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Mechanisms of distraction in acute pain perception and modulation

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1. Common applications and efficacy of distraction

Distraction is a shifting of attention away from pain or painful stimuli to stimuli that are more engaging or enjoyable. Distraction for acute pain can be internal (eg, imagery) or external to the individual; use audio (eg, music), visual (eg, book), or audiovisual (eg, movies) stimuli, require passive or interactive engagement, or involvement of others (eg, health care providers, parents).[1] Systematic reviews and metaanalyses generally support use of distraction for acute pain among infants and children, with less consistent evidence for adolescents and adults.[1,10,11]

2. Mechanisms of distraction for acute pain

2.1. Cognitive

Mechanisms of distraction center on it reducing or interfering with attention to pain. The limited attentional capacity theory posits that the more attentional resources used by distraction, the less resources are available for perceiving pain.[3,7] According to the multiple resource theory, the more a distracter competes for the same perceptual and spatial resources used to process pain, the more effective the distracter will be.[3,7] These theories predict that interactive or multisensory distracters should be more effective, although results are mixed.[1]

The neurocognitive model of attention suggests that involuntary attention demanded by pain (bottom-up process) is modulated by a voluntary goal-directed effort to prioritize attention to specific stimuli (top-down processes).[8] These top-down processes are directed by the degree of attentional investment required and what is attended to as goal-relevant information. Consistent with this, distraction seems less effective when pain holds increased salience (ie, high levels of pain catastrophizing, fear of pain, or pain-related threat),[6,14] but only in the absence of goal-directed motivation.[2,13]

2.2. Learning processes

A less discussed mechanism relates to behavioral learning theory.[3] Individuals are posited to develop a conditioned fear or distress response after pairing of pain with a previously unconditioned stimulus (eg, medical procedure equipment). Distraction is believed to interfere with this process by (1) reducing or avoiding development of a conditioned fear response by deterring attention away from painful stimuli and previously unconditioned stimuli; and (2) eliciting behaviors or affective states incompatible with distress (eg, relaxation).

2.3. Neurobiological

Neuroimaging studies examining distraction mechanisms are limited but demonstrate specific changes in brain activation during distraction which correspond to decreased acute pain. These changes are in areas associated with sensory and affective motivational pain processing, including decreased activation in the thalamus, primary and secondary somatosensory cortices, and the insula and anterior cingulate cortex, and increased activation in the periaquaeductal gray, cingulofrontal cortex, and posterior thalamus.[4-6,9,12]

3. Future directions in distraction for acute pain

Despite extensive research, our understanding of what, when, how, and for whom distraction works best for acute pain is surprisingly limited. This is due, in part, to the minimal integration of neuroimaging and attention research with distraction as used in clinical practice. Furthermore, clinical trials offer little investigation regarding mechanisms. Future directions include determining effective distraction for acute pain based on individual, procedural, intervention (eg, novelty), and contextual factors (eg, setting).[1]

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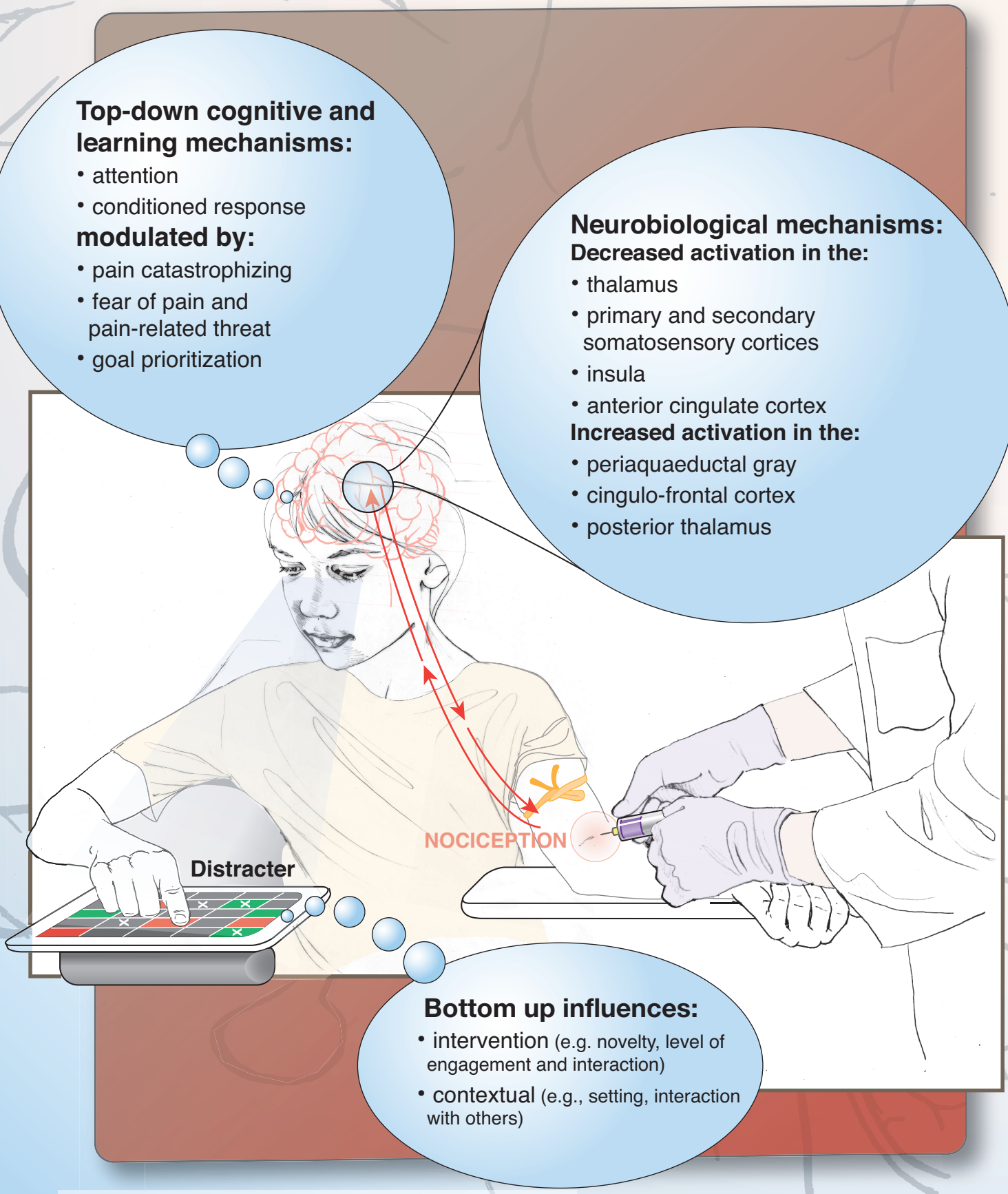

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