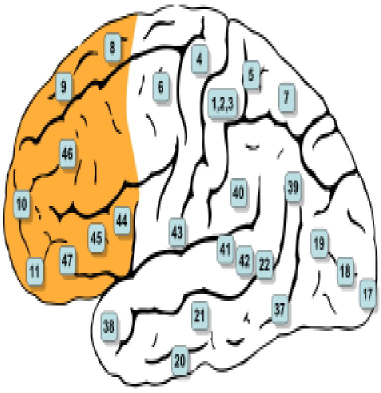

Prefrontal top-down regulation

Description

Neural top–down control of physiology concerns the direct regulation by the brain of emotional and physiological functions. Cellular functions include the immune system’s production of T-lymphocytes and antibodies, and nonimmune related homeostatic functions such as liver gluconeogenesis, sodium reabsorption, osmoregulation, and brown adipose tissue nonshivering thermogenesis.More at Wikipedia

Chiesa, A., Serretti, A., & Jakobsen, J. C.. (2013). Mindfulness: Top-down or bottom-up emotion regulation strategy?. Clinical Psychology Review

Plain numerical DOI: 10.1016/j.cpr.2012.10.006
DOI URL
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“The beneficial clinical effects of mindfulness practices are receiving increasing support from empirical studies. however, the functional neural mechanisms underlying these benefits have not been thoroughly investigated. some authors suggest that mindfulness should be described as a ‘top-down’ emotion regulation strategy, while others suggest that mindfulness should be described as a ‘bottom-up ’ emotion regulation strategy. current discrepancies might derive from the many different descriptions and applications of mindfulness. the present review aims to discuss current descriptions of mindfulness and the relationship existing between mindfulness practice and most commonly investigated emotion regulation strategies. recent results from functional neuro-imaging studies investigating mindfulness training within the context of emotion regulation are presented. we suggest that mindfulness training is associated with ‘top-down’ emotion regulation in short-term practitioners and with ‘bottom-up’ emotion regulation in long-term practitioners. limitations of current evidence and suggestions for future research on this topic are discussed. © 2012 elsevier ltd.”

McRae, K., Misra, S., Prasad, A. K., Pereira, S. C., & Gross, J. J.. (2012). Bottom-up and top-down emotion generation: Implications for emotion regulation. Social Cognitive and Affective Neuroscience

Plain numerical DOI: 10.1093/scan/nsq103
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“Emotion regulation plays a crucial role in adaptive functioning and mounting evidence suggests that some emotion regulation strategies are often more effective than others. however, little attention has been paid to the different ways emotions can be generated: from the ‘bottom-up’ (in response to inherently emotional perceptual properties of the stimulus) or ‘top-down’ (in response to cognitive evaluations). based on a process priming principle, we hypothesized that mode of emotion generation would interact with subsequent emotion regulation. specifically, we predicted that top-down emotions would be more successfully regulated by a top-down regulation strategy than bottom-up emotions. to test this hypothesis, we induced bottom-up and top-down emotions, and asked participants to decrease the negative impact of these emotions using cognitive reappraisal. we observed the predicted interaction between generation and regulation in two measures of emotional responding. as measured by self-reported affect, cognitive reappraisal was more successful on top-down generated emotions than bottom-up generated emotions. neurally, reappraisal of bottom-up generated emotions resulted in a paradoxical increase of amygdala activity. this interaction between mode of emotion generation and subsequent regulation should be taken into account when comparing of the efficacy of different types of emotion regulation, as well as when reappraisal is used to treat different types of clinical disorders.”

Terhune, D. B., Cleeremans, A., Raz, A., & Lynn, S. J.. (2017). Hypnosis and top-down regulation of consciousness. Neuroscience and Biobehavioral Reviews

Plain numerical DOI: 10.1016/j.neubiorev.2017.02.002
DOI URL
directSciHub download

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“Hypnosis is a unique form of top-down regulation in which verbal suggestions are capable of eliciting pronounced changes in a multitude of psychological phenomena. hypnotic suggestion has been widely used both as a technique for studying basic science questions regarding human consciousness but also as a method for targeting a range of symptoms within a therapeutic context. here we provide a synthesis of current knowledge regarding the characteristics and neurocognitive mechanisms of hypnosis. we review evidence from cognitive neuroscience, experimental psychopathology, and clinical psychology regarding the utility of hypnosis as an experimental method for modulating consciousness, as a model for studying healthy and pathological cognition, and as a therapeutic vehicle. we also highlight the relations between hypnosis and other psychological phenomena, including the broader domain of suggestion and suggestibility, and conclude by identifying the most salient challenges confronting the nascent cognitive neuroscience of hypnosis and outlining future directions for research on hypnosis and suggestion.”

Zelazo, P. D., & Carlson, S. M.. (2012). Hot and Cool Executive Function in Childhood and Adolescence: Development and Plasticity.

Child Development Perspectives

Plain numerical DOI: 10.1111/j.1750-8606.2012.00246.x
DOI URL
directSciHub download

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“Executive function (ef), which refers to the more deliberate, top-down neurocognitive processes involved in self-regulation, develops most rapidly during the preschool years, together with the growth of neural networks involving prefrontal cortex but continues to develop well into adulthood. both ef and the neural systems supporting ef vary as a function of motivational significance, and this article discusses the distinction between the top-down processes that operate in motivationally and emotionally significant situations (‘hot ef’) and the top-down processes that operate is more affectively neutral contexts (‘cool ef’). emerging evidence indicates that both hot and cool ef are surprisingly malleable, with implications for intervention and prevention.”

Johnstone, T., van Reekum, C. M., Urry, H. L., Kalin, N. H., & Davidson, R. J.. (2007). Failure to Regulate: Counterproductive Recruitment of Top-Down Prefrontal-Subcortical Circuitry in Major Depression. Journal of Neuroscience

Plain numerical DOI: 10.1523/JNEUROSCI.2063-07.2007
DOI URL
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“Although depressed mood is a normal occurrence in response to adversity in all individuals, what distinguishes those who are vulnerable to major depressive disorder (mdd) is their inability to effectively regulate negative mood when it arises. investigating the neural underpinnings of adaptive emotion regulation and the extent to which such processes are compromised in mdd may be helpful in understanding the pathophysiology of depression. we report results from a functional magnetic resonance imaging study demonstrating left-lateralized activation in the prefrontal cortex (pfc) when downregulating negative affect in nondepressed individuals, whereas depressed individuals showed bilateral pfc activation. furthermore, during an effortful affective reappraisal task, nondepressed individuals showed an inverse relationship between activation in left ventrolateral pfc and the amygdala that is mediated by the ventromedial pfc (vmpfc). no such relationship was found for depressed individuals, who instead show a positive association between vmpfc and amygdala. pupil dilation data suggest that those depressed patients who expend more effort to reappraise negative stimuli are characterized by accentuated activation in the amygdala, insula, and thalamus, whereas nondepressed individuals exhibit the opposite pattern. these findings indicate that a key feature underlying the pathophysiology of major depression is the counterproductive engagement of right prefrontal cortex and the lack of engagement of left lateral-ventromedial prefrontal circuitry important for the downregulation of amygdala responses to negative stimuli.”

Heatherton, T. F., & Wagner, D. D.. (2011). Cognitive neuroscience of self-regulation failure. Trends in Cognitive Sciences

Plain numerical DOI: 10.1016/j.tics.2010.12.005

DOI URL
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“Self-regulatory failure is a core feature of many social and mental health problems. self-regulation can be undermined by failures to transcend overwhelming temptations, negative moods and resource depletion, and when minor lapses in self-control snowball into self-regulatory collapse. cognitive neuroscience research suggests that successful self-regulation is dependent on top-down control from the prefrontal cortex over subcortical regions involved in reward and emotion. we highlight recent neuroimaging research on self-regulatory failure, the findings of which support a balance model of self-regulation whereby self-regulatory failure occurs whenever the balance is tipped in favor of subcortical areas, either due to particularly strong impulses or when prefrontal function itself is impaired. such a model is consistent with recent findings in the cognitive neuroscience of addictive behavior, emotion regulation and decision-making. © 2010 elsevier ltd.”
Holzman, J. B., & Bridgett, D. J.. (2017). Heart rate variability indices as bio-markers of top-down self-regulatory mechanisms: A meta-analytic review. Neuroscience and Biobehavioral Reviews

Plain numerical DOI: 10.1016/j.neubiorev.2016.12.032
DOI URL
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“Theoretical perspectives posit that heart-rate variability (hrv) reflects self-regulatory capacity and therefore can be employed as a bio-marker of top-down self-regulation (the ability to regulate behavioral, cognitive, and emotional processes). however, existing findings of relations between self-regulation and hrv indices are mixed. to clarify the nature of such relations, we conducted a meta-analysis of 123 studies (n = 14,347) reporting relations between hrv indices and aspects of top-down self-regulation (e.g., executive functioning, emotion regulation, effortful control). a significant, albeit small, effect was observed (r = 0.09) such that greater hrv was related to better top-down self-regulation. differences in relations were negligible across aspects of self-regulation, self-regulation measurement methods, hrv computational techniques, at-risk compared with healthy samples, and the context of hrv measurement. stronger relations were observed in older relative to younger samples and in published compared to unpublished studies. these findings generally support the notion that hrv indices can tentatively be employed as bio-markers of top-down self-regulation. conceptual and theoretical implications, and critical gaps in current knowledge to be addressed by future work, are discussed.”
Kerr, C. E., Sacchet, M. D., Lazar, S. W., Moore, C. I., & Jones, S. R.. (2013). Mindfulness starts with the body: somatosensory attention and top-down modulation of cortical alpha rhythms in mindfulness meditation. Frontiers in Human Neuroscience

Plain numerical DOI: 10.3389/fnhum.2013.00012
DOI URL
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“Using a common set of mindfulness exercises, mindfulness based stress reduction (mbsr) and mindfulness based cognitive therapy (mbct) have been shown to reduce distress in chronic pain and decrease risk of depression relapse. these standardized mindfulness (st-mindfulness) practices predominantly require attending to breath and body sensations. here, we offer a novel view of st-mindfulness’s somatic focus as a form of training for optimizing attentional modulation of 7-14 hz alpha rhythms that play a key role in filtering inputs to primary sensory neocortex and organizing the flow of sensory information in the brain. in support of the framework, we describe our previous finding that st-mindfulness enhanced attentional regulation of alpha in primary somatosensory cortex (si). the framework allows us to make several predictions. in chronic pain, we predict somatic attention in st-mindfulness ‘de-biases’ alpha in si, freeing up pain-focused attentional resources. in depression relapse, we predict st-mindfulness’s somatic attention competes with internally focused rumination, as internally focused cognitive processes (including working memory) rely on alpha filtering of sensory input. our computational model predicts st-mindfulness enhances top-down modulation of alpha by facilitating precise alterations in timing and efficacy of si thalamocortical inputs. we conclude by considering how the framework aligns with buddhist teachings that mindfulness starts with ‘mindfulness of the body.’ translating this theory into neurophysiology, we hypothesize that with its somatic focus, mindfulness’ top-down alpha rhythm modulation in si enhances gain control which, in turn, sensitizes practitioners to better detect and regulate when the mind wanders from its somatic focus. this enhanced regulation of somatic mind-wandering may be an important early stage of mindfulness training that leads to enhanced cognitive regulation and metacognition.”
Wagner, D. D., Altman, M., Boswell, R. G., Kelley, W. M., & Heatherton, T. F.. (2013). Self-Regulatory Depletion Enhances Neural Responses to Rewards and Impairs Top-Down Control. Psychological Science

Plain numerical DOI: 10.1177/0956797613492985
DOI URL
directSciHub download

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“To be successful at self-regulation, individuals must be able to resist impulses and desires. the strength model of self-regulation suggests that when self-regulatory capacity is depleted, self-control deficits result from a failure to engage top-down control mechanisms. using functional neuroimaging, we examined changes in brain activity in response to viewing desirable foods among 31 chronic dieters, half of whom completed a task known to result in self-regulatory depletion. compared with nondepleted dieters, depleted dieters exhibited greater food-cue-related activity in the orbitofrontal cortex, a brain area associated with coding the reward value and liking aspects of desirable foods; they also showed decreased functional connectivity between this area and the inferior frontal gyrus, a region commonly implicated in self-control. these findings suggest that self-regulatory depletion provokes self-control failure by reducing connectivity between brain regions that are involved in cognitive control and those that represent rewards, thereby decreasing the capacity to resist temptations.”
Phillips, A. G., Vacca, G., & Ahn, S.. (2008). A top-down perspective on dopamine, motivation and memory

. Pharmacology Biochemistry and Behavior

Plain numerical DOI: 10.1016/j.pbb.2007.10.014
DOI URL
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"Dopamine (da) activity, in the form of increased neural firing or enhanced release of transmitter from nerve terminals and varicosities, is linked to a number of important psychological processes including: movement; hedonic reactions to positive reward; provision of an error detection signal during the acquisition of new learning; response to novel stimuli; provision of reinforcement signals essential for acquisition of new action patterns; and incentive motivation. this review focuses primarily on our research linking dynamic changes in da efflux on the timescale of minutes, with incentive motivation, as revealed by brain dialysis experiments in behaving animals. recent experiments on sensory-specific satiety and successive positive and negative contrast are discussed along with the distinction between preparatory behaviors that precede contact with biologically significant stimuli and subsequent consummatory behaviors. the relationship between da efflux in the medial prefrontal cortex (mpfc) and foraging for food based on working memory is also discussed in support of the conjecture that da may serve as a link between motivation and memory functions. evidence in support of 'top-down' regulation of dopaminergic activity in the mesocorticolimbic da pathways is reviewed briefly to introduce a mechanism by which activation of ascending da projections in this manner might optimize dopaminergic modulation of executive function within regions such as the mpfc. collectively, these processes could ensure coordination between cognitive processes that assess current opportunities and the motivational systems that select and engage patterns of approach behavior that bring organisms into contact with the essentials for survival. © 2007 elsevier inc. all rights reserved."
Tiesinga, P., Fellous, J. M., & Sejnowski, T. J.. (2008). Regulation of spike timing in visual cortical circuits. Nature Reviews Neuroscience

Plain numerical DOI: 10.1038/nrn2315
DOI URL
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"A train of action potentials (a spike train) can carry information in both the average firing rate and the pattern of spikes in the train. but can such a spike-pattern code be supported by cortical circuits? neurons in vitro produce a spike pattern in response to the injection of a fluctuating current. however, cortical neurons in vivo are modulated by local oscillatory neuronal activity and by top-down inputs. in a cortical circuit, precise spike patterns thus reflect the interaction between internally generated activity and sensory information encoded by input spike trains. we review the evidence for precise and reliable spike timing in the cortex and discuss its computational role."
Category

1. Cognitive science
2. General

3. General psychology
4. Neuropolitics
5. Neuroscience

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