

Compensatory Carry-Over Action Model (CCAM)

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The Compensatory Carry-Over Action Model (CCAM) is innovative as most behavioral theories only model single activity. The CCAM, however, models different single activities—such as physical activity and nutrition—and how they change as a result of one another. Such lifestyle activities are assumed to be formed by higher-level goals, which can drive activity volitionally or unconsciously, and are rather unspecific. They become specific because of activities that are subjectively seen as leading to this goal. Each activity must be intended, pursued, and controlled. Specific resources ensure that individuals have the chance to translate their intentions into activity and that they resist distractors. Compensation and transfer (also called carry-over) operate between the different activities. If people devote all of their energy to one domain and believe that no resources remain for the other activity, compensation can help to attain goals. It is also possible that an individual successfully performs one activity, and existing or developing resources may be transferred to another activity.

Multiple Behavior Change

Physical Activity

Physical Exercise

Nutrition

Health Behavior

Work-Life Balance

1. Introduction

Most goals in life (e.g., becoming/remaining a high performing scientist or/and staying healthy, a so-called higher-level goal) can only be reached by means of more than one behavior (e.g., to work effectively and also to detach from work adequately by means of regular physical activity). At the same time, experiences and health outcomes like well-being result from such different behaviors. This is the main idea of the CCAM, which is displayed in Figure 1.

Figure 1. The CCAM (Lippke, 2014, 2019).

As there are very few other theories explaining explicitly such complex behavior change. Thus, the CCAM Lippke (2014, 2019) is unique in terms of explaining and predicting multiple (health) behaviors jointly. The CCAM is based on other social-cognitive models which assume that behavior must be intended, planned, and translated into concrete activities. Higher-level goals can in turn determine what individuals experience in terms of the outcome from the behaviors. Thereby they further control behavior adoption or maintenance via goal setting, planning but also self-efficacy beliefs.

Compensatory cognitions (CC) start operating in case of a tempting situation (e.g., having to work over hours): If behavior A (e.g., exercising appropriately after work) is hindered by behavior B (e.g., work hard), one can decide to perform another behavior instead of behavior A (behavior C; e.g., do active commuting). Alternatively, one can adapt the performance of behavior A by either executing it later or in a different way (e.g., exercising the next morning or just later and with a shorter duration). Based on this idea, individuals who perform a risk behavior may believe that they can compensate for this by performing another behavior or the planned behavior at a later point in time. However, many individuals experience problems with the intended compensatory behavior and end up not performing behavior A at all or behavior C. They may regret this, may not reach their higher -level goal of becoming/remaining a high performing scientist, because they cannot work hard only but also need to detach from work by physical activity. Thus, they may also fall ill in the long run or may question whether striving for the goal of becoming/remaining a high performing scientist makes sense and give up on investing maximum energy into it. Altogether, the main experience may be that the well-being is lowered unless a new higher-level goal is set or the

behaviors are optimized in concert. Thus, to help individuals to reach their goals requires a view of different behaviors.

Individuals with strong habits are less at risk of being distracted from their intended behavior. Thus, one can distinguish two groups: group 1 with those individuals who are experienced with a behavior, and group 2 with those for whom the behavior is completely new. Whereas group 1 has a higher likelihood of successfully translating intentions into behavior; group 2, without previous behavior experience, has to invest more volitional control and is more at risk for not translating intentions based on compensatory cognitions (CC) into action.

In that sense, also reviewing ones' compensatory intentions retrospectively may serve the purpose of understanding how compensating for the non-performance of the originally intended behavior actually lead to giving up the intention of the originally intended behavior. The key is that the awareness of ending up with an unhealthy lifestyle instead of the intended physically active lifestyle which also serves the purpose of being a high - performing scientist by means of detaching from work can help to prioritize higher-level goals and behaviors.

The intentions to perform the different behaviors must reach at least a moderate degree: The individual has to intend to perform the behavior sufficiently, performing the behavior even in face of temptations. Previous intentions and behavioral experiences (also called 'stages of change') come into play. Individuals with high intentions but no previous behavior performance and success experiences are those individuals most at risk for not translating their healthy intentions into behavior. Accordingly, helping individuals to have positive experiences is key. When the intended or needed behavior is not providing this for the individual (e.g., jogging due to knee problems with subsequent pain) then an alternative behavior enactment is needed to identify (e.g., nordic walking, swimming). There are many examples that can be found by experts. However, the key component is individualization and personalization: The personally or individually fitting behavior, situation and time, built and social environment has to be found. Action planning is the behavior change technique that aims for helping with that. However, which coping planning is well known and research, rather rarely the hindering function of different behaviors such as work and physical activity is considered. This needs to be done by means of sophisticated perspective -taking multiple behaviors into account.

Evidence for these cognitive processes demonstrates that compensatory cognitions are generally negative for adherence to the goal behavior (e.g., the exercise regime). However, intrinsic motivation can lower the risks of a lapse. And positive experiences from managing challenges such as a lapse can be carried over from one behavior to another. Carry-over is also known as transfer effects. For instance, if an individual manages to work long hours but then also manages to perform physical exercise, this may increase the belief to be able to manage difficulties in general. Next time when a challenging work task arises, the individual approaches this task more efficiently due to a higher self-efficacy in general. Or the other way around, a generally hard -working scientist may also have more confidence to overcome temptations to exercise physically even when feeling tired or low. In other words, carry-over are mechanisms that help to carry over resources from one domain to another or in terms of one behavior serving as a gateway for another. Generally, experience, skills, knowledge, and self-efficacy can be carried over from one behavior or its predictors to another.

2. Five Assumptions

Higher-level goals may volitionally or unconsciously regulate different behaviors and their predictors by readjusting the prioritization. Overall, the CCAM consists of five assumptions, which are as follows.

- (1) Different behaviors (such as work effectively and perform physical activity regularly) interrelate.
- (2) Higher-level goals (e.g., becoming a high performing scientist or/and staying healthy) drive different behaviors by initiating and strengthening behavior-specific intentions (e.g., work hard as a scientist and staying healthy; perform physical activity on a regular basis).
- (3) Within each behavior, one translates intentions into behavior via planning. Self-efficacy functions as a moderator of planning, and also directly supports behavior enactment.
- (4) Behavior-specific processes for behavior A (physical activity) and behavior B (being a high performing scientist) interrelate via carry-over mechanisms and via compensation or compensatory cognitions.
- (5) A healthy lifestyle consists of multiple behaviors, which buffer the stress response (e.g., due to chronic health limitations or disabilities, an acute infection, or environmental challenges) and increase well-being.

Single studies support specific assumptions (see reference below). There is much evidence that different behaviors interrelate. Different studies support the assumption that carry-over mechanisms exist and showing that cognitive carry-over and behavioral outcomes depend on, for instance, whether physical activity resources are being transferred to nutrition behavior. Research is still needed, however, to extend assumptions of the CCAM. This is required by using different research designs, particularly longitudinal observations, Randomized Control Trials with experimentally testing effects, and complex analyses of different behaviors and how they change depending on each other.

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