emotion, and survival-related behaviour in the human brain. As Dr DiMattina and Dr Pipitone continue their investigations, they hope to unravel further the complex interactions between our visual system and ancient defensive mechanisms that shape our responses to the world around us.

MEET THE RESEARCHER

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Dr Christopher DiMattina obtained his BA in Mathematics and Psychology from Cornell University and his PhD in Neuroscience from Johns Hopkins University in 2009. He is currently a Professor of Psychology (Cognitive Neuroscience) at Florida Gulf Coast University. Dr DiMattina's research focuses on computational and experimental vision science, including problems of edge detection, texture segmentation, and shadow discounting. More recently, he has developed an interest in the behavioural and neural bases of visual aesthetics, collaborating on research to better understand and describe the phenomenon of trypophobia (fear of holes). Dr DiMattina's work spans theoretical analyses of neural networks, adaptive data collection methods for sensory neurophysiology, and psychophysical studies of visual perception. His research aims to advance our understanding of how the brain processes and interprets visual information to guide behaviour and emotion.

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FURTHER READING

C DiMattina, RN Pipitone, MR Renteria, KJ Ryan, Trypophobia, skin disease, and the visual discomfort of natural textures, *Scientific Reports*, 2024, 14(1), 5050. DOI: https://doi.org/10.1038/s41598-024-31299-1

RN Pipitone, C DiMattina, ER Martin, *et al.*, Evaluating the 'skin disease-avoidance' and 'dangerous animal' frameworks for understanding trypophobia, Cognition and Emotion, 2022, 36(5), 943–956. DOI: https://doi.org/10.1080/02699931.2021.1989348

RN Pipitone, C DiMattina, Object clusters or spectral energy? Assessing the relative contributions of image phase and amplitude spectra to trypophobia, *Frontiers in Psychology*, 2020, 11, 1847. DOI: https://doi.org/10.3389/fpsyg.2020.01847