

General Discussion



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6.1. Summary

This thesis aimed at evaluating health behaviour change factors as derived from the Health Action Process Approach (HAPA; Schwarzer, 1992; Schwarzer et al., in press) and at providing evidence for the stage assumptions in the HAPA, for the first time in the context of oral-self care behaviours.

The focus was on the differential conditions under which especially action planning and coping planning (Sniechotta, Schwarzer, Scholz, & Schüz, 2005) and action control in the sense of negative feedback loops (Carver & Scheier, 1998; Miller, Galanter, & Pribram, 1960) work best. This was examined relying on the stage assumptions of the HAPA, which differentiates a motivational, an intentional and an actional stage. These stages can be further subsumed under two meta-stages, the motivational and volitional stage. These meta-stages are derived from the idea that with deciding in favour of a specific behaviour, the focus of attention changes from information related to making an informed decision to information and factors related to initiating and maintaining behaviour changes (Gollwitzer, Heckhausen, & Steller, 1990; Heckhausen & Gollwitzer, 1987).

The behavioural context for the studies in this thesis was oral self-care behaviour, specifically the regular application of dental floss. Although the regular, at best daily use of dental floss is recommended by all major dental associations (ADA, 2005; BDA, n.d.; DGZMK, n.d.) and by many dentists, actual prevalence in Germany as well as most industrialised countries is fairly low (Bader, 1998; Staehle, 2004). These data and former studies examining psychological predictors of dental flossing behaviour (McCaul, O'Neill, & Glasgow, 1988; Rise, Åstrøm, & Sutton, 1998; Stewart, Strack, & Graves, 1999) indicate that dental flossing poses challenges to self-regulation not covered by instruction and information alone.

Three studies with differing samples (university students, a convenience sample of visitors at an university open day, and a population of Berlin dental patients) and different research designs (longitudinal prediction studies and a RCT) were conducted in order to examine the role of postintentional factors and the abovementioned two/three stages of behaviour change in describing and facilitating health behaviour change.

The main findings of this thesis are summarised in Table 6.1.

| Chapter | Aims | Findings | Conclusions |
|---------|--|--|--|
| 2 | To examine the predictive validity of the action and coping planning scale for the adherence to a daily dental flossing regime over and above intentions, outcome expectations, self-efficacy and risk perception | Planning emerged as the only predictor of adherence to a daily flossing regimen eight weeks after baseline in logistic regression analysis when controlling for Time 1 flossing. Motivational predictors including intentions were not significant. | Planning helps in establishing a daily flossing regimen. Above that, it helps in increasing dental flossing frequency. |
| 3 | To examine stage-specific prediction patterns in predicting dental flossing behaviour in motivational and volitional individuals with intentions and individual change scores in action control after receiving an action control intervention | Residualised change scores as indicators of the effects of an action control intervention were predictive of increases in dental flossing in volitional participants only. Intentions predicted flossing increases in motivational participants. | Results support two qualitatively different stages of health behaviour change. Action control interventions are effective with regard to regular behaviour in volitional individuals, intentions in motivational individuals. |
| 4 | To identify stage-specific predictors of three stages of change as well as progression and regression from these stages with regard to dental flossing according to the assumptions of the HAPA with discriminant function analysis | Action planning and maintenance self-efficacy predicted stages cross-sectionally. Action planning predicted progression from the preintentional stage, coping planning and maintenance self-efficacy predicted progression and regression from the intentional stage, and maintenance self-efficacy predicted regression from the action stage | Results support three qualitatively different stages of health behaviour change. Action planning promotes stage progression for non-intenders, coping planning and maintenance self-efficacy for intenders and maintenance self-efficacy prevents from regression. |
| 5 | To investigate stage-specific effects of an action planning intervention on dental flossing behaviour in motivational and volitional participants within a RCT with three measurement points | Volitional participants profited more from the action planning condition than motivational ones. All participants profited from the planning intervention in terms of increased flossing frequency 2 and 6 weeks after baseline. | Results support two qualitatively different stages of health behaviour change. Providing information and floss samples promotes flossing in all participants. On top of that, volitional individuals profit from an action planning intervention. |

Table 6.1: Summary of the findings in the thesis

Chapter 2 confirmed the important role of planning in the process of establishing a regular health behaviour regimen. Planning, as measured with the action and coping planning scale (Sniehotta, Schwarzer, Scholz, & Schüz, 2005) adapted to dental flossing, emerged as the most important

predictor of adhering to daily flossing eight weeks after baseline while controlling for self-efficacy, risk perceptions, outcome expectancies and intentions. This finding was further underscored with a discriminant function analysis that found planning along with baseline behaviour as the only variables discriminating those who flossed daily from those who failed to do so.

The following three chapters examined the differentiation of two/three stages of change employing methods as proposed by Weinstein, Rothman and Sutton (1998) and Sutton (2000).

Chapter 3 tested whether individual residualised change scores in action control as indicators of the effectiveness of a self-monitoring calendar were predictive of changes in dental flossing behaviour, specifically if they were more predictive in volitional than in motivational participants. Action control has been identified as proximal predictor of behaviour and as a factor especially important in volitional individuals (Sniehotta, Scholz, & Schwarzer, 2005). The change scores were only predictive of behaviour change in volitional individuals, while intentions predicted behaviour change in motivational ones. This finding also speaks in favour of two qualitatively different stages of health behaviour change.

Chapter 4 examined whether transitions between the three stages of the HAPA could be predicted with stage-specific factors derived from evidence of prevailing theories of health behaviour. Action planning predicted progression from the preintention stage, coping planning and maintenance self-efficacy predicted progression and regression from the intention stage, and maintenance self-efficacy predicted regression from the action stage. These findings speak in favour of three stages of health behaviour change.

Chapter 5 finally employed a RCT with an action planning intervention as means to test the stage assumptions of the HAPA. Individuals in the motivational and volitional stage were randomly assigned to a control condition receiving floss samples as well as flossing instructions and an action planning condition receiving an action planning intervention on top. This condition was designed as being matched to the volitional stage and mismatched to the motivational stage. Results confirmed the assumption of two qualitatively different stages: Volitional participants profited more from the action planning intervention than motivational participants in terms of dental flossing frequency.

This discussion will integrate the findings of this thesis into a general perspective on health behaviour change: Aspects of the discussions of the different chapters, which could not be fully elaborated on, will be integrated. I will further outline some more general considerations on working mechanisms of planning and action control in health behaviour self-regulation by integrating findings from the chapters in the thesis and related findings from the literature. Further, the implications of the studies in this thesis for the conceptualisation of behaviour change processes as progressing through stages will be elaborated on, with a special emphasis on common-

alities of current stage approaches. This will be followed by some critical reflections on strengths and weaknesses of the studies conducted in this thesis. At the end, I will develop some implications for further research from the background of this thesis.

6.2. Action planning and coping planning in health behaviour change

6.2.1. Operationalisation of action planning and coping planning

Chapters 2 and 4 examined the role of action planning and coping planning in health behaviour change, chapter 5 was restricted to action planning.

Although “planning” refers to the same cognitive act of prospectively linking behaviour to situational cues, the operationalisation differs fundamentally across the chapters: While chapters 2 and 4 follow a psychometric approach, i.e. interindividual differences in self-induced and self-regulated planning activities were set in relation to interindividual differences in the dependent variables, chapter 5 experimentally induced action planning processes with an interviewer-based action planning intervention.

The individual, non-manipulated levels of planning measured in Chapters 2 and 4 could also be examining planning processes reflecting concurrent behaviour, a disposition to plan health behaviour in advance or interindividual differences in self-regulatory competencies. In Chapter 2, Time 1 flossing is controlled for in the prediction of Time 3 flossing adherence. This ensures that possible interindividual differences in the predictivity of planning are not due to baseline differences in behaviour. It could well be that those who have higher levels of flossing at baseline also report higher planning levels, because these plans reflect their concurrent behaviour.

In the study in chapter 5, action planning was manipulated experimentally, i.e. participants in the planning condition were asked by trained interviewers to formulate plans and to vividly imagine themselves flossing in the specified situations. With this procedure, participants not yet flossing and not thinking about flossing were also forced to formulate an action plan.

Chapter 4 used individual action and coping planning levels to predict stage transitions between three stages of change. Here again, it might be that individual flossing habits are reflected in the planning levels at baseline. In this study, it was necessary to use baseline levels of planning as predictors, because data from only two measurement points were available.

6.2.2. Working mechanisms of planning

The act of prospectively linking behavioural outcomes to specific situational properties is structured by an if-condition linked to a then-component: If situation x (denominated by information on time and place) is entered, then action y (denominated by modal information on the behav-

avioural component) is performed. This if-then-structure is the same for action plans and coping plans (Schüz & Renneberg, 2006). If-then-plans following this structure have in a multitude of studies proven to be important factors in health behaviour change (Gollwitzer & Sheeran, 2006). It is supposed that forming action plans facilitates behaviour initiation, because the links between situational cues and behavioural responses improve the detection of good opportunities to act, prevent from forgetting behavioural intentions and prioritise intended behaviour over possible conflicting behavioural tendencies (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Good opportunities are more reliably identified, because cue discrimination in situations with these good opportunities is enhanced.

It has also been argued that the act of linking behavioural responses to situational cues leads to automated behaviour enactment, thus overcoming possible self-regulatory problems (Gollwitzer, 1999). Automatisation in this context means that the control over behaviour can “strategically [be switched] from conscious and effortful control of [...] goal-directed behaviours [...] to being automatically controlled by situational cues” (Gollwitzer, 1999; p. 495). Support for this assumption stems from research in groups with assumed limited self-regulatory capacities or strong cognitive distractions such as drug addicts on withdrawal and schizophrenic psychiatric in-patients (Gollwitzer & Brandstätter, 1997). These findings suggest that the cognitive links created with formulating if-then plans are strong, and it might be sufficient to stimulate this link in order to trigger the intended behavioural response.

For coping planning, the mnemonic and attentual mechanisms are thought to work along the same pathways (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Prospectively planning behavioural responses to situations with the potential for self-regulation problems increases the likelihood that in the critical situation an intention-conform behavioural response is triggered rather than not acting at all. In this thesis, chapter 4 provides some support for this important lapse-preventing effect of coping planning: Participants scoring low on coping planning were more likely to regress to the preintention stage than those with higher coping planning levels.

In the following, I will present research findings and some theorising on the working mechanisms and mediating processes of the effects of planning on goal attainment.

In a recent study, Webb & Sheeran (2007) provided evidence that at least with regard to laboratory task solving, the mediating processes of the effectiveness of if-then plans are better detection of good opportunities to act and faster triggering of specified behaviour: They examined whether forming if-then plans increased the accessibility of situational cues specified in the *if*-condition of a plan, and whether it strengthened the links between these situational cues and the behavioural response outlined in the *then*-component. It was then examined whether changes in these two

process components mediated the effects of if-then plans on behavioural performance in a puzzle task.

Another possible working mechanism of if-then plans relates to their motivational structure. Making if-then plans has strong resemblances to creating positive possible selves (Markus & Nurius, 1986). Possible selves are future-oriented self-images describing possible outcomes of a person's development. Possible selves are, according to Markus and Nurius, very concrete vivid imaginings of the individual in a future situation, as such comparable to daydreams. It is assumed that this concrete image of the person is the main motivational property of possible selves. This concrete imagination of the person in a goal state (behaviour) makes possible selves very similar to if-then plans. The way in which possible selves influence motivation for behaviour depends on the way in which they are evaluated. Negatively evaluated selves engage avoidance motivational systems, whereas positively evaluated selves engage an approach motivational system to promote their realisation. This might also relate to if-then plans: If the goal state in an if-then-plan is evaluated positively, then the individual will be more motivated to act in order to be maximal similar to the possible self specified in the if-then-plan. In the experimental manipulation of planning in this thesis (Chapter 5), participants were asked to vividly imagine themselves performing goal behaviour. This represents a positively evaluated possible self, which according to possible selves theory serves as a motivational incentive fostering behaviour enactment.

In Personality Systems Interaction Theory (PSI Theory; Kuhl, 2001), it is assumed that positive affect (conscious or unconscious) facilitates intuitive behaviour regulation. Intuitive behaviour regulation refers to acting without strong conscious effort. If affect is managed (e.g., by imagining successfully accomplishing behavioural goals in an if-then-plan), this leads, according to PSI theory, to increased likelihood of acting according to intentions.

Although there are no psychophysiological studies on the working mechanisms and cerebral locations of planning processes, there are conceptually related findings from EEG studies on event-related potentials for the working mechanism of tailoring interventions to participants' characteristics (Ruiter, Kessels, Jansma, & Brug, 2006). In this study, participants receiving a tailored nutrition message were compared to participants receiving an unspecific nutritional message with regard to reaction time in an unrelated task and N 100 and P 300 event-related potentials. Longer reaction time, larger N 100 and smaller P 300 amplitudes in the tailored group for the unrelated task indicate that more attention is being allocated to the tailored health message, thus processing this information more thoroughly. How does that relate to if-then planning? Tailoring in this context refers to taking into account individual characteristics of the participant and including these into feedback in a personalised health message. Among other characteristics of tailored health messages, this would mean that participants are addressed by their names, that situations

and behaviours specified by participants are referred to, and that the contents of messages are designed according to the individual levels of critical variables (Dijkstra, 2005). By asking participants to formulate specific individual if-then plans which take into account their subjective environment, and especially by asking them to vividly imagine themselves in these situations, the main characteristics of tailored feedback according to Dijkstra (2005) and Ruiter et al. (2006) are fulfilled. Feedback is given on individual characteristics by referring to the circumstances in the plan, and asking participants to imagine themselves in the respective situations immerses this feedback. Thus, there are some structural similarities between tailored health messages and planning interventions, which suggest transferring the findings from Ruiter et al. to the planning context.

6.2.3. Moderators of planning-behaviour relations

Intention

If-then planning has been conceptualised as being subordinate to goal intentions (Gollwitzer, 1999). According to this view, action plans and coping plans furnish goal intentions with small identifiable steps which – taken together – serve to accomplish the goal intentions. For example, an if-then plan like “When the late news are on, I will floss my teeth in front of the TV” will increase the probability that the person will indeed floss in front of the TV during the late news. Repeated accomplishments like this increase the probability that the goal intention (e.g., “I intend to floss daily”) is fulfilled. Taken further, if-then plans would make no sense without goal intentions, because the superordinate goal would be missing. Such concrete plans for the execution of behaviour to reach a certain goal would not work, if the goal itself was not intended. For example, making concrete plans on where and when to floss are unlikely to increase flossing likelihood, if the person making this plan is not intending to floss. Several studies provide evidence for this argument: It has been demonstrated that implementation intentions facilitated goal attainment only in participants with high goal intentions (Sheeran, Webb, & Gollwitzer, 2005) and that the degree to which planning mediates between intentions and behaviour is dependent on intention levels (Norman & Conner, 2005). If planning is considered the construction of a positive possible self (Markus & Nurius, 1986), the dependence of planning on superordinate intentions is even more obvious: The imagination of oneself in the target situation of an if-then plan can only be positively evaluated, if the goal itself is positively evaluated and wanted, i.e. intended.

Statistically, this would represent an interaction between goal intentions and planning (if planning was assessed psychometrically) or the moderation of the effect of planning by intentions or stage (if planning was induced experimentally). Within this thesis, one study partially supports this as-

sumption: In chapter 5, it has been shown that participants already intending to floss profited more from an action planning intention than participants not intending to floss. There was however also a main effect of the planning intervention, indicating that even participants not intending to floss regularly increased their flossing frequency if they were assigned to the planning condition. This finding – that the effectiveness of planning is not necessarily related to intention levels – is also supported by the findings in Chapter 2 and Chapter 4. Chapter 2 predicted adherence to daily interdental hygiene from intentions and planning and found an interaction term intentions*planning not to improve the prediction of adherence. This indicates a main effect of planning irrespective of intention levels. In Chapter 4, it was examined whether there are stage-specific predictors of stage transitions. Coping planning predicted regression from the intention stage in the sense that participants changing to the preintention stage scored lower on coping planning, as it could be expected by the assumption that planning is only effective after intentions have been formed. Action planning however promoted progression from the preintention stage, where participants scored low on the intention to floss daily. This finding contradicts the assumption that planning is only effective in participants with high goal intentions. However, other studies similarly found that planning promoted progression from all stages of the TTM, including the preintentional stage (Armitage, 2006). Although the interpretation of this main effect irrespective of stages or intention strength depends on the behaviour under study, it represents a promising finding for intervention design and health promotion: If in some behaviours, planning has beneficial effects on behaviour initiation irrespective of goal intentions, this is encouraging for health promotion in non-intending individuals, an otherwise hard to motivate but highly at risk population. This issue will be further discussed in section 6.4.1.

Personality traits

Although the studies in this thesis did not examine the moderating role of personality traits, it is worth noting that personality traits such as perfectionism can moderate the effects of plans (T. A. Powers, Koestner, & Topciu, 2005). In this study, persons with high extraneous oriented perfectionism performed worse after forming if-then plans than persons with lower levels of perfectionism. The authors argue that perfectionists have strong tendencies towards behavioural self-regulation, and that for these persons, if-then plans might be interpreted as behavioural standards too high to reach, thus causing anxiety and impeding performance.

Emotional states

There is also evidence from studies on dental flossing that anxiety can moderate the effects of planning on behaviour (Schüz, 2006). Here, participants with high levels of dental anxiety did not

profit from planning in terms of behaviour prediction. Similar to the inhibiting effects of if-then plans on goal attainment in perfectionists, constant occupation with the plan contents may backfire. In perfectionists, this occupation leads to the perception of not being able to reach the standards formulated in the plan, in participants with dental anxiety, thinking about a behaviour closely related to the object of fear (dental treatment) might undermine the effectiveness of if-then planning.

Similarly, work by Aarts, Custers & Holland (2007) suggests that negative affective states (here induced experimentally) coactivated with goals undermine goal attainment processes, partly by devaluing the goal state, partly by negative affect undermining attentional processes necessary for effective goal pursuit (Anderson, 2005).

The mediating effects in both conditions however are thought to be the same in anxious and perfectionist participants: Processing efficiency theory (Eysenck & Calvo, 1992) suggests that worry-related cognitions reduce the storage and processing capacity of the working memory. According to Kuhl (2000), this suggests that in both cases, positive emotions are blocked, which impedes the activation of goal-directed action.

Especially with regard to the claim that planning requires little self-regulatory effort and works without conscious effort (Gollwitzer & Brandstätter, 1997), these results suggest that not everyone profits from if-then plans with regard to goal attainment.

6.3. Action control in health behaviour change

Integrated in the HAPA, action control constitutes the proximal cognitive impact factor for health behaviour, mediating between intentions and behaviour and planning and behaviour (Sniehotta, Scholz, & Schwarzer, 2005). Contrary to if-then planning, which represents a prospective act of planning subsequent behaviour steps, action control as conceptualised in this thesis refers to cognitive behaviour regulation while acting. In a taxonomy on cognitive volitional strategies, planning has been labelled an “ex situ” process, as such being applied outside or before the target situation, whereas action control represents an “in situ” process which is active and enabled during actual behaviour and refers to the cognitive processes during acting (Sniehotta, Winter, Dombrowski, & Johnston, in press).

Action control as employed here refers to self-regulatory processes derived from negative feedback loops in cybernetic regulation models (Carver & Scheier, 1998; Karoly, 1993; W. T. Powers, 1973), which compare input values to set standards and induce compensatory action, if discrepancies between these two values are detected. This idea has been introduced to the psychology of behaviour regulation in the 1960s (Miller, Galanter, & Pribram, 1960) and has been introduced as

a core idea in self-regulation theories that try to explain the process of setting goals and acting in accordance to these goals (Carver & Scheier, 1998).

Following this conceptualisation, action control describes the process of comparing actual behaviour (input value) to a self-set behavioural goal (standard value) such as the intention to clean between the teeth on a daily basis. The result of this comparison can emerge negative (i.e., actual behaviour underscoring the reference/standard value) or positive (actual behaviour outperforming the reference/standard value). In the case of negative outcomes, compensatory action is needed to regain a certain homeostasis. This can be reached by either enhancing endeavours to reach the behavioural standard (i.e. increasing action frequency) or by re-setting goals, if these are unrealistic, thus re-entering the motivational processes of goal setting. In the studies in this thesis, action control has been measured according to Sniehotta, Scholz & Schwarzer (2005) with three facets depicting this self-regulatory circle. The facet *awareness of standards* corresponds to the reference/standard value. Only if this reference value is present in working memory, actual behaviour can be compared against it. The second facet, *self-monitoring* refers to the process of monitoring own behaviour and comparing it to the reference values. *Self-regulatory effort* as third facet describes compensatory action to approximate actual behaviour to the reference values. The main mediating process guiding behaviour is thought to be the striving to reduce discrepancies between actual self-perceptions and intended goal states.

According to W. T. Powers (1973) and Carver & Scheier (1998), such regulatory circles operate in complex behaviour regulation systems in hierarchies with three basic assumptions:

- i. The central operating unit (central nervous system) operates as a hierarchy of feedback loops
- ii. Output values of higher-level control units serve as reference/standard values for lower-level units
- iii. On the lowest level, the system output is measurable as behaviour (physiological changes in muscle tonus)

Becker (1995) illustrates this hierarchical regulation of behaviour with the example of preparing coffee. Here, the higher-ordered goal is to be a generally nice person. Correlates of this principle contain the program offering coffee to guests, which consists of a sequence of behavioural programs, one of them filling the spoon with coffee powder. This sequence requires changes in current behaviour: The spoon needs to be inserted in the coffee powder can. In order to effect this change, changes in the current behavioural configuration need to be exerted; this would result in muscle tonus changes in order to pick up the spoon.

Results in this thesis (Chapter 3) support this hierarchic conceptualisation of regulation loops. Here, changes in action control following the distribution of a self-monitoring tool were predic-

tive of behaviour changes only in individuals who already had formed the goal intention to floss regularly. Applied to Becker's (1995) example, the goal principle could be the desire to be a person with good oral health; the program to achieve this state would include the regular application of dental floss (this level corresponds to behavioural intentions); the behavioural sequence represents dental flossing; the changes in current behaviour accordingly consist of increasing the frequency of dental flossing, with the respective changes in behavioural configurations. The intervention delivered to participants in Chapter 3 corresponds to the process of changing behaviour: Self-monitoring tools have been found to facilitate self-set behavioural changes

6.3.1. Structure of action control

While action control is conceptualised as a process in this research and is measured by process measures of ongoing action control processes, similar constructs have been conceptualised as personality traits (Becker, 1995) or self-regulation tendencies (Kuhl, 2001).

Becker construes behaviour control (*Verhaltenskontrolle*) as a superordinate second-order factor of personality, with an independent second factor psychological health (*seelische Gesundheit*). People scoring high on behaviour control are assumed to be moderate, anticipating, precautionary, orderly, norm-oriented, able to tolerate delay of gratification, and generally controlled. According to this theory, persons scoring high on behaviour control have less difficulty in suppressing competing behavioural tendencies and in achieving self-set goals. The intensity of these self-regulatory processes is assumed to vary interindividually. Combinations of behaviour control and psychological health have strong implications for clinical psychology. There are some conceptual similarities between Becker's behaviour control and the perfectionism concept as applied in the study by T. A. Powers, Koestner & Topciu (2005).

In Kuhl's (2001) personality systems interaction theory, action control corresponds to aspects of the self-control process, which supports the maintenance and enactment of conscious goals. The main task of the self-control process in the theory is to maintain goals and tasks that are not fully self-compatible, or which are imposed on the individual by others. This process is hypothesised to be accompanied and facilitated by negative affective states, because it suppresses processes related to the self (thoughts, evaluations and emotions towards the behaviour, which might be negative). In contrast to this conscious process, the self-regulation mode of behaviour regulation refers to mainly unconscious goal attainment processes, which are accompanied by positive emotions. This mode of regulation is active, whenever the goals and desired outcomes are interpreted as being congruent with the self.

6.3.2. Resources for action control processes

In the following, I will focus on some thoughts about the resources for action control processes, although these resources were not examined in the present thesis. Action control as employed here describes conscious cognitive processes relevant for the maintenance and accomplishment of self-set behavioural standards. These processes include self-monitoring, the maintenance of behavioural standards in the working memory and – if there are discrepancies – self-regulatory effort. It has been argued that such processes of self-control rely on some kind of energy or limited resources, as for example tiredness or prior engagement in tasks requiring self-control is associated with poorer performance in self-control tasks and behavioural self-regulation in general (Baumeister, Gailliot, DeWall, & Oaten, 2006; Baumeister, Heatherton, & Tice, 1994; Vohs & Heatherton, 2000). This depletion effect has also been demonstrated in the health domain for alcohol and food intake (Kahan, Polivy, & Herman, 2003; Muraven, Baumeister, & Tice, 1999).

Although the widely applied term “willpower” has been used in many and unscientific ways, there is evidence that this resource may be more than just a metaphor and have substantial physiological substrates. In a series of experiments, Gailliot et al. (2007) have demonstrated that blood glucose levels covary with depletion effects in self-control tasks. Thus, blood glucose levels may be a physiological correlate of action control processes and may explain intraindividual differences in action control performances. Certainly, further research along these lines is needed.

Following the argumentation of Kuhl (2000, 2001), conscious control processes impede positive affect, while behavioural control processes below consciousness facilitate positive affect. In this framework, positive affect might serve as a resource for control processes, and this positive affect will be more pronounced when behaviour and tasks are interpreted as being self-congruent.

6.4. Stages in health behaviour change

Besides research on the role of post-intentional processes on health behaviour change, this thesis aimed at testing whether health behaviour change can be construed as a transition through qualitatively different stages. While chapters 3 and 5 provided evidence for qualitative differences between two stages, namely motivational and volitional, chapter 4 integrated this two-stage approach into a broader framework that searched for commonalities between prevalent stage theories and subsumed them under a three-stage approach according to the HAPA by providing evidence for stage-specific predictors of stage transitions.

In examining these staging assumptions, the studies followed the recommended tests by Weinstein, Rothman & Sutton (Weinstein, Rothman, & Sutton, 1998): In Chapter 3, discontinuity between stages was demonstrated by the finding of differential prediction patterns of behaviour between the motivational and the volitional stage after the distribution of an intervention

matched to volitional and mismatched to motivational participants. In Chapter 4, stage-specific predictors of stage transitions in three stages were found, while Chapter 5 employed a partial matched/mismatched intervention design to test qualitative differences between two stages of change.

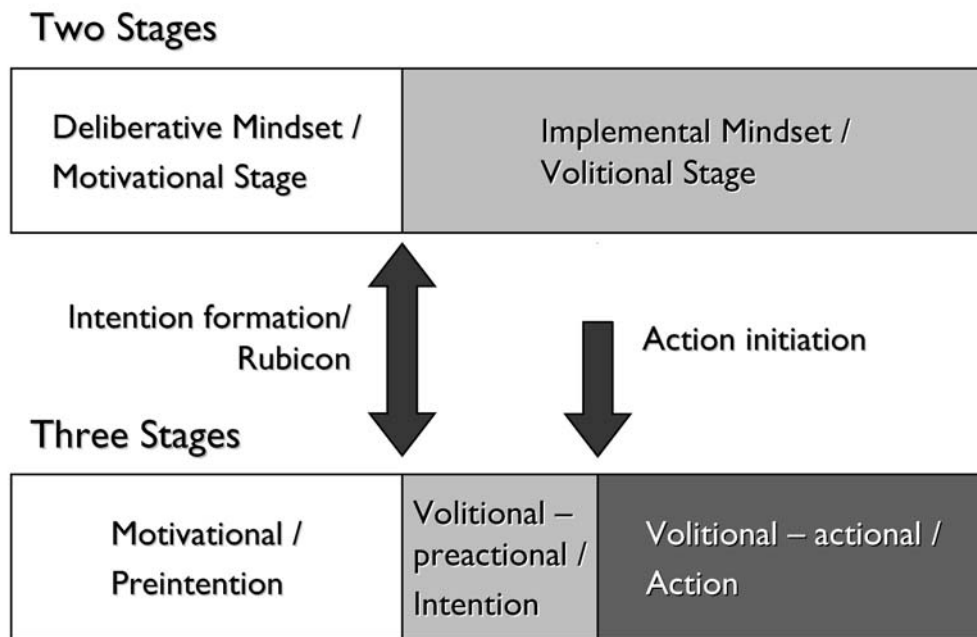


Figure 6.1: Stages in health behaviour change: Two-stage and three-stage approach with critical transition points as examined in this thesis

6.4.1. A two-stage approach: Motivational and volitional

The idea that something changes before and after a person has formed the intention to do something is a very basic one. Lewin (1926) illustrated the idea that the relevant processes differ before and after an intention has been formed with the example of selective attention. According to his example, if one has the intention to drop a letter in the post-box, all post-boxes will be recognised more easily, because they are primed stimuli with strong links to the intended behaviour. Such qualitative differences in attention and information selection are also being referred to in the model of action phases (Gollwitzer, Heckhausen, & Ratajczak, 1990; Gollwitzer, Heckhausen, & Steller, 1990; Heckhausen & Gollwitzer, 1987), which distinguishes a deliberative (motivational) and an implemental (volitional) mindset (Fig 6.1). While in the deliberative mindset information is processed that relates to making a qualified decision about whether to perform behaviour or

not (evaluation of positive and negative consequences of behaviour with the goal to weigh this information), in the implemental mindset information processing is preoccupied in that more positive information about behaviour is perceived (Taylor & Gollwitzer, 1995). People in an implemental mindset have stronger positive control illusions (self-efficacy) than those in a deliberative mindset (Puca, 2001) and process information related to implementing and performing behaviour more thoroughly (e.g., detect good opportunities to act more quickly).

Evidence for this two-stage distinction is provided by findings from several experimental studies: For example, participants in the implemental mindset recalled more information related to implementing behaviour after hearing fairy-tales (Gollwitzer, Heckhausen, & Steller, 1990), while participants in a deliberative mindset recalled more incidental ambiguous information (Fujita, Gollwitzer, & Oettingen, 2007). In the PAPM, this distinction also plays a central role and is defined by the decision to perform behaviour or not. In one of the few experimental studies with a matched/mismatched research design, Weinstein and colleagues (1998) demonstrated that participants who had already decided to test their homes for radon profited equally from information related to test ordering and from information related to pros and cons of testing. Similarly, participants not yet decided to test profited more from information related to the pros and cons of testing. Matched/mismatched studies for decided and undecided participants following the framework of the TTM have yielded less compelling results (Quinlan & McCaul, 2000), but this relative failure might also be related to the flawed temporal definition of stages in the TTM.

Two studies in this thesis (Chapter 3 and Chapter 5) provided evidence both for the assumption of two qualitatively different stages and their distinctness with regard to the relevant processes. In both studies, interventions on volitional factors produced stronger effects on behaviour in participants in the volitional stage. In Chapter 3, residualised change scores in action control after handing out a self-monitoring tool predicted behaviour changes in volitional participants only; in chapter 5, a planning intervention was more effective with regard to regular flossing in volitional participants.

If-then planning has been construed as a volitional strategy (Gollwitzer, 1996), and there is some support from both experimental and correlational studies for the idea that planning is most effective after goal intentions have been formed (e.g., Lippke, Ziegelmann, & Schwarzer, 2004; Norman & Conner, 2005; Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2007; Sheeran, Webb, & Gollwitzer, 2005). However, there are also findings which suggest that planning could facilitate behaviour change irrespective of prior goal intentions (Armitage, 2004, 2006; Sniehotta, Soares, & Dombrowski, in press). It is not entirely clear which processes determine whether planning is effective in all participants or especially effective in volitional participants, or whether this effect is dependent on the goal behaviour. However, three studies reported in this thesis (Chapter 2,

Chapter 4, Chapter 5) suggest that planning might be an efficient strategy for goal attainment in all participants, but at the same time that it might be even more effective in volitional than in motivational individuals (Chapter 5). The findings in Chapter 5 underscore both the efficiency of planning in health behaviour change, as participants in the planning condition outperformed those in the control condition regardless of their behavioural stage, and the stage-related efficiency of planning, as volitional participants profited more from planning than motivational ones. Similarly to if-then planning, action control as examined within this thesis represents a volitional variable. The conceptualisation of action control within this thesis is derived from self-regulation theory, which describes the processes involved in following self-set goals. As such, the strategies described in action control are dependent on the formation of goal intentions, because these goal intentions serve as behavioural reference value in the negative feedback regulation loop. The study in Chapter 3 also demonstrated that the intervention (self-monitoring tool) served as a stimulus for action control only, as motivational variables (behavioural intentions) did not change after handing out the tool.

In both studies, volitional processes affected behavioural performance in volitional participants, who they were targeted at. This supports the idea that there are qualitative differences between a motivational and a volitional stage. However, in order to fully underscore this claim, full matched/mismatched experimental research designs are needed.

6.4.2. A three-stage approach: Preintention, Intention and Action

Although the difference between a deliberative/motivational and an implemental/volitional mindset is one of the key differentiations in psychology (thus the “Rubicon” metaphor for forming intentions; Heckhausen, 1991), intentions alone are not sufficient for changes.

This has been recognised long before the beginning of academic psychology. That the intention to be good may be doomed due to the deficits of the human nature and because of temptations is a central argument in the New Testament: τὸ μὲν πνεῦμα πρόθυμον ἢ δὲ σὰρξ ἀσθενής. (*the spirit indeed is willing, but the flesh is weak*; Matthew 26: 41).

Apart from theological, there is also very strong psychological support for this distinction. Conceptual and empirical reviews (Orbell & Sheeran, 1998; Sheeran, 2002) have identified individuals who despite having the intention fail to subsequently act (“inclined abstainers”) as the main originators for the relatively weak relations between intentions and behaviour (with intentions explaining only about 27% of behavioural variance; Sheeran, 2002). This gap between intentions and behaviour suggests that there must be something that makes the difference between actors and intenders. This suggests qualitative differences between individuals who only intend to act and those who successfully translate their intentions into behaviour. Thus, in Chapter 4, the voli-

tional stage was further subdivided into an intention and an action stage. This division is implied in the HAPA and has been confirmed empirically (Lippke, Ziegelmann, & Schwarzer, 2005) by demonstrating differential prediction patterns in these three stages.

Current stage theories such as the TTM, PAPM, the Multi-Stage Model of Behaviour Change (MSM; Lippke & Ziegelmann, 2006) or the Social-Cognitive Stage Model (SCSM; Dijkstra, Conijn, & De Vries, 2006) can be subsumed under this three-stage approach with a preintention, an intention and an action stage. This stage aggregation is qualified by two major transition points shared by all the models (no intention – intention; not yet acting – acting), where the greatest qualitative differences can be assumed. Empirical evidence on behaviour self-regulation can also be pooled around these three superordinate stages. As outlined above, the differentiation between participants who do not yet intend to act and those who intend is justified by evidence from studies on deliberative and implemental mindsets (e.g., Fujita, Gollwitzer, & Oettingen, 2007), which demonstrate that attentional processes have different foci in the two mindsets, thus supporting qualitative differences between a preintentional and an intentional stage.

The differentiation between those who intend to act, but do not yet act and those who act is supported by obvious changes in behaviour: a person actually quits smoking or takes up regular dental flossing. Additionally, research on phase-specific self-efficacy has demonstrated that these specific self-efficacy beliefs have the strongest effects in their respective phases of behaviour change (Scholz, Sniehotta, & Schwarzer, 2005). Only those, who already maintain behaviour changes profit from high maintenance self-efficacy. Similarly, interventions based on self-monitoring behaviour obviously only work in those participants who actually perform behaviour (Febbraro & Clum, 1998).

6.4.3. Predictors of stage transitions

In the prevalent stage theories, only very vague assumptions are being made about the processes relevant for the transitions between the stages. Differentiating three stages of behaviour change and trying to identify factors promoting transitions between these stages can help to find a minimal consensus of stage theories, which differ with regard to the factors or make no clear predictions. This problem is also illustrated by the results of a Delphi study among stage theorists (De Vet, Brug, De Nooijer, Dijkstra, & De Vries, 2005), which showed that there is no consensus about factors; in fact, some (e.g., implementation intentions) were deemed relevant in more than one stage.

The TTM for example assumes ten processes of change relevant for stage progression. These ten processes are divided in experiential processes relevant in the non-behavioural stages and behavioural processes. However, there is only inconsistent evidence regarding the usefulness of these

processes in predicting stage transitions (De Vet, De Nooijer, De Vries, & Brug, 2005; Herzog, Abrams, Emmons, Linnan, & Shadel, 1999). With regard to the PAPM, only very sparse information is available regarding the relevant factors for stage transitions. Weinstein (1988) assumes that risk perception is important for stage progression in early stages of behaviour change, while self-efficacy is assumed relevant throughout the change process. Similarly, self-efficacy is assumed relevant for all stages in the HAPA, but self-efficacy is differentiated with regard to phase-specific tasks (Luszczynska, 2004; Scholz, Sniehotta, & Schwarzer, 2005; Schwarzer, 1999; Schwarzer & Renner, 2000). In the preintention stage, risk perception, task self-efficacy and outcome expectancies are assumed to promote the formation of intentions. After intentions are formed, action planning and maintenance self-efficacy are assumed to promote the implementation of behaviour. In the action stage, coping planning and recovery self-efficacy are assumed to prevent lapses and relapses, while action control is relevant for the attainment of behavioural goals.

In the present thesis, Chapters 3 and 5 examined the factors relevant for participants in the volitional stage (planning and action control).

Chapter 4 examined a three-stage model of behaviour change and found stage-specific predictors of stage transitions. The factors examined within Chapter 4 have on the one hand been derived from the predictions of the HAPA. On the other hand, they were found by scrutinising evidence of prevalent health behaviour theories on the critical transition points between preintention and intention as well as intention and action. From a strict theoretical point of view, this procedure may seem syncretistic or eclectic. However, as there are strong resemblances and similarities between the assumptions of prevalent health behaviour theories (Maddux, 1993; Weinstein, 1993), such an approach may help to identify the relevant factors in behaviour change and to test shared predictions of health behaviour theories in order to refine, revise or reject their predictions (Noar & Zimmerman, 2005; Rothman, 2004; Weinstein & Rothman, 2005). For example, the valence of the expected outcomes of behaviour is a core element in various theories, but the names and operationalisations differ. Attitudes in the Theory of Planned Behaviour (Ajzen, 1985), response efficacy and costs in Protection Motivation Theory (Maddux & Rogers, 1983), decisional balance in the TTM (Prochaska, DiClemente, & Norcross, 1992), outcome expectancies in Social Cognitive Theory (Bandura, 1986) and in the HAPA all refer to the same cognitive process: Do I expect more positive than negative outcomes from the behaviour I am contemplating about? It is therefore justified to identify commonalities by pooling the evidence from examinations of these theories, and at the same time to reject theory predictions which are not supported by data. Within this thesis, this approach guided research and analysis of the study in Chapter 4 and proved useful.

6.5. Limitations of the studies

There are some limitations in the studies in the present thesis that need to be acknowledged and taken into consideration when interpreting the results.

6.5.1. Reliance on self-reports for behaviour assessment

One major limitation that has also been referred to in the chapters is the reliance on self-reported measures of behaviour. Self-reported behavioural measures might fall prone to a positive or a negative recall bias. As this is depending on the level of behaviour (Sallis & Saelens, 2000), correction is difficult. Thus, two studies in this thesis (Chapter 2 and Chapter 3) applied a multimodal assessment of the dependent variables (Eid, 2006) by comparing self-reported behavioural data with measures of residual floss. This yielded a correlation of $r = .69$ ($p < .01$), which implies satisfactory validity of the self-report measure. Additionally, no significant differences between those returning floss ($n = 95$) and those not returning floss ($n = 68$) on any baseline variable were found, thus suggesting that sending in residual floss was not confounded with study variables. However, the residual floss measure cannot be considered an objective measure of behaviour, as there is intra- and interindividual variance with regard to the amount of floss used per flossing session. The major dental associations (ADA, 2005; BDA, n.d.; DGZMK, n.d.) recommend to use between 30-50 cm of dental floss per session, thus strong intraindividual variations can be assumed. The floss container might have been used by more than one person, or participants could have used other brands and containers of floss. Additionally, there is variation in the amount of floss in the containers themselves, not all contained exactly 5m of floss as stated on the container. Another limitation with regard to the assessment of behaviour relates to flossing itself. Although all participants were provided with instructions on flossing, the measurement instruments did not measure flossing quality, i.e. whether the recommendations were fully followed. The assessment of flossing skills could have been covered by dental hygienists monitoring participants' flossing skills after instructions (McCaul, Glasgow, & O'Neill, 1992; Philippot, Lenoir, Hoore, & Bercy, 2005), but this procedure is still susceptible to positive bias, because it cannot detect insufficient flossing at participants' homes. Truly objective measures of behaviour would in this case only be possible by observing flossing behaviour in the bathrooms of participants and by additional validation of behaviour by examining participants' plaque status (Stewart, Strack, & Graves, 1999).

6.5.2. Experimental vs. non-experimental study design

A more general limitation concerns the strictness and rigidity of the methods employed in this thesis. Generally, experimental designs allow more sound conclusions than correlational designs. For the examination of stage theories, matched/mismatched experimental research designs pro-

vide the strongest support (Weinstein, Rothman, & Sutton, 1998). However, only one study in the present thesis (Chapter 5) followed an experimental design, and here, no full matched/mismatched design was applied. There was no intervention mismatched to the volitional stage and matched to the motivational stage. Hence, taken strictly, the results support targeting effects, but the differential results in motivational and volitional participants could still be caused by a continuum underlying artificially generated stages. Thus, the results are in line with the stage assumptions, but only a full matched/mismatched research design can rule out the possibility of an underlying continuum with pseudostages.

In Chapter 3, participants received an intervention, but this intervention was delivered to all individuals and there was no control group. Therefore, individual changes in action control were computed as indicators of the effect of the self-monitoring tool. This approach represents only a stub of an experimental design, thus, in Chapter 3 no conclusions have been made concerning the effectiveness of the self-monitoring tools. Taken strictly, the differential prediction patterns of action control changes represent a longitudinal test of discontinuity patterns across stages, which is considered the weakest support for stage theories (Weinstein, Rothman, & Sutton, 1998). Thus, the results are in line with the stage assumptions, but here again, only a full matched/mismatched research could rule out the possibility of pseudostages.

In Chapter 4, the staging assumptions were tested by predicting stage transitions with stage-specific factors. This approach provides a more rigid test of the stage assumptions, but differential prediction patterns as observed here could still be caused by an underlying non-linear continuum or a continuum containing interactions with other variables.

In a full matched/mismatched research design targeting a three-stage model with regard to dental flossing, participants in the preintentional stage could, for example, be provided with risk information, receive a demonstration about the effectiveness and easiness of dental flossing and receive dental floss. Participants in the intention stage could be subject to an action planning intervention.

6.5.3. Biased sample

The participants in the studies in the present thesis were generally of relatively high socio-economic status, as the samples for the studies in Chapters 2, 3 and 5 were approached in university settings. The sample of study 4 was acquired via dental practices. As the participation in this study was unpaid, only practices convinced of the importance of individual prophylaxis enrolled for the study. This means that the sample in this study may have been positively biased towards oral self-care. As especially dental health behaviours correlate positively with socioeconomic status (Blaxter, 1990; Staehle, 2004), the samples in the studies represented a positive selection

towards dental flossing. Participants with more problematic dental health profiles were thus not reached by the approaches in the present thesis.

An alternative approach could be the recruitment of participants in settings with high frequencies of patients with a low socioeconomic status, such as consultation hours in dental clinics, where treatment is either fully insurance-covered or extra payment is very low. Additionally, a deliberately skewed sample (*woblüberlegt verzerrte Stichprobe*; Iseler, 1996) such as periodontal patients where poorer oral self-care can be assumed (Philippot, Lenoir, Hoore, & Bercy, 2005) would provide a stronger test of the assumptions about the effectiveness of factors in health behaviour theories.

6.5.4. Selective dropout and imputation of missing values

Selective dropout represents another possible limitation for the interpretation of the results in the present thesis. In all studies the longitudinal sample was more positively positioned towards dental flossing than the subsample of dropped out participants. However, this phenomenon is often reported in psychological studies. In unpaid studies, the lack of motivation to continue in a study about behaviour one is not interested in is obvious. Another explanation may be the mismatching of interventions to participants. In Chapter 3, participants in the motivational stage received a mismatched intervention, which might cause reactance. Similar findings are often reported in studies on stage-matched interventions (e.g., Prochaska, DiClemente, Velicer, & Rossi, 1993).

There are several possibilities for addressing this problem. Remunerating participants for the returning of questionnaires or enrolling them in raffles could prevent attrition (Görizt, 2004). However, due to financial restrictions in the design of the studies, this option was not available. Imputation of longitudinal missing values might be another option, as listwise deletion of cases with longitudinal missing values as employed here might lead to a skewed sample as data are not missing completely at random (Little & Rubin, 2002). Following an intention-to-treat-approach, longitudinal missing values could be imputed following a last observation carried forward approach, which would substitute longitudinal missing values with the last available measures. This approach however does not take into account behavioural changes due to the study situation in the whole sample, as observed here in Chapter 5.

Alternatively, advanced techniques for missing data imputation such as Maximum-Likelihood estimations in Full Information Maximum Likelihood Imputation (Enders & Bandalos, 2001) or Expectation-Maximisation Imputation (Enders & Peugh, 2004) could have been used. Because in Chapters 2 and 3, only the differences in stages between the longitudinal samples and the initial sample were significant, the analyses in these chapters were not based on a longitudinally imputed data set, but relied on cross-sectional imputation. Parallel analyses with a longitudinally imputed

(EM) data set yielded very similar results to those reported in Chapters 2 and 3. With regard to the study in Chapter 4, longitudinal imputation would have increased the sample size by 40%, therefore a conservative approach was chosen by discussing the limitations for generalising interpretation of the data. As the research aim in Chapter 4 was however related to the identification of general processes, this implication for generalisation seems less restrictive. Multiple imputation is often considered the gold standard for handling missing data (Fichman & Cummings, 2003; Schafer & Graham, 2002), but the available procedures for the integration of the analysis with several imputed data sets according to Rubin (1991) do not allow to analyse repeated-measures analyses of variance.

6.5.5. Mediation analyses

Although the study in Chapter 5 has demonstrated that an action planning intervention may successfully change behaviour, and that these changes are stronger in volitional than in motivational participants, the exact working mechanisms remain unclear. Thus, among the questions posed by Michie & Abraham (2004), “Does it work?” can be answered with “yes”, “How does it work?” however cannot be answered satisfactory by demonstrating mean differences between the different groups in the study. Here, mediation analyses with the hypothesised active ingredient of the intervention as covariate in the ANOVAs need to be conducted. In the present study, this active ingredient could have been changes in planning processes due to the intervention (e.g., Sniechotta et al., 2005). However, due to time restrictions at participant recruitment, no baseline assessments of planning are available. Alternatively, the quality of the plans generated by participants could have been rated and examined for its mediating function between intervention and behavioural outcome (Ziegelmann, Lippke, & Schwarzer, 2006). But as the focus of the study in Chapter 5 was on the examination of qualitative differences between stages in health behaviour change rather than the demonstration of intervention effects, we chose not to conduct mediation analyses here.

6.5.6. Effect sizes

Although the mean differences between the three transition groups in Chapter 4 as well as the differences between the experimental groups in Chapter 5 are significant, the effect sizes are all in the small range. In Chapter 5, the main effect of the intervention yielded an effect size of $\eta^2 = .10$ over time and an interaction effect of time*intervention of $\eta^2 = .05$. Similarly, the stage*intervention effect was as small as $\eta^2 = .11$. In chapter 4, the effect sizes of the factors predicting stage transitions range between .06 and .10 (η^2) and .05 and .07 (ω^2), respectively. It is thus ques-

tionable whether these small effect sizes justify the cost- and time-intensive development of stage-matched interventions as compared to non-stage-matched interventions.

6.6. Implications

In the last paragraph, the implications of this thesis for practical health promotion as well as for theory building and research in Health Psychology are discussed. Additionally, I will point out some directions that future research on health behaviour self-regulation might consider.

6.6.1. Practical Implications

Planning

One of the key implications of the studies in this thesis regards the application of planning techniques in health behaviour change. In Chapter 2 and Chapter 4, it was demonstrated that planning processes are relevant for regular flossing and for the advancement through behavioural stages. The finding in Chapter 2 represents a main effect, i.e. the efficiency of planning in this context is not restricted to individuals who already have goal intentions. In Chapter 4, high levels of action planning predicted progression from the preintention stage, while low levels of coping planning predicted regression from the intention stage. In Chapter 5, it was demonstrated that all participants profited from a one-on-one planning intervention as compared to a control group. Together with findings from a multitude of other health-related domains such as nutrition (Armitage, 2004), physical activity (Scholz, Sniehotta, Burkert, & Schwarzer, in press) or self-examination behaviours (Prestwich et al., 2005), these results suggest to apply planning interventions in general health consultations.

Within the dental context, this could for example be implemented in sessions with the dental hygienist. After demonstrating the benefits and effectiveness of interdental hygiene, hygienists could instruct the patients to formulate concrete if-then plans for interdental hygiene following a protocol as outlined in Chapter 5.

Matching interventions to stages

The findings from Chapter 3 to Chapter 5 suggest that it might be a promising approach to match interventions to behavioural stages. Changes in action control due to interventions such as the self-monitoring calendar in the study in Chapter 3 were only effective in promoting behaviour change in volitional participants. This suggests providing volitional individuals with the intention to change behaviour with tools to monitor behaviour changes and behaviour maintenance. Self-monitoring interventions have for example been successfully employed in the context of physical

activity promotion (Scholz & Sniechotta, 2006; Sniechotta et al., 2005), weight reduction (Boutelle, Kirschenbaum, Baker, & Mitchell, 1999) and smoking cessation (McFall & Hammen, 1971).

For concrete health promotion measures, this would imply to assess behavioural stages in participants, e.g. by using the stage algorithm used in Chapter 3 or Chapter 5 and hand out self-monitoring tools with instructions to volitional participants.

Although there is evidence for the notion that if-then planning is more effective in volitional individuals than in motivational ones (Gollwitzer, 1996; Lippke, Ziegelmann, & Schwarzer, 2005; Norman & Conner, 2005; Sheeran, Webb, & Gollwitzer, 2005), the findings from Chapters 2, 4 and 5 of the present thesis and other studies (Armitage, 2004, 2006; Sniechotta, Soares, & Domrowski, in press) suggest that all individuals profit from planning. Thus, stage-matching with regard to if-then planning might spare motivational individuals the benefits of if-then plans.

6.6.2. Implications for theory and research

With regard to planning processes, the results of the present thesis imply more research on the critical factors that determine whether planning works regardless of prior goal intentions or not. This would require a variation of goals, goal attainment processes, populations and intervention settings. For example, it might make a difference between motivational and volitional individuals if planning interventions are delivered in a more intensive one-on-one setting, or if participants are required to generate plans on a planning sheet with instructions (Ziegelmann, Lippke & Schwarzer, 2006). Another possibility for differential effectiveness regards the complexity of the behaviour under study. Findings from a study on physical activity (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2007) suggest that with regard to more complex behaviours such as physical activity, coping planning might be more effective than action planning. Similarly, in complex nutrition behaviour patterns such as the increase of fruit and vegetable consumption, if-then plans related to action initiation are not sufficient for sustainable changes in behaviour (Jackson et al., 2005). These findings suggest that with the complexity of the behaviour to be changed, the effectiveness of planning processes varies. While nutrition and physical activity might require more than action plans only specifying the initiation of behaviour, in behaviours with relatively small difficulties such as dental flossing or taking vitamin supplements (Sheeran & Orbell, 1999), these action plans might suffice.

With regard to stages of health behaviour change, the present thesis suggests to examine two or three stages of behaviour change instead of finer-graded stage distinction. Chapter 4 demonstrated differential prediction patterns of transitions between three stages, Chapter 3 and 5 suggested distinguishing two stages of change. Further research on stages in health behaviour change might consider these superordinate stages (Fig. 6.1) rather than finer-graded stage distinctions.

The rationale for this suggestion is that apart from Chapters 3, 4 and 5 in this thesis, most conclusive evidence on stage theories stems from research targeting the transitions between these superordinate stages. For example, successful stage-matched interventions have targeted two (Dijkstra, De Vries, Roijackers, & van Breukelen, 1998; Weinstein, Lyon, Sandman, & Cuite, 1998) or three (Dijkstra, Conijn, & De Vries, 2006) stages of change rather than the full range of stages. Additionally, the evidence for qualitative differences around these meta-stages from other research is very strong. For example, the review by Sheeran (2002) demonstrated that there is a substantial gap between intentions and behaviour, thus suggesting qualitative differences between actors and intenders. On the other hand, the findings in Chapter 3, various findings on if-then planning and on motivational and volitional mindsets (Fujita, Gollwitzer, & Oettingen, 2007) suggest qualitative differences between pre-intenders and intenders.

This thesis also take into consideration arguments that the prevailing health behaviour theories are “*more similar than dissimilar*” (Maddux, 1993, p.116; Weinstein, 1993). In Chapters 3, 4 and 5, it was argued that current stage theories can be subsumed under two (Chapter 3 and 5) or three (Chapter 4) superordinate stages of change. This argument has been explicitly raised and supported with evidence in Chapter 4 and Figure 4.1. In Chapter 4, it has further been demonstrated that the factors predicting intentions and behaviour in the prevailing social cognitive theories can be integrated into a testable parsimonious set of predictors that take into consideration the similarities of the concepts in prevailing social-cognitive theories. This procedure takes into account recent suggestions for improving research on health behaviour theories by recognising similarities, comparing theories with regard to their evidence and regarding commonalities between theories for research and intervention design (Noar & Zimmerman, 2005; Rothman, 2004; Weinstein & Rothman, 2005). In future studies, conceptualisations of behaviour change processes might want to take into consideration similarities and dissimilarities of stage theories in order to make the most out of the available data and evidence. With regard to intervention design, this approach has been integrated into the steps of protocols that promote an evidence-based approach such as Intervention Mapping (Kok, Schaalma, Ruiter, Van Empelen, & Brug, 2004).

6.6.3. Future directions for research and theory on health behaviour self-regulation

In this thesis, I have demonstrated the utility of the HAPA framework (Schwarzer, 1992) for research on health behaviour regulation. Processes derived from social-cognitive theories correspond to those integrated in the HAPA, and commonalities of current stage theories can be identified in the two/three stages as proposed by the HAPA. In the following, I will point out some future directions for research and theory on health-behaviour self-regulation. These points concern the integration of aspects and techniques for change processes from other psychological

disciplines and the importance of integrating concepts of emotional self-regulation in prevailing theories of health behaviour, which are mostly cognitively oriented.

Interdisciplinary integration of behaviour change processes

As interventions based on social-cognitive theories such as the Theory of Planned Behaviour (Ajzen, 1985) are not very successful in changing behaviour, sometimes not even in changing the beliefs underlying the factors in the theory (Chatzisarantis & Hagger, 2005), it might be promising to integrate techniques which effectively change cognitions into theory and research on health behaviour change. These elements can for example be derived from cognitive behavioural therapy (Hobbis & Sutton, 2005a, 2005b; Michie, 2005). This seems a promising approach, especially as the techniques and factors examined in the present thesis (action planning, coping planning and action control) are directly derived from cognitive behavioural therapy.

Making concrete plans for action is a key technique in cognitive behavioural therapy, e.g., in multimodal approaches (Lazarus, 1989), where clients are supposed to generate hierarchical plans of action for the most prevailing problems in the relevant dimensions of personal functioning. Plans for behavioural alternatives (coping planning) in critical situations can prevent relapses into old or unwanted behaviour routines. Thus, it is a key component in the treatment of addictions (e.g., Marlatt, 1996), where clients are asked to plan in advance how to cope with high-risk situations in order not to relapse into addiction behaviour. Similarly, in the prehearsal process in self-management therapy (Kanfer, 1979), clients are supposed to rehearse for upcoming problematic situations in role plays with their therapist. Finally, self-monitoring as a crucial process in self-regulation plays an important role in therapeutic approaches and has in various problems such as habit disturbances, depression and anxiety (Febbraro & Clum, 1998) proved to effectively change behaviour and cognitions. Integrating concepts and ideas from cognitive behavioural therapy and clinical psychology in general might be a viable path towards a better understanding of health behaviour change processes.

Emotional self-regulation in volitional self-regulation

Findings from the studies in this thesis published elsewhere (Schüz, 2006), from research on physical activity regulation (Mohiyeddini & Bauer, 2007) and from research on the moderators of the effectiveness of if-then planning (Aarts, Custers, & Holland, 2007) as well as self-regulation (Koole & Jostmann, 2004) suggest that affective states and emotions in general might pose another important influence factor not fully covered by the theoretical approaches in this thesis. In the study by Schüz (2006), for example, it was demonstrated that the impact of action planning

on behaviour change was moderated by the fear of dental treatment and self-injury. This implies that emotional states play an important role in behavioural self-regulation.

A recent conceptual review of the theoretical locations of volitional systems and processes (Sniehotta, Winter, Dombrowski, & Johnston, in press) differentiated ex-situ (prospective behaviour control, not in the behaviour situation) and in-situ (control accompanying behaviour performance) regulation processes and differential targets for these processes. According to this conceptualisation, *action planning* (ex-situ) and *action control* (in-situ) refer to the execution of new, intended behaviour, while *coping planning* (ex-situ) and *temptation resistance* (in-situ) describe processes shielding intended behaviour against incongruent influences.

This can be expanded to a view on emotional self-regulation in behaviour change: According to Kuhl's (2006) conceptualisation of self-control, the ability to downregulate negative affect after failures (action-orientation; *Handlungsorientierung* versus state-orientation; *Lageorientierung*) is a crucial factor in self-regulation and a central resource in control processes. In an attempt for integration, action-orientation would represent a core resource both for inducing positive affect during initiation and maintenance of behaviour changes as well as for preventing, shielding and converting negative affect during action.

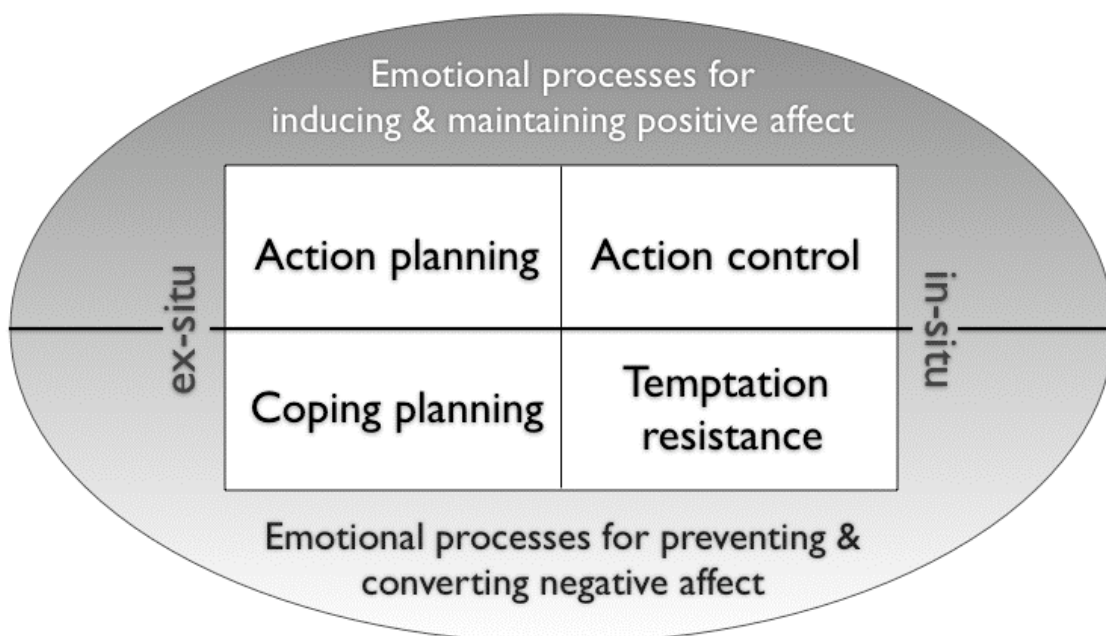


Figure 6.2.: Integration of cognitive and emotional regulation processes for volitional self-regulation

While volition psychology during the last 10 years has produced great advancements with regard to cognitive behavioural self-regulation, only sparse theoretical advice is available regarding emotional self-regulation during health behaviour change. Descriptive theories about self-regulation, intrinsic motivation and emotions such as Self-Determination Theory (Deci & Ryan, 1985) or Flow Theory (Rheinberg, 2006) are not very helpful with regard to these questions, as they make only very limited assumptions about the regulative processes underlying emotional correlates of behaviour and offer very limited target points for interventions. In Kuhl's Personality Systems Interaction Theory (Kuhl, 2001), it is assumed that low positive affect impedes the capacities of the behaviour self-regulation system, while positive affect facilitates the initiation of behaviour. The ability to downregulate negative affect and to generate positive affect in action regulation is a central point in this theoretical framework. According to Kuhl, this ability may be altered by system conditioning. Here, the regulation of affects is learned, if self-activation (self-disclosure, expression of emotions and affects) is paired with the experience that negative affect can be downregulated by e.g., consolation or encouragement by relevant others (parents, friends, partners...). These interactions have to be empathic, so that the individual feels accepted and understood by these interaction partners.

In Becker's (1995) integrative framework, clinical psychology is referred to for interventions on regulating emotions. This corresponds to Michie's (2005) suggestions to integrate techniques from cognitive behaviour therapy into health behaviour theory and research.

Thus, integrating a framework of emotion and emotion regulation with recurrence to related disciplines in psychology seems a promising approach for further research on behaviour self-regulation.

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