



# Positive Change for Wellbeing

- Maintained intervention-induced behaviors and healthier lifestyles



Frida Skarin



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Faculty of Arts and Social Sciences

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Psychology

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## ABSTRACT

Lifestyle behaviors such as increased private car use, stress, low physical activity, and unhealthy eating negatively affect individual and global health, environment and economy. We must change, not only to decrease suffering and economical costs, but to promote wellbeing for flourishing human beings on a living planet. It may not be simple to change ingrained behaviors. Nevertheless, with aid from interventions, the success rate for behavioral change is quite high, yet not automatically lasting. Despite growing problems and that brief change generates brief effects, research on maintained intervention-induced behavior is scarce. Due to this research gap, this thesis aims to broaden understanding of psychological mechanisms involved in health- and lifestyle-related intervention-induced behavior and maintenance and suggest potential development for intervention initiators and participants. This aim is approached through three field studies:

Study I uses a quantitative approach to investigate motives for intervention participation, as well as psychological mechanisms in early phases of behavior adoption, in relation to immediate behavior change in a travel-intervention setting using incentives.

Study II uses a quantitative approach to investigate psychological mechanisms in adopting and maintaining intervention-induced behavior in a mandatory, wellbeing intervention setting.

Study III uses a mixed-methods approach to investigate psychological mechanisms on a deeper level, in a fee-based lifestyle intervention.

For maintained intervention-induced behavioral change, the main findings indicate the importance of: Focusing on behavior goals; undergoing positive experiences during an intervention; experiencing gains from immediate outcomes; and learning to apply a flexible approach that meets shifting conditions and responses through the different intervention phases.

Keywords: maintain, behavioral change, intervention, wellbeing, health, lifestyle

## SVENSK SAMMANFATTNING

Livsstilsbeteenden såsom ökad bilanvändning, stress, låg fysisk aktivitet och ohälsosamt ätande påverkar negativt individuell och global hälsa, miljö och ekonomi. Vi måste förändra beteende, inte bara för att minska lidande och ekonomiska kostnader, utan för att främja välmående människor på en frodande planet. Att förändra invanda beteenden kan vara svårt, men med hjälp av interventioner är framgångsfaktorn hög. Dock inte automatiskt bestående. Trots växande problem och att kortvarig förändring ger kortvarig effekt, så är forskning om bibehållen interventions-inducerad beteendeförändring knapphändig. För att bemöta detta forskningsgap syftar denna avhandling till att vidga förståelsen för psykologiska mekanismer involverade i bibehållen hälso- och livsstilsrelaterad interventions-inducerad beteendeförändring, och föreslå potentiell utveckling för interventions-skapare och -deltagare. Syftet approcheras genom tre studier:

Studie I tar en kvantitativ ansats för att undersöka motiv för deltagande, och psykologiska mekanismer i tidiga faser av beteendeförändring i relation till direkt beteendeförändring i en resbeteende-intervention, där deltagarna erhåller gratis kollektivresor.

Studie II tar en kvantitativ ansats för att undersöka psykologiska mekanismer vid direkt och bibehållen beteendeförändring i en välbefinnande-intervention med obligatoriskt deltagande och fritt val av aktivitet.

Studie III använder mixed methods för att undersöka psykologiska mekanismer för bibehållen förändring på en djupare nivå, i en avgiftsbelagd livsstilsintervention. Huvudfynd för bibehållen interventions-inducerad beteendeförändring belyser vikten av: fokus på beteendemål; positiva upplevelser under interventionen och av direkta resultat av beteendet; samt att lära sig att tillämpa flexibilitet i bemötandet av de skiftande förhållanden som uppstår under de olika interventionsfaserna.

Nyckelord: bibehålla, beteendeförändring, intervention, välbefinnande, hälsa, livsstil



## LIST OF SCIENTIFIC STUDIES

1. Skarin, F., Olsson, L. E., Friman, M., Wästlund, E. (2019). Importance of motives, self-efficacy, social support and satisfaction with travel for behavior change during travel intervention programs. *Transportation Research Part F: Traffic Psychology and Behaviour*, 62, 451–458.
2. Skarin, F., and Wästlund, E. (2020). Increasing students' long-term well-being by mandatory intervention – a positive psychology field study. *Frontiers in Psychology*, 11, 553764.
3. Skarin, F., Wästlund, E., Gustafsson, H. (2021). Maintaining or losing intervention-induced health-related behavior change. A mixed methods field study. *Frontiers in Psychology*, 12, 2406.

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## ACKNOWLEDGEMENTS

Ever since I was an elite youth runner, I have been astonished yet fascinated by the fact that there can be such a difference in performance at competition between athletes equally good at practice. I remember my teammate dwelling upon anxiety, other competitors and their former performances and ranking. Meanwhile, I was quite unaware – even clueless – knew nothing about the other competitors and, more deliberately, revealed nothing about my own excitement and tingling body for an upcoming event. I realized at an early stage that my teammate's brain-inducing stress and the bodily reactions to this stress hindered optimal functioning, while my brain produced reactions that powered my body and enhanced my performance. At that time, I was always at my best during competition. Sometimes, I wish I still had that power from staying unconcerned. However, right there I understood that there is so much to learn about the power of connections between body and mind. I wanted to learn more about that power, about change and positive functioning, not just for optimal performance, but for optimal living. Through various paths in life, I am now completing this thesis on intervention-induced, positive behavioral change for wellbeing.

As with all time it is hard to grasp all moments that pass by. Moments so present in the present and then, suddenly, they have fluttered by to another time in the past. When this doctoral journey now after an eternity and a blink of an eye comes to an end, I want to thank many people along the way. Since most of my thanks are to native Swedish speakers, it feels most personal to write these in Swedish.

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*Frida Skarin*

Stockholm, March 2023

# 1. INTRODUCTION

Human and planetary health is affected by individuals' lifestyle behaviors. In a world of increasing pollution, mental health problems and excess weight triggered by Western society's lifestyle (including private car use, stress, and inactivity), behavioral change is urgently required. This background section starts with an overview of three health- and lifestyle-related topics in three contexts, respectively, from where this thesis originates.

First, private car use causes both pollution (since most cars are powered by gasoline or diesel) and a sedentary lifestyle. Pro-environmental behavioral changes, such as less car use, generate positive benefits for both the environment and health. Environmental advantages of less car use help cultivate biodiversity and save our planet by not expanding gasoline pipelines onto land needed for life-giving forests, wetlands and grasslands. Additionally, fewer cars generate less air pollution, both locally and globally. The ongoing increase of invasive species has negative effects for the original flora and fauna and ecosystem functioning. These harmful effects may lead to deterioration of the economy and human health, which can be mitigated by lowering pollution levels (Swedish Environmental Protection Agency, 2022). Reducing car use also generates health benefits by increasing physical activity, either by walking to the nearest transportation hub, or by using more physically active transportation modes such as walking, running, or bicycling.

Second, mental health conditions are increasing all around the world. As an example, depression and anxiety, two of the leading causes of disability, cost the global economy \$USD 1 trillion per year, and suicide is the fourth-leading cause of death among 15- to 29-year-olds (World Health Organization [WHO], 2022). Mental health problems can be prevented by promoting mental health strategies, since increased wellbeing buffers against these issues. Both WHO (2022) and researchers (Ivancic et al., 2017) have called for the use of such prevention and promotion methods. Nurturing wellbeing helps to counteract socioeconomic consequences, such as disability pension costs and long-term work-related stress associated with debilitating diseases and mental health problems. Promoting mental health and wellbeing helps improve job satisfaction, attendance and productivity (Fredrickson, 2001; Ivancic et al., 2017), which makes organizations more cost-effective. Therefore, all individuals, societies, and organizations have much to gain from investing in wellbeing.

Third, unhealthy behaviors, such as a sedentary lifestyle, low physical activity and unhealthy eating, are associated with noncommunicable diseases or NCDs (Kontis et al., 2014) because they cause high blood pressure, cholesterol and blood-sugar levels, as well as obesity. Cardiovascular diseases, chronic respiratory diseases, cancers, and

diabetes are four of the most common NCDs, which not only affect individuals, but also incur economic and resource costs from the health care system and society as a whole (Cesare et al., 2013). According to WHO, as many as 41 million people die from NCDs every year, which is 74% of all deaths (WHO, 2023). Since NCD risk factors can be reduced by changing unhealthy behaviors, individual and global expenses can benefit from intervening ventures.

### **Behavioral change and wellbeing outcomes**

In using an ecological model of health promotion (Dustin et al., 2010), individual and global health appear closely connected and interdependent. From this perspective, individual health demands other healthy people, societies, and eco systems.

Approaching individual behavioral change from a viewpoint that includes both other people and the environment is constructive in several ways. Accordingly, spending time outdoors makes us more physically active, rather than sedentary, and simultaneously produces less pollution and greater wellbeing. Successful behavioral changes are called for in all three highlighted areas listed previously, not only to decrease suffering and costs, but also to promote wellbeing. The benefits of wellbeing are far-reaching. Both longitudinal and cross-sectional research studies show how wellbeing makes people more productive, engage in more meaningful relationships, and reduces their health care costs (Keyes and Grzywacz, 2005). Overall wellbeing is positively related to physical health, possibly because a healthier lifestyle and immune system help buffer against potential harmful stressors (Pressman and Cohen, 2005). The multifaceted nature of wellbeing means that it can be generated by either engaging in a behavior or as an outcome of that behavior (such as physical activity). Furthermore, wellbeing can manifest as a pure feeling of happiness, enjoyment or satisfaction, or as a state of autonomy (such as the freedom to choose) (Haworth and Hart, 2007/2012). Previous researchers have tried to define different aspects of wellbeing. The most common definitions are subjective wellbeing (SWB) and psychological wellbeing (PWB) (Weiss et al., 2016). In short, SWB takes a hedonic, happiness view of wellbeing, while PWB takes a purposeful view of wellbeing and is concerned with the necessary conditions to produce wellbeing. Therefore, SWB includes the longer-term assessment of overall life satisfaction and the immediate experience of a balance between a positive and negative affect. Whereas life satisfaction reflects an individual's perceived distance from their ambitions, their affect status reflects their happiness level (Diener et al., 1999). PWB focuses on a deeper meaning, personal growth, and purpose in life. This definition may include a broader touch on human development and existential challenges, involving circumstances, processes, and interactions with situations, people and within oneself (Keyes et al., 2002). In this thesis, wellbeing refers to SWB.

With regard to wellbeing, it is worth mentioning that the debate about mental health being more than just absence of mental illness was highlighted through the emergence of positive psychology in the late-1990s. Positive psychology became an umbrella term, under which positive functioning was viewed as a contrast to the focus on negative emotions and mental health problems and disorders that had previously dominated psychology research (Seligman and Csikszentmihalyi, 2000). Therefore, the absence of mental health problems does not automatically indicate wellbeing, as unhappiness or dysfunction in everyday life can still be an issue (Keyes, 2007). Likewise, people with mental problems or disorders can be happy, cope well with their difficulties, and enjoy life (Bergsma et al., 2011). Consequently, increasing wellbeing enhances life for individuals and generates positive effects on global health, economy and environment. Therefore, changing from individual detrimental behaviors to those engendering wellbeing during an activity and/or as an outcome of a behavior, have potential to create great effects on individuals, societies, and the world.

In what follows, I will first introduce behavioral change in relation to theoretical models to draw a map wherein this these fits. I will then introduce the concept of interventions by describing aspects connected to the aim and composition of interventions, as well as initiation to, and recruitment for interventions. This section also includes an overview of relationships between the intervention phases, behavioral (change), psychological mechanisms, and outcomes in relation to the included studies' specific attention. This is followed by introducing the phases of the intervention process (pre-intervention, intervention, and post-intervention phases), followed by the psychological mechanisms associated with each phase. In connection with this I present a timeline with data-collection plots during the intervention process to clarify study measurement points in relation to intervention phases. I will close the background chapter by introducing the intervention characteristics and research methods used in the three included studies in this thesis, which I will briefly present in relation to each other. I will then move on to present the aims of this thesis, followed by a study overview for the included studies, ethical considerations and discussion. I will discuss findings of this thesis in relation to recent research in the last chapter. Finally, my concluding discussion will offer limitations and suggestions for future research, as well as recommendations for people who want to maintain behavioral change or help others to do so.

### **Behavioral change**

It is appropriate to make a distinction between *spontaneous* behavioral change and *intervention-induced* behavioral change. Core behavior research examines why certain behaviors occur or change, while this thesis investigates intervention-induced behavioral change. When further referring to behavioral change, the intended meaning is intervention-induced behavioral change.

Previous research called for evidence-based research on methods for promoting behavioral change, rather than effects of desired behaviors (such as physical activity and dietary interventions), with an emphasis on promoting behavioral changes that last over time (e.g., Fjeldsoe et al., 2011; Swedish Agency for Health Technology Assessment and Assessment of Social Services [SBU], 2007). As challenging as it may be to change a behavior, most intervention participants succeed in doing so during the limited time of their intervention enrollment. However, intervention-induced behavior does not automatically guarantee maintenance. When the intervention is over, many stop the positive behavior (Anderson et al., 2001; Curioni and Lourenço, 2005; Rothman et al., 2011). Without maintenance, behavioral change during the intervention obviously has limited effect on larger-scale issues such as pollution, NSDs, or mental health (Shortreed et al., 2013). Despite that, previous research on maintenance is scarce (Fleischer et al., 2015; Glasgow et al., 1999; Kwasnicka et al., 2016). Studies must include post-intervention follow-up measurements of six months or more to meet the maintenance perspective requirement (SBU, 2007). The aggregated scientific foundation must be sufficient, including ability to answer a certain question in a reliable way, and appropriate scientific quality of each study to meet the evidence-based perspective requirement (SBU, 2007). Previous research argues for important aspects for successfully maintained behavior to include: A larger intervention scope (including several lifestyle behaviors in parallel); interventions with a theory-based behavioral-change model foundation; and perceived self-efficacy (SBU, 2007). Accordingly, research on behavioral change theory components that promote intervention-induced maintained behavioral change is demanded, and will be explored in this thesis.

### **Behavioral change through interventions**

It is not an easy change to modify an ingrained behavior, even if we limit our focus to just the Western world and to people who actually want to voluntarily change their behavior. In a perfect world, all humans would behave in a way that generates wellbeing, good health, and constructive outcomes for themselves and others. Most people recognize that it can be difficult to change a behavior, despite knowledge that it is unhealthy or even harmful to them, other people, and/or the environment (Rothman et al., 2009). Hence, there are ways to influence positive behaviors and tools that are helpful for those who want to change a certain behavior, or want to help others do so. These tools are called *interventions*, which are programs, setups or frameworks for behavioral change that help participants adopt desired behaviors and generate desired outcomes, such as wellbeing and a healthier lifestyle (Rothman et al., 2015). Interventions can be run in various contexts, with various target behaviors, setups, and recruitment of participants.

### ***Initiation and recruitment***

Interventions can either be initiated by various governmental or societal forces for public health investment, or by private actors targeting individuals. There are several ways to obtain participants, which can be divided into either push or pull measures (Steg et al., 2005). *Push measures* regulate people's actions through fines, fees, restrictions, and other penalties. Toll roads and waste fines are examples of this. Conversely, *pull measures* encourage participants to voluntarily change behaviors by promoting better ones, offering free trials or other incentives, and providing support (Harring, 2018). This thesis only includes interventions that use pull measures. Fee-based interventions are initially marketed in the same way as those that are free, with pull measures (such as trial offers, two-for-one deals, or giveaways) to attract participants to sign up. Additionally, intervention participation may be voluntary, but it may also require commitment to specific mandatory tasks. On the other hand, intervention participation can be mandatory, but may offer choices, options, and autonomy in setting up, planning, and performing the intervention tasks. Recruiting for voluntary behavioral-change interventions often aims to attract participants with possible outcome gains, such as increased wellbeing, health, or wealth (Michie and Johnston, 2012). This may tend to attract participants who are less motivated by the target behavior, so are less likely to change behavior, either during the intervention or as an effect of participation (Dombrowski et al., 2012). When marketing a behavioral-change intervention, it can be tempting for intervention initiators to try to attract as many participants as possible. However, it is questionable whether it is preferable to have more intervention participants, but with a potentially lower behavioral-change rate, or fewer participants but with a potentially higher rate. I will return to this question in the discussion chapter.

Even with intervention participants voluntarily signing up, and stating their willingness and desire for change, neither behavioral change nor desired outcomes automatically emerge as a result (Rothman et al., 2011). As illustrated in Figure 1, interventions lead to outcomes, but those outcomes are engendered from behavior induced by the intervention. Psychological mechanisms within each participant must impel behavior for the desired behavior to occur. In turn, intervention-induced outcomes lead to further outcomes via behavior. Similar to the initial intervention-induced behavior, post-intervention behavior is generated by psychological mechanisms. For an overview of the nature of intervention-induced behavioral change (and attention of the studies included in this thesis), see Figure 1.

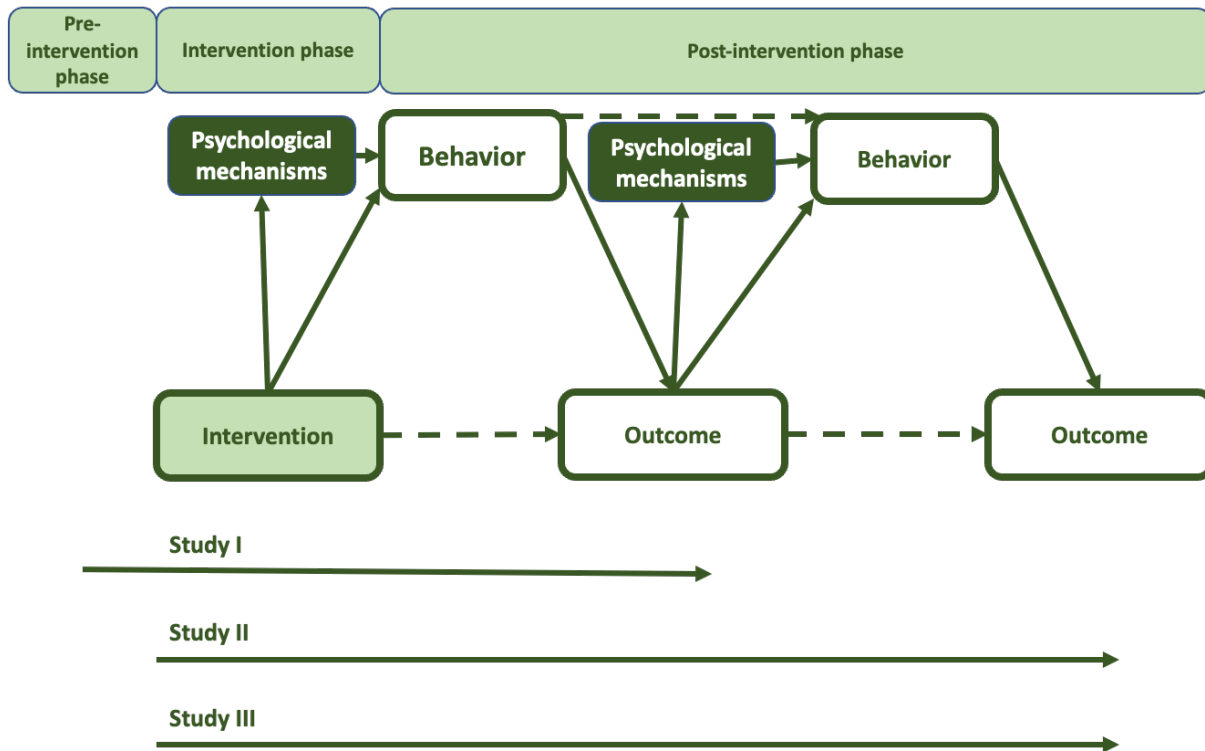


Figure 1. Overview of intervention-induced behavioral change, phases, and study attention

Behavioral change processes can be examined from several viewpoints. A trans-theoretical model suggests that behavioral changes in health progress through stages, which represent participants' readiness for the next level of change. Previous research also suggests that applying stage-matching can improve the effect of an intervention on continued behavior (Prochaska and Velicer, 1997). I will return briefly to this in the discussion. Dividing the change process into stages can be beneficial, similar to dividing the intervention process into phases.

### **Intervention phases**

The intervention process can be divided into phases, usually to clarify that a behavioral change process begins before an actual change; continues during the intervention, where the change takes place; and then continues after the immediate change (see Figure 1). There are various ways to divide and name the phases. Some examples of divisions include *behavioral focus* (*intention formation, adoption, maintenance*) (Blicher-Hansen et al., 2022) or *response focus* (*initial response, continued response, maintenance, habit*) (Rothman et al., 2011), or *intervention time-span focus* (*pre-intervention, intervention, post-intervention*) (Skarin et al., 2019). However, since both spontaneous and intervention-induced behavioral changes can be divided into phases, I chose to use the terms *pre-intervention phase, intervention phase, and post-*

*intervention phase* to focus on the phases of the intervention process, rather than those of behavioral change, even though the former often relate to the latter.

Generally, an intervention process starts in the pre-intervention phase: Participants are recruited; participants who are eligible join the intervention; and baseline measurements are made. After the pre-intervention events take place, the intervention phase starts, in which participants perform the intervention during a set amount of time determined by the intervention initiator. During the intervention phase, new measurements are taken to compare with the initial baseline measurements. These measurements indicate the immediate, ongoing outcomes of the intervention. At the end of the intervention phase, the post-intervention phase starts, in which participants continue to engage in unmonitored and uninfluenced behaviors. For maintenance studies, new measurements are made after a period of time, for comparison with baseline and immediate outcome data. The maintenance data is usually collected at least six months into the post-intervention phase to indicate behavior maintenance. See Figure 2 for a timeline overview.

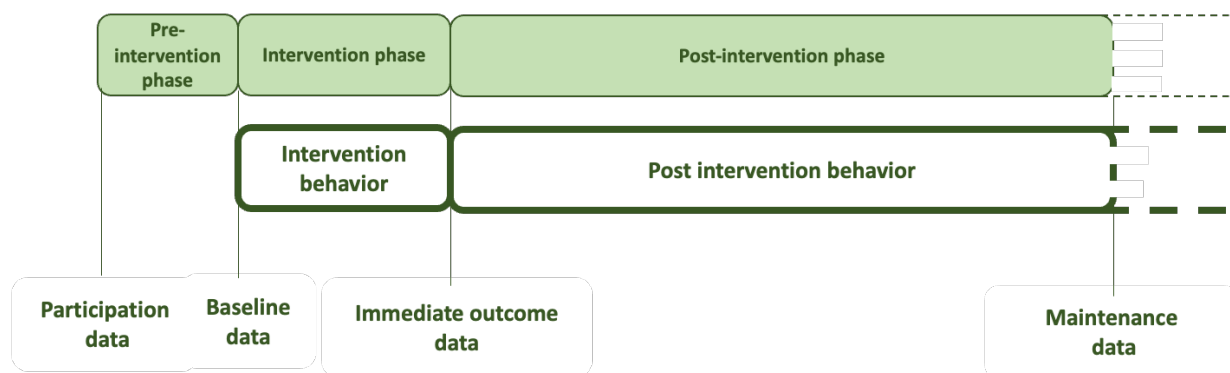


Figure 2. Timeline of intervention phases and study measurements points

Transitions between phases of the intervention process are influenced by participants' self-regulatory strength, which is a cognitive resource consumed by regulation of emotions, thoughts, and behaviors (Rothman et al., 2011). From a learning perspective, changing behavior involves learning something new, through both positive and negative reinforcement of the target behavior, and immediate and delayed consequences of that behavior. Identifying triggers for original behavior, and prompts for continuing toward target behavior, are helpful for maintaining that desired behavior (Ramnerö and Törneke, 2006). Rothman et al. (2011) provided a potential explanation for defining features of each intervention phase. At early points, behavior is continuously evaluated and the mind is busy with restraining cues associated with old behaviors meant to be replaced by new target behaviors. Adopting new behaviors include restraining old behaviors that involve impulses from emotions, thoughts, and behaviors. Such impulses

challenge individuals' resilience, requiring the use of self-regulatory strength to overcome. When skills have been developed enough to be properly established, the focus can be on self-regulation of target behavior alone, rather than simultaneously resisting the undermining processes associated with old behaviors. Therefore, when the target behavior is established, the pull from old behaviors will be weaker as values associated with the target behavior grow stronger. In early research, self-regulation was argued to be solely of a conscious nature, but more recent research is concordant in recognizing its unconscious facets (Vohs and Baumeister, 2016). A discussion on psychological mechanisms associated with the phases in relation to the included studies follows in the discussion chapter.

### **Intervention phases and psychological mechanisms**

By itself, no theory is ever able to fully describe reality but it can be helpful for increasing understanding of reality. Therefore, this section introduces psychological mechanisms and theories associated with the intervention process for immediate and maintained intervention-induced behavioral change. This chapter is arranged in line with the intervention-process phases, going through the psychological mechanisms in the pre-intervention and intervention phases, before concluding with processes in the post-intervention phase. The chapter closes with a brief on maintenance, including definitions in recent research.

#### ***Pre-intervention phase - Motivation, expectations, goals***

Even before joining an intervention, psychological mechanisms influence behavior. Motivations, expectations, and goals are needed to direct the body and mind toward a certain course. Both motivations and goals can include conscious and unconscious aspects (Laran et al., 2016). Overall unconscious aspects are not investigated in this thesis. However, the discussion chapter will present a potential unawareness of outcome desires overtaking desires for behavioral change during an intervention.

The level and type of motivation varies between individuals, and may also fluctuate over time. Self-Determination Theory (SDT) (Deci and Ryan, 1985; 2000) is a motivational theory that involves positive psychology in understanding optimal functioning and succeeding in wellbeing interventions. It highlights three basic psychological needs for motivation to occur, which is necessary to activate behavior (Sheldon and Ryan, 2011). According to SDT these three needs are linked to psychological health and successful performance: The need to control the outcome of one's actions (*competence*); the need to act out of free will and true values (*autonomy*); and the need to engage in activities, including social support and togetherness (*relatedness*). To increase understanding of motivation, SDT categorizes *motivation* into *intrinsic* (autonomously engaging in activities out of curiosity, joy, and internal rewards from positive emotions) and

*extrinsic* (engaging in activities for external or to avoid punishment) (Deci and Ryan, 2008).

Extrinsic motivation can take various forms, in which *introjection* is the least autonomous version (Ryan, 2012). Examples include trainers reacting to their athlete's performance by reward or punishment. This example typically does not result in long-term high performance because of its non-volitional nature. Rather, it results in consequences from negative wellbeing, as a cause of low self-worth. A more autonomous form of internalized extrinsic motivation is *identified regulation*. An example of this would occur if the athlete in the above example understood and accepted the value of the desired behavior (for example, running a certain number of miles per week).

The most autonomous form of internalized extrinsic motivation is *integrated regulation*, which means the behavior is fully integrated and adopted by the athlete and is in line with their own identification and true needs. Fully integrated motivation refers to engaging in an activity for its own value and meaning. Externally motivated behaviors do not normally transform into intrinsic motivated ones, but several forms of motivation can exist simultaneously. Furthermore, a behavior can start in one form and transform into another. A combination of more than one form of motivation is often the true picture of reality, but research on this is limited (Locke and Latham, 2002).

The psychological needs of SDT are involved in a process including psychological development and wellbeing, which form a base for setting goals, which may then stimulate motivating behavior and achieving those goals (Deci and Ryan, 2000). The psychology of changing a behavior includes partly conflicting goals, in terms of immediate versus longer-term outcomes of a certain behavior. Immediate outcomes of one behavior, such as a gratifying feeling of eating unhealthy food, may override the longer-term outcomes of the same behavior, such as being overweight (Marteau et al., 2012). Goal setting is linked to expectations, which also play a role for behavior. Expectations can be divided into *expectancy on behavior* and *expectancy on self* (Bandura, 1997). Expectancy, or belief, that a certain behavior leads to a desired outcome is called *outcome expectancy*, while expectancy on, or belief in one's own ability to perform a behavior is called *self-efficacy* (Bandura, 1997). Self-efficacy is important for goal-setting in several ways. High self-efficacy usually generates higher goals; greater commitment to the goals; more effective strategies to reach goals; and more constructive responses to negative feedback while working toward goals (Locke and Latham, 2002).

### ***Intervention phase - Support, experiences, emotions***

Previous research shows that experiences and emotions during the intervention phase are important for succeeding in health-related behavioral-change interventions (Black et al., 1990; Nizamani et al., 2022). Social support is one such important experience during

the intervention phase. Deci and Ryan (2008) highlighted social support when addressing *relatedness* as one of the psychological basic needs for motivation to perform a behavior. Various studies have focused on support from friends and colleagues (Wing and Jeffery, 1999;), couples and families (Black et al., 1990; Gorin et al., 2005; Skarin et al., 2017), or a combination of the above (Kiernan et al., 2012; Kumanyika et al., 2009; Wang et al., 2014). In a recent review of couples-based interventions combining physical activity and eating behavior, the power of social support was described as lying in the togetherness and aiding adherence (Nizamani et al., 2022). Accordingly, remaining committed is evidently a main issue in maintaining a behavioral change.

Previous research shows that experiencing satisfaction plays a significant role for behavioral change, regarding satisfaction both during the intervention phase and as an immediate outcome (Kwasnicka et al., 2016). Since immediate reinforcement and instant gratification are more likely than long-term gains and delayed gratification to lead to the continuation of a behavior, satisfaction during an intervention is important for target behavior to maintain over time. This satisfaction may occur either by enjoying the target behavior, per se, or by the immediate outcomes that the target behavior brings about (Hall and Fong, 2007; Rothman, 2009). After initially engaging in a target behavior, it is natural to evaluate its cognitive and emotional consequences. If the outcome of the target behavior is in line with expectations, intrinsic motivation is reinforced, self-efficacy increases, and the effort to continue the behavior is likely enhanced (Ryan and Deci, 2000).

When being truly motivated to change behavior, the potential to experience positive emotions while engaging in the activity naturally increases. All studies in this thesis imply the importance of experiencing positive emotions during the intervention for successful behavioral change. Examples of positive emotions are joy, interest, contentment and love (Fredrickson, 2004). The positive effects from positive emotions have been widely researched. An important theory associated with positive psychology is the broaden-and-build theory of positive emotions (Fredrickson, 1998). The broadening aspect of the theory refers to capacity of positive emotions to broaden momentary thought-action repertoire and the building aspect stands for capacity to build enduring personal resources (Fredrickson, 1998; 2001). By broadening the thought-action repertoire, thoughts and actions that come to mind are fostered to a more flexible approach. This means positive emotions can cultivate flexibility. Positive emotions build flexibility through such means as broadening cognition. An example is that the experience of joy generates a desire to push limits and create, physically, socially, intellectually and artistically. Another example is that the experience of interest generates a desire to explore, learn, and seek new experiences and self-development

(Fredrickson, 2004). For positive emotions to occur, a cognitive process is required as compared to sensory pleasure (such as satisfying a bodily need of hunger).

### ***Post-intervention phase processes***

When the intervention phase passes into the post-intervention phase, most intervention initiators and participants wish to maintain the intervention-induced behavior.

Nevertheless, theories that focus on maintaining positive, healthy behavioral changes are limited (Dunton et al., 2021; Kwasnicka et al., 2016). Early theories (such as Social Cognitive Theory, SCT [Bandura, 1986]) and many interventions have focused on initiating behavioral change, rather than considering its maintenance. This is unfortunate, since maintained behavior is the true goal of intervention-induced behavioral change. More recent theories (such as the Physical Activity Maintenance Theory [Nigg et al., 2008] and the Theory of Maintenance [Rothman et al., 2009]) have addressed the interplay between reactive and reflective processes in promoting healthy behavioral maintenance. *Reactive processes* can include contextual triggers and stress, while examples of *reflective processes* are goal-setting, motivation, and self-efficacy (Dunton et al., 2021). *Reflective mechanisms* are represented in plan-making, goal-setting and evaluations, while *reactive mechanisms* are represented in emotions during and after the intervention. The division of the motivational mechanisms into reflective and automatic/reactive processes is found in research on maintaining physical activity (Nigg et al., 2008) and eating behavior (Rothman et al., 2009), as well as studies on improving intervention design (Michie et al., 2011). A recent study by Dunton et al. (2021) highlighted the importance of *micro-temporal shifts* for behavioral maintenance. *Temporal shifts* are short-term changes between reactive and reflective processes that are necessary to enforce maintenance. Since motivation, energy, and circumstances shift throughout life (and between individuals), responses also shift, blend, and separate. Reflective processes, such as experienced self-efficacy seem to be more important for new behaviors. Reactive processes (such as perceived satisfaction with the behavior) may overtake behavioral guidance as time goes on, in order to maintain results (Castonguay and Miquelon, 2017; North, 2012).

Similar to temporal shifts between reflective and reactive processes, occurrences of a new behavior shifts between progress, temporal setbacks and plateaus, during both the intervention and post-intervention phases. It is important to acknowledge that temporary discontinuation of behaviors are normal parts of maintaining change, and are not relapses to pre-intervention behavior. Research on identifying maintenance failure varies between one missed physical activity session (Murphy and Taylor, 2019), three consecutive weeks of disengagement (Wilbur et al., 2005), and three months of not exercising (Sallis et al., 1992).

### ***Maintenance - Eat, leap, repeat***

Current research is undergoing an ongoing discussion concerning when a behavior can be considered maintained. Physical activity intervention studies traditionally define regular activity for six months post-intervention as maintained behavior (Dunn et al., 1999; Murray et al., 2017). However, a recent review by Nordmo et al. (2020) defined maintenance as longer than six months, since the average weight regain in their review was approximately four years. Maintenance of behavioral change is complex, especially when dealing with starting new behaviors, such as physical activity and eating. The difference in such measurements becomes quite clear if we compare maintaining a new behavior (such as exercise) with maintaining the cessation of an old one (such as smoking). It is easier to measure the elimination of behavior when it is no longer maintained. In the matter of continuing a new behavior in terms of physical activity or healthy eating, there are many more nuances to consider when determining maintenance. For example, the variety of different foods and amount dependence make it difficult to define whether or not healthy eating behavior is maintained. However, key subjects for maintenance should include an observable behavioral state including threshold, period of observation, frequency and consistency (Dunton et al., 2022). These key issues are more easily applied to physical activity than eating behavior, since factors such as frequency and consistency are clear measurements for physical activity. In a recent review, Dunton et al. (2022) discussed the need for a consensus in physical activity maintenance and problems with using the same terminology as in addiction research. They also highlighted the ongoing discussion on physical activity maintenance. Dunton and colleagues argued that behavior adoption and maintenance often are followed by a vulnerability phase, which results in disengagement. Making things more complex is the fact that physical activity maintenance is not an absolute stage of behavioral performance, but is instead a process including shifts in cognitive and motivational mechanisms (Rhodes and Sui, 2021). This thesis uses the traditionally applied, physical activity maintenance definition, which is measured six months after the intervention ends.

### **Intervention characteristics of included studies**

It is now time to introduce the intervention characteristics of the included studies in this thesis. There are both shared characteristics connecting the studies together in this thesis, and diverging characteristics, which adds important diversity.

There are four important shared characteristics among the included studies in this thesis. All of the studies:

Are field studies, studying participants in a natural environment, without any participant manipulation to fit the studies.

Aim to change health- and lifestyle-related behaviors.

Comprise intervention-induced behavioral change. Therefore, the intervention approach to behavioral change means that participants are willing to apply a new behavior in their everyday life, at least for a limited period of time.

Generate a potential wellbeing outcome.

The interventions' diversity lay in: Degree of voluntariness; inducement; length; target behavior; context; and participant interaction.

First, the three studies included in this thesis represent different degrees of voluntariness and inducements to participate: Voluntary, free-ticket, incentive-based participation (Study I); mandatory<sup>1</sup> participation with free choice of design and activity (Study II); and voluntary, fee-based participation (Study III). The shortest intervention lasted two weeks, in Study I, which also was the only incentive-based intervention. The participants were offered a free, public-transportation ticket, valid for two weeks across the region. In the longer, six-week intervention in Study II, students participated in the intervention as part of a program mandatory university course. However, the participants voluntarily chose to study the program, and could freely choose the behavioral change activity and how best to complete the intervention. The three-month intervention in Study III was the only fee-based intervention, and the longest study. Study III provided insight into yet another perspective of voluntariness and inducements. Selection of incentives and the degree of participant voluntariness are associated with the initiator's aim for potential outcomes. Initiators of the intervention studied in Study I may have aimed to reach many participants, which is why incentives are effective. On the contrary, initiators of the intervention studied in Study III may have wanted to recruit truly motivated participants with a potentially higher success rate, which meant that other promoted motives and inducements were more appropriate.

Second, the target behaviors and intervention contexts among the included studies ranged from travel behavior in a public-transportation, commuting campaign in Study I, to different wellbeing activities in a university course in Study II, to physical activity and eating behavior in a lifestyle program provided by certified gyms in Study III. A benefit of the range of included behaviors is their variety of complexity. The travel behaviors in Study I are relatively simple to change, with a clear substitution issue in replacing use of private cars with public transportation, as well as a clear start and stop of the behavior in commuting to and from work. This can be compared to the 12 different wellbeing activities that could be selected in Study II, ranging from meditation and physical activity, to writing gratitude journal. The range of activities added diversity and

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<sup>1</sup> Participation in the intervention was mandatory when enrolled in university course, but fully voluntary participation in the study.

complexity, in terms of open solutions to duration, frequency, time, and place to execute an activity. In terms of the physical activity and eating behaviors studied in Study III, the complexity is raised further. Study III starts with the same open solutions as in the wellbeing intervention, but adds further complexity by also managing two simultaneous behavioral changes. Complexity is built in by eating behavior that not only involves changing to a new behavior (eating nutritious foods), but also restraining a behavior (stopping eating unhealthy foods). Additionally, eating is something to be done several times every single day, which intensifies the intricacy.

Third, further examples of multiplicity among the studies are provided participant interaction. Here, *interaction* refers to the initiator's provided setup for involving participants in planning and monitoring the behavioral change, as well as support and guidance during the intervention process. Study I does not incorporate any planning, guidance, monitoring, or support for participants. Instead, it is entirely up to participants to determine how to make use of their free ticket throughout the entire intervention, without guide, regulation or specific check points. In Study II, the participants actively design their own plan for their chosen activity, framed by guide lines and support from tutor and peers. The participants are responsible for studying literature, performing the intervention, and tracking their behavior. At the same time, they must also complete pre-determined written assignments and participate in individual- and instructor-led check points. This structured, free-range approach can be compared with the roles in Study III, in which personal trainers involve participants by providing structure in terms of group sessions of coaching and training, information, planning and monitoring in the aim of helping the participants to modify their behaviors. The range of characteristics cover different perspectives of participant interaction and division of responsibility between participant and initiator. Additionally, the methodology used for the included studies differed. Study I and Study II uses a quantitative analysis method, while Study III uses a mixed-methods approach. See Table 1 for an overview of included studies.

Table 1. Overview of intervention characteristics for included studies

Study	Intervention type	Participants	Provided plan, monitoring and support	Data Collection	Statistics	Type of analysis
I	Incentives used 2-week public transport campaign	Self-referred car owners (n=181)	None	Self-report assessments online before and after intervention	Descriptive statistics, bivariate correlations, hierarchical regression.	Quant.
II	6-week mandatory wellbeing intervention in university course	Self-referred students (n=59)	Participant planning, participant monitoring, teacher- and peer support	Self-report assessments before, after, and 6 months after	Descriptive statistics, moderation analysis, follow-up spotlight analysis, independent sample t-test, bivariate correlations.	Quant.
III	Fee-based, 3-month lifestyle program given by cert. gym (n=22, n=12)	Self-referred overweight adults	PT planning, PT monitoring, PT- and peer support	Self-report assessments and body measure before, after, and 6 months after	Descriptive statistics, bivariate correlations, independent samples Mann-Whitney U test	Mixed methods

In closing this section, it is appropriate to clarify some recurring concepts throughout this thesis. First, goals are divided into outcome goals, which refer to the desire for consequences of behaviors, and behavior goals, which refer to the desire for engagement in behaviors per se. Second, the overall use of expectations in this thesis refers to: Measurements of expectation of one's own ability (self-efficacy): expectation of certain behaviors leading to certain outcomes (outcome expectancy); and expectation of actually achieving set goals, including current circumstances and life events (goal expectancy). In Study II, the concept of *expectancy* is used for the overall expectation of an outcome for oneself from participating in the intervention. Study III develops the expectation measurements, so includes *efficacy* and *goal expectancy* as two concepts of expectations. *Efficacy* refers to a merged measurement of self-efficacy and outcome expectancy. To capture an additional angle of expectation, we measured expectation of, under current life circumstances, actually reaching personal set goals (in physical activity, eating, weight, and other areas). This measurement is referred to as *goal expectancy*.

## Summary

Lifestyle behaviors are increasing individual and global health and economic costs from pollution, diseases, and mental illness (Swedish Environmental Protection Agency, 2022; WHO, 2022; 2023). Therefore, behaviors such as increased private car use, stress, a sedentary lifestyle, low physical activity, and unhealthy eating must change, not only to decrease suffering and economical expenses, but to promote wellbeing for flourishing human beings on a living planet. It is difficult to change ingrained behaviors. Nevertheless, with aid from participation in interventions, the success rate for behavioral change is quite high, although not automatically lasting (Shortreed et al., 2013). Despite the fact that intervention-induced behavior does not spontaneously transform into maintained behavior, so any resulting change effects are short-lived (Dunton et al., 2021; Sheeran et al., 2017), previous research has mainly focused on immediate change and outcomes (Dunton et al., 2021; Glasgow et al., 1999; Kwasnicka et al., 2016). Consequently, many people struggle to continue behavior in the post-intervention phase (Anderson et al., 2001; Curioni and Lourenço, 2005; Rothman et al., 2011). Due to a previous gap in maintenance research, an increased understanding of intervention-induced, behavior maintenance is necessary (Dunton et al., 2021; Kwasnicka et al., 2016). By investigating the intervention process through its phases and different characteristics, including psychological mechanisms for participation, carrying through the intervention and intervention-induced consequences, this thesis helps broaden understanding of maintained intervention-induced behavior and its potential outcomes.

### 3. RESEARCH AIMS

This thesis aims to broaden understanding of psychological mechanisms involved in health and lifestyle-related intervention-induced behavioral change and its maintenance, in order to suggest potential improvements for intervention initiators and participants. The overall aim is approached in several specific ways through each study. In Study I, motives for participation, support, self-efficacy, satisfaction, and future intentions are investigated. This study broadens understanding of participation and immediate intervention-induced behavioral change in an incentive-based travel behavioral intervention setting.

In Study II, motivation, expectations, and wellbeing are investigated, in relation to maintaining behavioral change and wellbeing. This study helps us to further understand the intervention process of a mandatory, wellbeing intervention setting, with free-choice of activities and high participant interaction throughout the intervention process.

In Study III, mixed methods are used to investigate motivation, expectations and goals, in relation to maintaining behavioral change and body mass index (BMI). This study aids our understanding of psychological mechanisms on physical activity and eating behavior, before, during, and after a fee-based, intervention setting.

### 4. INCLUDED STUDIES

The three empirical studies included in this thesis are presented below.

#### Study I

##### ***Importance of motives, self-efficacy, social support and satisfaction with travel for behavior change during travel intervention programs***

##### ***Background and aim***

This field study took place within the context of everyday travel behavior. It studied an intervention targeted to influence commuting behavior (to and from the workplace) by promoting use of public transportation, rather than private cars. The study aims were to investigate the importance of motives to enroll in an intervention, and the effects of self-efficacy, social support, and satisfaction with travel during the intervention. The aims were concretized in two research questions:

**RQ1:** Does motives in the pre-intervention phase influence travel behavior change?

**RQ2:** Do self-efficacy, social support, and satisfaction with travel during the intervention phase influence travel behavior change?

## **Method**

The two-week intervention was run by a regional, public transportation company using free trial incentives to attract participants who owned cars. The initiator created a large-scale campaign, including poster advertising, ads, and postal mail addressed to potential participants with a driver's license. Each participant received a free public-transportation ticket that was valid for two weeks across the region's network.

Invitations to voluntarily participate in the study were sent by e-mail, with a link to a web-based questionnaire sent before, during, and after the intervention. The questionnaires asked about motives and experiences regarding travel behavior, self-efficacy, future intentions, and social support. The participants' responses resulted in 181 complete questionnaires, from which the final data was analyzed in SPSS (Hayes, 2013).

To test RQ1, a hierarchical regression analysis was conducted, with behavioral change as the dependent variable, and seven motives to enroll as predictor variables. The seven predictor variables of motives to enroll were: Desire to change travel behavior; concern about the environment; desire for a free ticket; concern about health; concern about the cost of using a car; curiosity for trying public transportation; and desire for freedom to do things other than drive during travel. To test RQ2, a hierarchical regression analysis was conducted with dependent variable behavior change, and predictor variables the seven motives with the addition of self-efficacy, social support, and satisfaction. Correlational analysis was conducted on future intentions and behavioral change, in order to verify the relevance of the hierarchical regression modeling.

## **Main findings**

In answering RQ1, the motive with the highest weight was *desire to change behavior*. Although this motive was not statistically significant ( $p=0.06$ ), it indicates that the advertised (outcome-related) motives (*saving money* and *saving the environment*) to obtain participants may not attract participants most associated with immediate behavioral change. This finding is intriguing, not least from a profitability perspective.

In answering RQ2, both experiencing social support and self-efficacy during the intervention were significant for immediate behavioral change. Due to overall high levels of satisfaction with travel, a ceiling effect may explain why the satisfaction was not in line with previous research arguing for the importance of satisfaction during intervention for behavioral change (Taniguchi et al., 2014).

The verifying correlational analysis showed that immediate behavioral change was significantly positively related with future travel behavioral intentions ( $r=0.237$ ,  $p=.001$ ). This means that greater intentions to continue the intervention-induced behavior after the intervention is associated with higher frequency of immediate behavioral change. Previous research (Webb and Sheeran, 2006) has shown that intentions play a non-negligible role in future behavior.

## **Study II**

### ***Increasing students' long-term wellbeing by mandatory intervention – a positive psychology field study***

#### ***Background and aim***

This field study was conducted within the context of applying positive activity behaviors to everyday life. The positive activity intervention was run in a course setting mandatory for program students. The original perspective of research on applying positive activities in everyday life (Lyubomirsky, 2008) focused on the relationship between positive activities and increased wellbeing. This study focused on the relationship between psychological mechanisms and (realization of) positive activities; in other words, behavioral change as a primary outcome. As a secondary outcome we investigated links between successful behavior change and change in wellbeing. In this study, the concept of *expectancy* refers to the overall expectation on outcome for oneself participating in the intervention.

Since participation in interventions often induces high rates of initial behavioral change, we wanted to analyze baseline measures related to immediate outcomes without initially including (immediate) behavioral change. Accordingly, motivation and expectancy were investigated in relation to experienced immediate wellbeing. Since the overall aim of the study was to investigate maintained intervention-induced behavioral change, we then wanted to include maintenance measures. Thus, we investigated experiences, during the pre- and post-intervention phases, in relation to maintained behavioral change. Since wellbeing is a previously researched outcome of positive activities, we were eventually interested in the relationship between maintained behavioral change and maintained change in wellbeing. This resulted in two research questions:

**RQ1:** How does expectancy influence the effect of motivation on experienced wellbeing change?

**RQ2:** How do students' motivation and expectancy relate to their long-term behavior change and their experienced increase in long-term wellbeing?

#### ***Method***

The intervention was conducted in a course setting requiring participants to learn about 12 positive activities for wellbeing (Lyubomirsky, 2008), from which they could each choose one activity to apply in their lives for six weeks. The positive activities were developed from evidence-based research (Deci and Ryan, 2000; Sheldon and Houser-Marko, 2001) showing increased wellbeing from simple, intentional, regular practice of activities in which people with naturally high wellbeing engage (Lyubomirsky and Layous, 2013). Participants were guided by literature (including a person-activity fit diagnostic) and their teacher in choosing which activity would best fit their individual interests, values and needs. With teacher and peer support, the participants designed

individual plans for their positive activity operations, including frequency, duration, time, and place. Participants also determined and how to log activities, experiences, and reflections during the intervention.

Voluntary study participants were recruited from three different cohorts of first-year university students in the psychology program. All participants were asked to fill out questionnaires before and after the intervention about their motivation, expectancy, behavior, and wellbeing. Additionally, six months after the intervention, the participants were asked to answer an unannounced follow-up questionnaire about their behavior and wellbeing to date.

Due to feasibility and practicality, as well as to avoid common methods bias, self-report measurements were applied since they are shown to generate good validity and reliability, as compared to objective monitors (Bergkvist and Rossiter, 2007; Dowd et al., 2018). Single-item, seven-point Likert scales were used to measure expectancy (e.g., Wanous et al., 1997), motivation (e.g., Markland and Hardy, 1997), and wellbeing (e.g., Abdel-Khalek, 2006). Self-reports are well established in previous research on wellbeing (Armenta et al., 2014) and behavioral change (Cohn and Fredrickson, 2010).

To answer RQ1, a simple moderation analysis using the model 1 PROCESS procedure for SPSS (Hayes, 2013) was conducted, along with three variables: Motivation as the independent variable; immediate wellbeing change as the dependent variable; and expectancy as the moderating variable.

To answer RQ2, independent sample t-tests were run between those who maintained their intervention-induced behavior at follow-up, and those who had not.

Finally, a correlational analysis was conducted to compare the relationships between immediate wellbeing, maintained wellbeing and maintained behavioral change.

### ***Main findings***

In answering RQ1, the moderation analysis indicated that the effect of motivation on immediate wellbeing was moderated by expectancy ( $p=0.0032$ ,  $R^2=0.25$ ). The follow-up spotlight analysis indicated that motivation only had a positive effect on immediate wellbeing change when expectancy was high. In other words, co-existing, intrinsic motivation and high expectancy were keys to increased immediate wellbeing.

In answering RQ2, the independent sample t-tests showed that the participants with significantly maintained behavioral change at follow-up, reported higher expectancy ( $t[20]=2.936$ ,  $p=0.009$ ), immediate wellbeing ( $t[21]=2.478$ ,  $p=0.022$ ), and maintained wellbeing ( $t[23]=2.310$ ,  $p=0.03$ ). No significant differences in motivation were indicated at this point.

The correlational analysis showed that increased immediate wellbeing correlated with higher maintained wellbeing and maintained behavioral change. In other words, intrinsically motivated participants, who believed that the intervention would lead to increased wellbeing, experienced more immediate wellbeing. This experience then

motivated them to maintain the behavior that continued to generate increased wellbeing.

Additionally, more than one-fifth of the participants reported internalizing the intervention-induced behavior into their everyday life and still volitionally engaged in the behavior at six months post-intervention. This engendering continued increased wellbeing.

## **Study III**

### ***Maintaining or losing intervention-induced health-related behavior change. A mixed methods field study***

#### ***Background and aim***

This field study took place within the context of a health-related lifestyle intervention that aimed to help participants change their physical activity and eating behaviors. The intervention program was run by certified gyms and directed by personal trainers, following a certified concept promoted as a weight-loss program. Participants who signed up for the program were expected to engage in the included parts of the concept, which contained two small-group personal training sessions per week, recurring group-coaching sessions each week, personal trainer guided goal setting and check-ups, diet advice, and access to healthy recipes. In contrast to previous research focusing on the effects of healthy eating and physical activity on health (SBU, 2007) or comparing intervention components at a group level (Samdal et al., 2017), this study focused on increasing understanding of each individual's experiences of the intervention journey. This means investigating psychological mechanisms in the pre-intervention, intervention and post-intervention phase, in relation to behavioral change. In this study, expectations are divided into efficacy and goal expectancy. *Efficacy* refers to a merged measurement of belief in one's own ability to perform a behavior (self-efficacy) and belief that the behavior will lead to a desired outcome (outcome expectancy). Since expectations are affected by life circumstances, an additional angle of expectancy were included: *goal expectancy*, which refers to belief in reaching goals due to current conditions and life circumstances.

The aim of the study was to broaden understanding of maintained intervention-induced behavioral change by combining quantitative links with qualitative narratives. This aim was specified in two research questions:

**RQ1:** Do intervention participants' levels of goal expectancy, efficacy, and motivation predict intervention-induced immediate and maintained behavioral change?

**RQ2:** How do intervention participants' perceptions describe their goal expectancy, efficacy, motivation, and goals in relation to intervention-induced immediate and maintained behavioral change?

### ***Method***

The three-month intervention included a \$ 650 entrance fee. Voluntary participants for the study were recruited at the first session of the intervention. Participants were asked to answer questionnaires on motivation, expectations, goals, and behavior at three time points: The first day of the intervention; the final day of the intervention; and six months after the intervention. Body measurement data taken by the personal trainers, with informed consent to share with the researchers, was collected at the same three time points. Additionally, pre-interviews and follow-up interviews were conducted. Single-item scales were used as much as possible to reduce participation fatigue. The validity of single-item measures has been shown to be satisfactory in general (Bergkvist and Rossiter, 2007), and in particular for self-efficacy (e.g., Hoepfner et al., 2011), expectations (e.g., Wanous et al., 1997), and motivation (e.g., Markland and Hardy, 1997).

To answer RQ1, correlational analysis was conducted to clarify the relationship between levels of expectations and motivation, as well as their relationship with immediate and maintained behavioral change. An independent sample Mann Whitney U-test was conducted to investigate which, if any, type of goal achievement (such as physical activity, eating behavior, or weight) was associated with maintained change.

To answer RQ2, pre-interviews were thematized with thematic analysis (Braun and Clarke, 2006) using the qualitative software Nvivo (version 12.2.0.443) to identify especially interesting content, describe patterns, noteworthy parts of the data and capture the essence of distinctions in discussion between themes. Follow-up interview analyses were conducted in the same thematic manner as pre-interviews. These analyses revealed subthemes on the most prominent matters properly representing the data set, in line with the aim of increasing understanding of individuals' intervention processes.

### ***Main findings***

In answering RQ1, the correlational analysis indicates that levels of goal expectancy, efficacy, and motivation were strongly related. However, these factors did not correlate with any other of the later measured factors (motivation type, goal achievement, BMI change or maintained change). Higher immediate BMI change (weight-loss) was associated with experiencing higher goal achievement. Motivation type and goal achievement correlated, as well as goal achievement and maintained change.

The Mann-Whitney U-test showed a significantly higher level ( $U=98.5$ ,  $p=0.036$ ) of physical activity goal achievement for follow-up respondents, as compared to participants who did not respond to follow-up. Results for eating behavior goal achievement, weight goal achievement, and other goal achievements were not

significant, although they all represented the same trend of follow-up participants reporting higher levels than those who did not respond.

In answering RQ2, the thematic analysis of pre-interviews refined and condensed into two main themes of *enabling talk* and *disabling talk*. There were also six conditions forming sub-themes: Target (reported reasons/targets for participating in the intervention); physical activity (attitude toward physical activity); change approach (attitude toward changing); self-talk (what the inner voice says); motives (reasons for wanting change); and future (plans for behavior maintenance). The disabling talk theme was characterized by vagueness, problems and/or negativity, flavoured by *why I will fail* in each sub-theme. An overall example quote of disabling talk is: *I don't think I will lose that much [weight] within 3 months*. The enabling talk theme was characterized by determination, power and/or structure, flavoured by *why I will succeed* in each sub-theme. An overall example quote of enabling talk is: *It's me who changed. It's me who has will and drive to make sure it will be a change*.

Thematic analyses of follow-up interviews resulted in six key factors for maintained intervention-induced behavior: Not cheating during the intervention; savoring positive gains with the new behaviors; seeing change as a determination; enjoying physical activity; using the intervention-induced impact as continuous motivation; and planning for physical activity and eating.

Integrated results further showed that quantitative pre-measurements do not explain immediate or maintained change because they do not capture actual motivation, goal expectancy and efficacy, rather wishes for desired outcomes. The integrated results from quantitative and qualitative data also showed that focusing on enabling talk, including self-talk, as well as positive experiences during the intervention and attainable behavior goals is preferred for maintained intervention-induced behavior, in favor of focusing on motivation-, goal expectancy-, and efficacy levels.

In other words, the levels of motivation, goal expectancy and efficacy were investigated in relation to maintained behavioral change. They neither predicted intervention-induced maintained change nor correlated with any other measures of motivation type, goal achievement, BMI change, or maintained behavioral change. However, interpreting the quantitative data together with qualitative narrative data broadened the understanding of a potential cause for reported high levels not being congruent with later quantitative measures. Participants displaying enabling talk expressed motivation for behavioral change (such as physical activity), while participants displaying disabling talk expressed motivation for receiving outcomes (weight loss), rather than behavioral change. Participants with enabling talk also had a specific target and a positive attitude toward physical activity, saw change as a determination issue, engaged in positive self-talk, focused on gains, and planned for the future. In comparison, participants with disabling talk had difficulty in defining a clear target, expressed a dislike of physical

activity, focused on problems related to behavioral change, expressed recurring talk about negative thoughts, used an avoidance approach, and expressed doubt about maintaining change. The content in pre-interviews can help increase understanding of how participants maintaining intervention-induced behavior resonate before the intervention, since maintained behavior was associated with enabling talk, while disabling talk was not.

We can compare the result of physical activity goal achievement being significant for maintained behavior to the objective measure of BMI change, which was not significant for maintained change. These results suggest that the experience of achieving behavior (physical activity) goals is more important for maintained behavior than actual weight loss. Participants with behavior goals seemed to truly enjoy the behavior and experience progress in terms of behavior rather than reaching outcome goals. The latter implying that they could quit the behavior that caused the outcome.

### **Ethical considerations**

In 2019, department colleagues submitted ethics applications on two different occasions for studies that are part of the same larger-scale research project as Study I in this thesis (The Swedish Ethical Review Authority diary number: 2019-00561). The Swedish Ethical Review Authority determined that the studies did not require examination by the Swedish Ethical Review Authority because the studies did not make interventions on participants, as specified in Section 4 of The Ethics Review Act, and did not process personal data, as specified in Section 3 of the same Act.

The Swedish Ethical Review Authority strengthened the regulations for ethical approval on Jan. 1, 2020. However, data collected for the studies included in this thesis was done prior to this date, and before GDPR was adopted in Sweden. Therefore, legislation concerning privacy and security was regulated by the Swedish PUL at the time of data collection.

Nevertheless, data collection for all included studies was done with caution and respect for ethics and integrity. Throughout the studies, we used voluntary authorization with full comprehension of the research project procedures and the ability to terminate participation at any time without negative consequences or questioning. All participants in the studies included in this thesis gave their informed consent to voluntarily participate in the studies and signed consent forms.

## **5. DISCUSSION**

The overall aim of this thesis was to broaden our understanding of psychological mechanisms involved in health- and lifestyle-related intervention-induced behavioral

changes and maintenance, in order to suggest potential improvements for intervention initiators and participants.

This chapter is arranged in accordance with the relationships of aspects of the intervention process (see Figure 3), drawn on the map of intervention-induced behavioral change, relating timeline and intervention phases, psychological mechanisms, behavior (change) and outcomes (compare with Figure 1) to previous research. The timeline starts with pre-intervention phase, followed by intervention phase and then post-intervention phase. The content covers psychological mechanisms from motives to join the intervention, pre-intervention mechanisms, intervention experiences, and immediate and maintained behavior and outcomes (see Figure 3 for an overview).

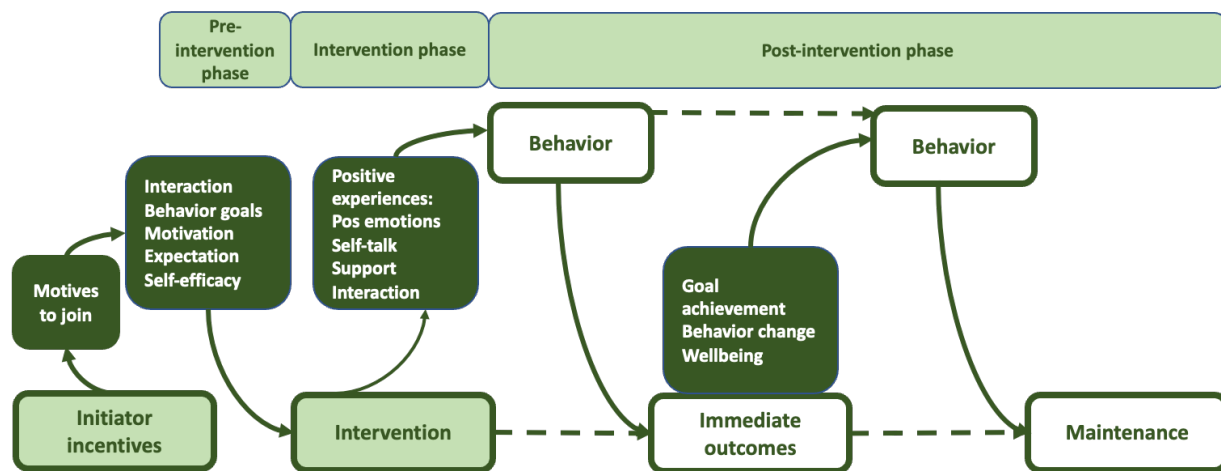


Figure 3. Thesis relationships overview

### **Pre-intervention phase**

This section presents study results related to the pre-intervention phase, including effective motives to participate, types of motivation, and type of goals.

Results from Study I indicate that pre-intervention motives other than the most selling- and outcome-focused motives may be related to immediate behavioral change. These results suggest that initiators should consider their desired target group when designing an intervention. The choice of target group refers to the question raised in the background intervention chapter: Is the initiator's aim to recruit as many participants as possible, regardless of behavioral change success rate; or is it to recruit fewer participants with a potentially higher rate of successful change. A possible reason for choosing the first alternative could be a primary focus on publicity, and simply aiming to reach as many as possible, rather than actually aspiring for participants to adopt an intervention behavior. When initiators are clear about their standpoint regarding target

group, the degree of voluntariness and incentives to use should be considered. Therefore, if the desire is to attract participants with a higher success rate, true motives with activity messages (that is, behavior goals), as in Study III, might be more efficient than motives equal to outcome goals/rewards, as in Study I. In line with Michie and Johnston (2012), all included studies in this thesis indicate that, for successful immediate and maintained behavioral change, the goal (and end-point of intervention) must be behavioral change rather than a consequence of a behavioral change (such as wealth, weight change, and wellbeing). The importance of separating aspiration of behavior and aspiration of outcome is demonstrated in various ways in the included studies. As just previously mentioned, Study I demonstrates that behavior-focused rather than outcome-focused participation motives may be related to immediate behavioral change. In Study II, the importance of separating aspiration of behavior and aspiration of outcome is highlighted by participants' unawareness of outcome desire overtaking behavioral change desire (as addressed in the pre-intervention phase section in the thesis introduction). Likewise, Study III results display the importance of true behavior goals in favor of goals equal to consequences of behavior. Knowledge gained from the mixed methods approach in Study III can be utilized when interpreting findings from Study III as well as Study II. The following section describes in greater detail these findings, interpretations and links between Study II and Study III results.

Study III showed that high pre-intervention levels of efficacy, goal expectancy, and motivation were not enough to predict maintained behavior. The need for authenticity and true intrinsic motivation for behavioral change was more important. This resonates with the autonomy perspective of SDT, pronouncing the need to act from true values to perform successfully and for psychological health (Deci and Ryan, 2008). The baseline interviews revealed a probable explanation to the lack of correlations between reported pre-intervention levels and behavioral change. That is: On direct level-focused questions pre-intervention, participant reports were generally high on motivation, goal expectancy, and efficacy levels. However, when analyzing interview data, participant talk about motives, goals, expectations and the future revealed a more descriptive picture of their authentic attitude, motivation and goals, not congruent to such overall high levels. Instead, participants reporting maintained behavior exposed baseline-talk congruent with high levels of pre-measurements, flavored with why they would succeed, while participants not answering follow-up revealed base-line talk flavored by why they would fail, obviously not compliant with high levels of motivation or expectations. Consequently, for participants reporting high motivation level but not maintained behavior, high level of motivation and expectations were plausibly associated with an (unaware) aspiration for outcome, rather than actual motivation for behavioral change.

It is reasonable to make a similar interpretation for the moderation result in Study II, in which the relationship between motivation and wellbeing during the intervention was moderated by expectancy. The more intrinsically motivated the participants saw themselves, the more wellbeing they reported experiencing, provided that their expectancy was high. With the findings from Study III in hand, a reasonable interpretation for the moderation in Study II is: for participants' reporting lower levels of expectancy and high levels of intrinsic motivation, authentic motivation may actually not be intrinsic for behavioral change, but rather for receiving desired outcomes. By contrast, authentic intrinsic motivation to change behavior apply for participants reporting high levels of expectancy and high levels of intrinsic motivation. These interpretations are in line with previous research emphasizing the importance of desiring to adopt a certain behavior rather than receiving pleasant consequences of behavior (Michie and Johnston, 2012). Additional results supporting these interpretations are the results from Study III showing that behavior goal achievement (of physical activity) was more important for maintained behavior than achieving outcome goals in terms of reduced BMI. In sum, caution needs to be taken into account regarding potential unawareness of outcome goals overriding behavioral change goals.

### ***Intervention phase***

This section presents study results related to the intervention phase including different kinds of positive experiences during the intervention influencing performance of target behavior.

All of the studies included in this thesis imply that (positive) experiences during the intervention-phase are important for (success in) immediate and maintained intervention-induced behavior. Positive experiences during the intervention generate positive emotions. Positive emotions are important for maintaining behavior since they evoke a drive to maintain engagement in the behavior generating those experiences (Fredrickson, 2004). Study II indicates that wellbeing during the intervention is associated with maintained behavior, which can be described by positive emotions being part of wellbeing. Social support is a source of positive emotions (Yang et al., 2016), strengthening adherence and upholding commitment to the target behavior (Nizamani et al., 2022), which explains its significance for behavioral-change interventions. Study I results imply that experiencing social support during the intervention is associated with immediate behavioral change, which is backed up by results from Study III showing that experiencing social support during the intervention is linked to maintained behavior. These results are in line with previous research highlighting the importance of social support (see for instance Mendonça et al., 2014).

Study II highlights the importance of setting fun, achievable behavior goals, rather than outcome goals for the adoption and maintenance of wellbeing activities. This is in line with a recent study by Blicher-Hansen et al. (2022) which argue that experiencing immediate outcome gains and positive emotions from achieving milestone goals promotes repeat engagement, while aspects such as pleasure and social support are central for maintaining (physical activity) behavior. Goal achievement is thus another positive experience during the intervention phase that influences maintenance positively (Samdal et al., 2017; Teixeira et al., 2015). Additional previous research supports these results, arguing that experiencing goal achievement (such as physical activity duration) is important in early stages of behavior adoption, which is due to the experience of success, even if outcome gains (such as weight loss) are missing (Rhodes, 2017). In line with this research is Study III results, showing that, even when outcome goals were achieved *de facto*, the importance of achieving physical activity goals was still greater. In other words, the power of experiencing achievement of behavior goals is stated in Study III results showing physical activity goal achievement exceeding BMI change achievement, in importance for maintained behavior.

In previous research, Goal Setting Theory (GST) (Locke and Latham, 1990) has typically been used to explain both how goals lead to results and how to manage interventions. In early stages of GST, specific, challenging performance goals were argued to be the most efficient for performance. The theory has developed further since then, suggesting that using the theory as it was used in the 1990s might be harmful (Locke and Latham, 2015; Swann et al., 2021). A recent review on GST in physical activity promotion (Swann et al., 2021) highlighted detrimental effects of setting specific challenging performance goals. Swann et al. (2021) found that psychological factors, such as negative emotions and damaged self-efficacy, could harm the maintenance of a behavior. They argued that when aiming to start a complex new behavior, such as physical activity, learning goals are appropriate. Once the behavior is learned, process goals are better for maintenance of the behavior. Process goals are explained as a focus on achieving or improving performance (compared to learning new skills or knowledge) (Swann et al., 2021), which resemble behavior goals, as highlighted in the results from the studies included in this thesis. This means, different phases of the intervention process demand different types of approaches and goals. Before the intervention starts, and at the beginning, learning goals are advantageous. When the behavior is learned, goals need to shift to be more about processes. In line with previous research (Rothman et al., 2011), combined results from this thesis highlight the benefits of dividing the intervention process into phases to better meet current conditions with appropriate response. This will be further discussed in the next section.

### ***Post-intervention phase***

This section presents study results related to the post-intervention phase, which means maintaining intervention-induced behavioral change.

As just previously mentioned there is a need to set appropriate goals, in accordance with current intervention phase. Similarly, there is a need to recognize other shifting conditions throughout the phases. Since psychological mechanisms that are active during the intervention process may shift between phases, they demand flexible responses (Rothman et al., 2011). This means that a determinant of behavior in initial phases of the intervention process can lead to dissimilar consequences in later phases of behavior maintenance. For example, high expectations on self usually generate a drive to initiate a behavior and receive immediate outcomes (Bandura, 1997), as seen in Study I. However, if the same high expectations are not met during later phases, they can transform into dissatisfaction or disappointment, thus undermining behavior maintenance (Rothman et al., 2011). Similarly, motives that lead people to make initial changes seem to be different from those that maintain behavior. Therefore, it may be more appropriate to focus on behavior enjoyment and satisfaction with outcomes, rather than on initial motives (Kwasnicka et al., 2016). When the ability is proved (and self-regulatory strength is adequate) to manage a target behavior, maintenance is no longer about self-efficacy, but rather about desire to maintain the behavior, which is associated with satisfaction with the target behavior (Rothman et al., 2011). Results of the studies in this thesis underline the importance of awareness of predictors' changing effect on behavior and the need for an appropriate approach in different phases of the intervention process. Consequently, applying a flexible approach can improve flexibility in participants' internal processes, and approaching psychological mechanisms flexibly through different phases (with awareness of same mechanism's potentially different effect in different phases) increases the chances of maintained behavior.

Important aspects of flexibility for maintained behavior are the need to have shorter shifts between the reflective and reactive processes (Dunton et al., 2021), as well as the need to have temporary shifts in duration and frequency when changing behavior (Wilbur et al., 2005). The core of a flexible approach can be explained with inspiration from the results in Study III, which imply that enabling talk, including positive self-talk, is prominent for those succeeding in maintained behavior. The link between positive self-talk and successful performance is clear in sports psychology (Fritsch et al., 2022), and can be used together with the combined results of this thesis to understand more about maintained intervention-induced behavior. Self-talk interventions have been used to build flexibility in maneuvering upcoming hurdles and situations. In these interventions, learning or enhancing flexibility is central in improving abilities associated with several aspects of behavioral change. A recent review (Fritsch et al., 2022) suggests using reflexive self-talk intervention to enhance self-regulatory skills.

Through identification of spontaneous self-talk, psychological challenges and typical reactions may be recognized and form the basis for an improved and more flexible self-talk process. Accordingly, results of this thesis suggest that a flexible approach should be utilized throughout the phases of the intervention process. As an example, the most advantageous approach for improving self-talk is working to provide greater flexibility in self-talk content and context of cue words, rather than using pre-determined words and situations (Hatzigeorgiadis, 2011). A flexible approach aims to bring awareness to automatic and emotional thoughts to replace dysfunctional processes with more functional ones, as well as help in responding to psychological processes more non-reactively and non-judgmentally (Fritsch et al., 2022). The flexible self-talk intervention resembles a similar approach throughout the phases of the behavioral-change intervention process as suggested in this thesis.

Therefore, dividing the process into phases and approach them with a flexible approach from their fluctuating conditions is a way to increase understanding of maintained intervention-induced behavior. This means, awareness of both internal sources (such as energy and motivation) and external circumstances (such as context and life events) naturally shift through life and between individuals, which require shifts in responses for keeping up maintenance (Rhodes and Sui, 2021; Dunton et al., 2021). By emphasizing these issues, I hope to broaden understanding of intervention-induced behavior maintenance, in order to enable improvement in future initiation and participation.

To reconnect to the beginning of this thesis, I started by introducing the three health- and lifestyle-related topics centered in this thesis, and different viewpoints in approaching them. The fact that behavioral change initially is about learning is probably beyond reasonable doubt. The learning perspective of behavioral change (Ramnerö and Törneke, 2006) related to this thesis highlights important aspects in all intervention phases:

- The importance of setting goals for learning behaviors, rather than receiving outcomes in the pre-intervention phase
- The importance of reinforcing the target behavior and embracing positive experiences of both immediate and delayed outcomes related to target behavior during the intervention phase
- The importance of planning for maintained behavior by learning to identify potential risks and preparing actions for upcoming hurdles in the post-intervention phase

Focus in this thesis is on dividing the intervention process into phases, rather than dividing the change process into stages (as in the trans-theoretical model [Prochaska and Velicer, 1997]). However, these models resemble a desire to match intervention

actions with participants' individual needs to be utilized for enabling an individualized and optimized behavioral change process. This is done by pro-active recruitment, interactivity during the intervention process, including individualized and flexible responses. Finally, approaching individual behavioral change with local and global symbiosis and interdependency in mind (Dustin et al., 2010), this thesis may be a little piece to more effectively transforming behaviors, cooperatively, and contribute to a better world.

### **Limitations and future research**

In addition to being aware of shifts through the phases, and being flexible in meeting them, this thesis' results indicate that participant involvement and interaction in planning and tracking intervention activities is important for maintained behavior. Previous research on interventions has suggested that involvement is a key to successful initiation, adoption, and maintenance of intervention-induced behavior in terms of, for example, mental health intervention (King et al., 2014). With several included levels of participant involvement, Study I contributes from the perspective of non-existing interaction or guidance in planning or monitoring, and no support during the intervention. In comparison, Studies II and III provide different levels of supervisory guidance, monitoring and support, as well as peer support. The results of Study II include several reasonable implications of participant interaction in the pre-intervention and intervention phase. Cultivating expectations, knowledge, skills, and true intrinsic motivation may start in the pre-intervention phase, develop during the intervention phase, and continue post-intervention in forming maintained behavior. Therefore, interaction can form a basis of learning to be active in one's own progress, act upon one's own initiative and find enjoyable twists on desired behavior activities, which contribute to learning how to design, plan, and act for maintenance. Positive effects of the active nature of interaction are related to the discussion on behavior goals versus outcome goals. Behavior goals are active and accentuate continuous movement, while outcome goals are stationary end results, which tend to emphasize passivity. However, further research is needed on participant interaction in the various phases of the intervention process.

A limitation of field studies is the limited generalizability among populations, including aggravating circumstances for research in terms of the natural environment and non-manipulated conditions (Schmuckler, 2001). These conditions bring reduced control over variables, such as age span and participant amount, in all of the studies included in this thesis, and caused different samples for quantitative and qualitative aspects in Study III. On the other hand, the field study nature of non-manipulated real-life settings generates beneficial ecological validity, which brings better generalizability among real-life settings (Schmuckler, 2001). Therefore, utilizing knowledge from this thesis makes

it possible to suggest potentiality for future interventions and maintained intervention-induced behavior.

This thesis is about relationships, rather than causality, and about helping individuals make desired behavioral changes, rather than persuading people to change. However, results from this thesis in combination with previous research can help make realistic interpretations on effects and can be utilized by individuals as well as professionals to shape and realize attractive and effective interventions for behavioral change.

Diversity in the included studies' characteristics can be seen as a limitation for replicability. However, the reason for choosing more diverse intervention characteristics is due to the advantage of perspectives they bring to the understanding of individuals' intervention processes. For the same reason, different methodologies are included, that is, quantitative approach and mixed methods approach. A potential disadvantage in Study I is the lack of follow-up and maintenance measures, as compared to Studies II and III, which did include follow-up measurements. However, Study I contributes to knowledge on early-stage motives to participate in an intervention and addresses commonly used promotion motives in comparison with motives associated with immediate behavioral change. Obviously, without behavioral change during the intervention, behavior maintenance is not an issue, so Study I brings knowledge about matters that are appropriate for intervention initiators to consider before setting up an intervention. Also, the free-ticket-incentive type of intervention in Study I, in contrast to the mandatory intervention in Study II and fee-based intervention in Study III, generates a multi perspective of voluntariness degree and pull measures, which is useful for development of interventions.

Finally, the follow-up in Study III were unannounced to avoid influencing participants to continue the intervention-induced behavior, in favor of investigating true volitional behavior maintenance. This probably generated a lower rate of maintained behavior, as compared to a pre-announced follow-up. It would be interesting for future research to investigate functional ways of helping participants maintain behavior, including announced follow-ups. For future research that aims to further broaden our understanding of maintained intervention-induced behavior, it would be exciting to investigate aspects of participant interaction through the intervention phases, and further investigate learning to apply a flexible approach. Perhaps such future research can include developing modern technology solutions for possibility to digitally support maintained intervention-induced change.

## **Conclusions**

I close this thesis by summarizing its key content, to increase understanding of maintained intervention-induced behaviors and suggest potential development for intervention initiators and participants to consider in each intervention phase.

In sum, participating in an intervention with true aspiration of changing behavior, rather than receiving outcomes, is important for maintained behavior. During the intervention, it is advantageous to pay attention to positive experiences, in terms of gains from immediate outcomes, achieving behavior goals/milestones, positive emotions engendered by the target behavior, social support and enabling self-talk. After the intervention, continuing to enjoy gains from the target behavior and continuing to work in accordance with a plan for maintained behavior are beneficial. Overall, active participants throughout the intervention phases is advantageous, where activeness include learning to apply a flexible approach that meets shifting conditions.

### ***Practical implications***

As final concluding remarks, I present some key take-away points in each phase, for intervention initiators and intervention participants respectively. For intervention initiators who want participants to succeed in maintaining an intervention-induced behavior, see Table 2.

*Table 2. Recommendations for initiators*

<b>Recommendation</b>	<b>Pre</b>	<b>During</b>	<b>Post</b>
Considering intervention set-up (mandatory vs. voluntary participation, pre-determined vs. free choices)	x		
Considering degree of participant interaction (planning, monitoring)	x		
Dividing the intervention process into phases and help approaching them, in accordance with prevailing circumstances	x		
Offering professional and social support and guidance	x	x	x
Boosting belief in one's own ability to adopt the target behavior and belief in the intervention's effectiveness	x	x	x
Supporting specific and fun behavior goals	x	x	x
Contributing to generating positive experiences	x	x	x

For intervention participants who want to succeed in maintaining behavior, see Table 3.

*Table 3. Recommendations for participants*

<b>Recommendation</b>	<b>Pre</b>	<b>During</b>	<b>Post</b>
Participating with the main aim of adopting a certain behavior, rather than receiving a certain outcome	x		
Setting specific, fun, behavior goals, including milestones	x		
Plan how to reach goals and keeping journal of the behavior process	x	x	x
Studying research about the target behavior, change process, and other sources that can boost trust in own ability and the change process	x	x	x
Engendering authentic motivation for target behavior and finding truly enjoyable ways to engage in it	x	x	x
Planning for the future	x	x	x
Involving significant others in the process	x	x	x
Generating positive experiences associated with target behavior and focusing on gains	x	x	x
Developing ability to meet shifting internal and external conditions with a flexible approach	x	x	x

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## Positive change for wellbeing

Lifestyle behaviors such as increased private car use, stress, low physical activity, and unhealthy eating negatively affect individual and global health, environment and economy. We must change, not only to decrease suffering and economical costs, but to promote wellbeing for flourishing human beings on a living planet. It is not simple to change ingrained behaviors, but the success rate for behavior change interventions is high, yet not automatically lasting. Despite growing harm and that brief change generates brief effects, research on maintained intervention-induced behavior is scarce. Due to this research gap, this thesis aims to broaden understanding of psychological mechanisms involved in maintained lifestyle-related intervention-induced behavior and suggest potential development for initiators and participants. This aim is approached through three field studies involving travel behavior, wellbeing activities, physical activity and healthy eating.

For maintained intervention-induced behavior change, the main findings imply the importance of: Focusing on behavior goals; undergoing positive experiences during an intervention; experiencing gains from immediate outcomes; and learning to apply a flexible approach meeting shifting conditions throughout the intervention phases.

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