

Implicating Self-Control in the Mechanism by which Implementation Intentions Reduce
Stress-Induced Unhealthy Eating: a Comment on O'Connor et al.

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O'Connor and colleagues (1) present an innovative evaluation of a theory-based tool to reduce stress-induced unhealthy eating. Their research is exemplary of the progress being made in research adopting theories of planning, particularly, action-control theory (2, 3), and how behavior modification strategies based on this model (e.g., planning, implementation intentions) can be applied to address the intention-behavior 'gap' frequently cited in models of social cognition (4-7) and attain better health outcomes (8, 9). I would like to commend their use of progressive methods of measurement and analysis. The use of daily diary methods as a means to evaluate caloric consumption represents a step-change toward more accurate and comprehensive assessments of eating behaviour (10). The adoption of multi-level analysis is also an important application in light of the recent focus on behavior *change* above mere behavioral *prediction* in the behavioral medicine literature (11-14). The inclusion of a moderator analysis to examine the effectiveness of the intervention among individuals with varying levels of motivation is also important given the claims that implementation intentions are maximally effective when individuals have formed strong intentions (3, 8, 15-18). Overall, my view is that the article makes substantial theoretical, measurement, and practical innovations.

I would like to seize this opportunity to point out some additional theoretical interpretations of the findings based on research developments in the domain of self-control and implicit processes. I hope that these proposals will make a contribution to further understanding the mechanisms by which planning interventions like implementation intentions affect changes in automatic, well-learned, and impulsive actions that are strongly associated through repeated action to cues such as stress (8, 19, 20). In particular, I think that self-control, a variable that has received considerable recent attention in the scientific

literature (21), particularly health (22), may be implicated in the explanation of the effects of planning strategies on behavior change. I think self-control is particularly pertinent in this context because it has been identified as a key factor in overcoming automatic, non-conscious responses that are well-learned and impulse driven, usually with a component that is reinforced by dopamine-mediated intrinsic reward systems in the brain (22-29).

O'Connor and colleagues' (1) focus on stress-induced eating is based on generalized models of stress and coping, in which individuals are motivated to engage in coping procedures to attenuate the negative affective responses brought about by stressors (30, 31). A frequently-adopted coping response to stress is to engage in unhealthy eating behaviors because consuming foods high in sugar and dietary fat tend to be strongly associated with dopamine release and concomitant positive emotional responses to counter stress-induced negative affect. The affective and intrinsic reward systems result in eating unhealthily becoming a well-learned, dominant response to stress, and make such responses difficult to alter because of the powerful reinforcement contingencies involved. Breaking such well-learned patterns of action, therefore, requires considerable effort and behavioral control (26).

Theories of self-control may provide some means to explain the process by which implementation intentions assist in breaking habits. Self-control is considered an individual's propensity or capacity to inhibit impulses, resist temptations, and break habits (32, 33). Many theories of self-control propose two systems that control behavior, consistent with dual-process theories of action (34-36). Epitomizing this approach, Mischel and coworkers (37-39) proposed a 'hot' system in which the processes leading to action were efficient, fast, and impulsive, and contrasted it with a 'cool' system in which behavior was driven by slower, deliberative, and reflective processes. Inhibiting impulsive responses was considered largely determined by the extent to which an individual's 'cool' system can 'put the brakes on' and inhibit the 'hot' system. This approach generally conceptualized self-control as a trait, and

individuals with higher self-control having greater capacity to inhibit their impulses (40-42). However, recent theories have viewed self-control as a limited resource that allows individuals to exert self-control but only for a finite period after which resources become depleted and self-control much more difficult (21, 43). Some have made the link between self-control resources and components of executive function, such that self-control capacity reflect individuals' propensity to exert cognitive control and engage in deliberative decision making (23, 44-46).

In the context of stress-induced eating, breaking the well-learned response to stress of eating unhealthily will require considerable self-control resources. If implementation intentions enable an individual to make the link between a cue and an alternative action to unhealthy eating more efficient, then engaging in the alternative action will be less taxing of self-control resources and improve an individual's capacity to manage their behavior more effectively. Given research that has demonstrated that forming an implementation intention improves the likelihood that a new situation cue-response (e.g., stress-healthy eating response: "when feeling stressed, eat an apple") will 'win out' in the horse race between the dominant well-learned response (e.g., stress-unhealthy eating response: "when feeling stressed, eat a donut") (47), it seems logical that implementation intentions will assist individuals with low self-control resources, or whose resources have been depleted, in managing their behavior because fewer self-control resources are required to manage the new 'automated' action (40, 48-50). This is particularly important for individuals who are constantly attempting to manage their eating behavior whose resources may be compromised by repeated attempts at self-control. Research has demonstrated that individuals with elevated body mass index, who may have low dietary restraint, are less effective at managing their eating behavior and tend to eat more if their self-control resources are depleted (51). My suggestion that self-control may be implicated in the mechanism by which implementation

intentions impact on reducing stress-induced unhealthy eating is also consistent with previous research that has demonstrated implementation intentions in moderating the resource depletion effect (48). Implementation intentions may, therefore, be more effective in cases where individuals have low self-control resources and are engaged in behaviors requiring impulse control that require them to break strong cue-response patterns that have been reinforced by habit and affective responses.

In conclusion, I fully condone O'Connor et al.'s development of theory-based planning interventions to attenuate stress-induced unhealthy eating and their methodological, measurement, and analytic innovations. Such research advances the development of implementation intention research in health-related contexts (8). My proposal that self-control is implicated in the process by which implementation intentions assist in managing stress-cued unhealthy eating by increasing the accessibility of the alternative cue and reducing individuals dependency on self-control resource availability will, I hope, provide an addition to the theoretical explanation of their findings.

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