

# Reward mechanisms in health behavior change processes

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## Summary

- Increasing prevalence of lifestyle-related chronic diseases worldwide requires better understanding of health behavior change.
- Current health behavior change theories rarely take into account **automatic, implicit or non-cognitive aspects of behavior**, including emotion and positive affect.
- Recent progress in the neuroscience of motivation and reward systems can provide further insights into the relevance of such domains.
- In this **integrative review**, we present a description of the possible motivation and reward systems involved in behavior change.

## Health Behavior Change Process

We synthesize exemplary theories that (i) have frequently been discussed, applied and tested in the literature and (ii) provide an account of several stages of behavior change, including the aspect of maintenance. We create a flexible **seven-stage behavior change process** with three engagement phases (non-engagement, motivational engagement, executive engagement) in order to relate the motivation and reward systems to each of these stages.

Stage	Definition	Precaution Adoption Process Model (Weinstein & Sandman, 2002)	Transtheoretical Model (Prochaska et al., 2008)	Health Action Process Approach (Schwarzer & Luszczynska, 2008)	Four Phases of the Behavior Change Process (Rothman et al., 2004)	Rubicon Model of Action Phases (Gollwitzer, 1990)
Unawareness Non-engagement	The individual does not know about the benefits of behavior change	Unaware of issue				
Awareness Non-engagement	The individual knows about the benefits of behavior change but does not intend to change behavior (yet)	Unengaged by issue	Precontemplation			Predecisional Action Phase
Contemplation Motivational Engagement	The individual is thinking about changing behavior but has not made any concrete plans to implement the new behavior	Deciding about acting	Contemplation	Intention Motivational Phase		
Planning Motivational Engagement	The individual makes concrete plans to implement the new behavior at a certain point in time	Decided to act	Planning	Action Planning Volitional Phase Coping Planning Volitional Phase		Preactional Phase
Initiation Executive Engagement	The individual has carried out the new behavior for the first time	Acting	Implementation	Initiative Volitional Phase	Initial response	Actional Phase
Continued Action Executive Engagement	The individual has carried out the behavior several times	Maintenance	Maintenance	Maintenance & Recovery Volitional Phase	Continued response	
Maintenance Executive Engagement	The individual has carried out the behavior on a regular basis				Maintenance Habit	
			Termination			Postactional Phase

## Motivation and reward systems

Motivation describes processes that lie at the core of biological, cognitive and social regulation (Esch & Stefano, 2004), including the regulation of intensity of behavior that leads to the attainment of a particular **goal or stimulus** (Puglisi-Allegra & Ventura, 2012).

### Approach Motivation

Approach motivation, or appetitive (incentive) salience, is directed towards stimuli or goals that are associated with **positive, hedonic, pleasurable processes** (Esch & Stefano, 2004) and functionally associated with the wanting-system, reward expectation, performance and action (Esch, 2017). When approach motivation has led to achievement of the stimulus or goal, a reward is experienced as a pleasurable feeling (which could also remain unnoticed).

### Avoidance Motivation

Aversive motivational, or negatively-valenced fearful salience, is related to the avoidance of threat and punishment (as an opponent to receiving reward) and related to the **fight-flight-freeze system** (i.e., stress physiology, stress response) (Esch & Stefano, 2004). It is usually being triggered by a frightening or challenging stimulus and compels a motivated response of avoidance, i.e., getting away from unpleasurable conditions.

### Assertion Motivation

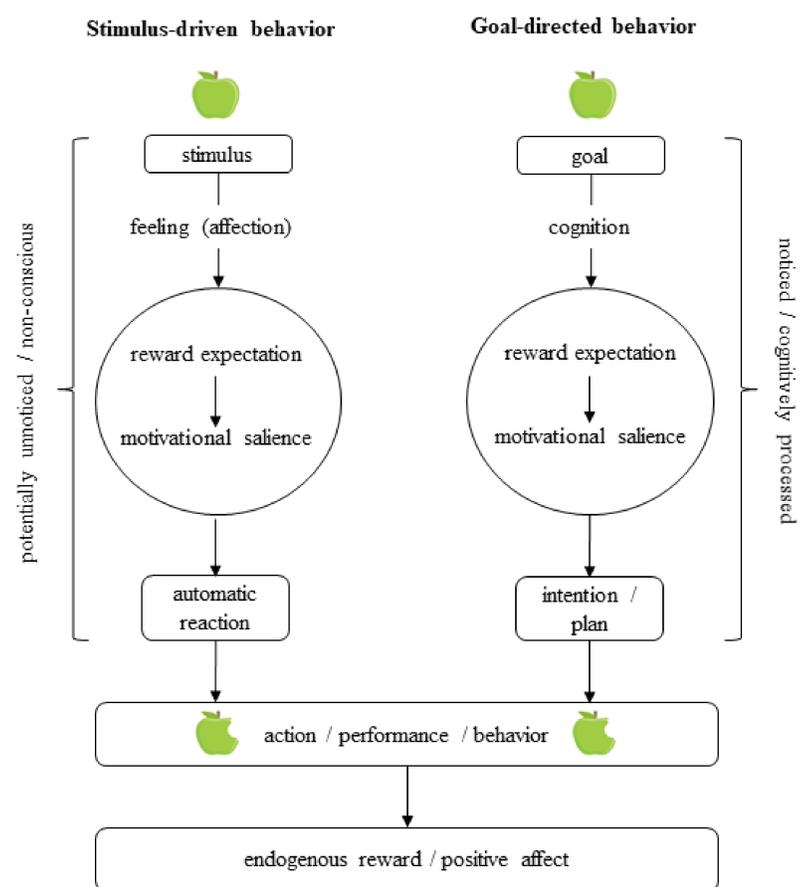
Assertion motivation, or assertive salience is associated with the 'non-wanting' system, with inaction, acceptance or contentedness, homeostasis and quiescence; it describes the motivation to maintain a certain condition or state (Esch, 2017; McCall & Singer, 2012), and its associated **positive valence is contentment**.

### Literature

Puglisi-Allegra, S., & Ventura, R. (2012). Prefrontal/accumbal catecholamine system processes high motivational salience. *Frontiers in Behavioral Neuroscience*, 6, 31. // Esch, T., & Stefano, G. B. (2004). The neurobiology of pleasure, reward processes, addiction and their health implications. *Neuro Endocrinology Letters*, 25(4), 235-251. // Esch, T. (2017). *Die Neurobiologie des Glücks: Wie die Positive Psychologie die Medizin verändert* (3. unveränderte Auflage). Georg Thieme Verlag. // McCall, C., & Singer, T. (2012). The animal and human neuroendocrinology of social cognition, motivation and behavior. *Nature Neuroscience*, 15(5), 681-688.

## Stimulus-driven and goal-directed motivation

We define stimuli as concrete physical objects, mental representations or memories of such objects, abstract concepts, or possibilities that are anticipated for the future (e.g. physical activity, healthier eating, smoking cessation etc., or the resulting increase in physical fitness, weight loss or other health benefits). The **pursuit of stimuli is based on affects** (or basic emotions) and can be automatic and occur **with or without awareness**. When cognitively processed, we may call these stimuli goals. Hence, behavior can be stimulus-driven (affective) or goal-directed (cognitive).



## Relating motivation to behavior change

### Non-engagement

- Unawareness / Awareness: motivation to change a behavior is yet **absent**. Progressing from unawareness to awareness solely requires an acquisition of information about the health improving potential of behavior change.

### Motivational Engagement

- Contemplation: If a stimulus leads to the activation of **appetitive or aversive salience**, a preference for a new behavior is set (Esch & Stefano, 2004).
- Planning: The cognitive action of planning is driven by appetitive or aversive motivational salience, and may result in intention.

### Executive Engagement

- Initiation: The behavioral consequence of a response-outcome mechanism, i.e., the individual is **actively responding** to the appetitive or aversive motivational salience.
- Continued Action: The activation of endogenous reward through initiating of the new behavior activates a **learning process**. As a consequence, reward expectancy increases. Learning takes place.
- Maintenance: Habitually performed behavior is driven by **assertive salience**.

## Conclusion

In addition to social, psychological and environmental domains already discussed in the literature, also automatic, affective or "non-conscious" domains and processes inherent in human behaviour – especially neurobiological motivation and reward processes – play crucial roles in behavior change and yet critically affect human well-being. Furthermore, behavior change interventions should thus focus more on positive stimuli and positively framed goals rather than evoke fear and threat through negatively framed stimuli and goals.