SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

This study aims to gain an understanding of how the brain processes visual images and to explore whether the emotional state of fear, anxiety, and pain can be linked to specific visual characteristics of visual images.

Image and Emotion: From Outcomes to Brain Behavior

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Key Concepts/Context

Existing outcome studies have established the link between exposure to visual images (with nature content) to improvements in stress, anxiety, and pain perception. However, there is a lack of understanding of the underlying perceptual mechanisms.

Methods

A systematic literature review on neuroscience articles, especially fMRI studies linking emotional responses (fear, anxiety, and pain) and visual properties of stimuli. Key word searches using *emotional state (fear/pain/anxiety), fMRI,* and *visual* were conducted in PubMed. Specific inclusion and exclusion criteria were identified. Inclusion criteria were: (1) published, full-text, English-language journal articles; (2) for experiments, visual stimuli; and (3) for review articles, relevance to visual stimuli or overall emotional context and papers published after 2001. Exclusion criteria included: (1) studies involving patients with specific neurological disorders and/or lesions and/or other damage to the brain; (2) studies involving patients diagnosed with specific psychological disorders (e.g., for fear studies, with phobia; for anxiety, studies of post-traumatic stress disorder); (3) studies with pediatric or geriatric populations; and (4) studies that tested the roles of certain chemical substances. After the first round of screening the reference list from each of these articles was reviewed to identify other articles of potential interest. 23 selected articles were organized by the type of study, specific emotions involved, and visual stimuli used.

Findings

The amygdala can be considered the single most important region of interest in the brain when considering the impact of visual images on fear, anxiety, and pain. Fear induction was found to have a strong association with the amygdala. Fear was also connected to previous memories of stressful experiences. In a hospital setting

where patients must come back, a stressful setting could initiate a chain reaction of fear and anxiety responses that can compound this response on subsequent visits. Anticipation of emotionally aversive stimuli involves brain structures that are involved in the anticipation of physically painful stimuli. There was a reciprocal relationship between fear and anxiety, and pain.

There was a strong relationship between novelty and arousal, demonstrating that subjects found novel images more arousing, which would, in turn, also have an impact on the amygdala. Because amygdala activation links to fear and anxiety, the novelty of stimuli should be considered carefully in settings where people might be vulnerable. Culture also played a role in emotional response to visual images. The fear response (measured by amygdala activation) increased when fear was detected in members of one's own culture relative to other cultural groups. Viewing a fearful facial expression induces more fear than viewing an angry face. Also, the amygdala was significantly more active in subjects viewing everyday sharp objects (e.g., a sofa with sharp corners) compared with their curved-contour counterparts.

In summary, the results showed that certain image properties would elicit negative emotional responses and should therefore be avoided, including: (1) fearful or angry faces; (2) ambiguous subject matter; (3) high novelty and unfamiliarity; (5) lack of realism; and (4) sharp contours. Images in high-stress areas of the hospital should have high valence (positive content) and low arousal (calming).

Design Implications

- Viewing images can have a direct impact on emotional processing centers in the brain; thus, art for healthcare facilities must be carefully selected.
- "Restorative" images are defined by content with high valence (positive) and low arousal (calming).
- When viewing novel/unfamiliar images, the brain struggles to create a context, which in turn is linked to anxiety. Abstract art should be selected with this trade-off in mind when it is for the vulnerable patient population.
- Fearful expressions on faces can trigger a greater fear response in a viewer than viewing a direct threat; thus, facial expressions should be carefully considered when selecting figurative art.
- The following elements in a visual image should be carefully evaluated and, if possible, avoided in high-stress areas: fearful/angry faces; ambiguous subject matter; high levels of novelty and unfamiliarity; lack of realism; and sharp-edged contours.
  The primal response to images is triggered by a quick evaluative system that rapidly extracts information from an image; this depends on global cues rather than a high level of detail. Form and content relate to global cues and must be addressed together when choosing art.
- Emotional impact must be balanced with aesthetic value in the context of healthcare art.

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Limitations

Some limitations identified by the authors include:

- The subject matter of this review was too large for the scope of this study. Emotion is a big subject, and each subsection -- fear, anxiety, and pain -- comprises a significant body of frequently overlapping literature.
- Detailed information on image properties and image selection was lacking in many articles.