



Positive Technology in Light of the Bitter-Sweet Ambivalence of Change

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Abstract. Positive technology combines approaches from positive psychology with the opportunities of interactive technology. Thereby, positive technology may support people in reaching personal goals, such as being more sporty, establishing mindfulness, or improving their nutrition. Regarding the conception of such technologies for positive behavior change, there are several reasons why positive psychology and technology are a particular promising connection. This ranges from the underlying humanistic image of humanity, to the easy technical operationalization of related exercises, up to the integration of practices into daily routines. However, a risk of positive psychology inspired approaches is that the inherent focus on the positive disregards the actual challenges that humans will be confronted with. In the worst case, solely positive focused interventions may backfire and eventually prevent change. For being effective, the design of positive technologies must consider human change in all its facets, including "bitter" and "sweet" components of change. This chapter presents key assumptions about the suggested change dynamics and possible strategies for positive change along the bitter-sweet continuum of change and discusses findings from first empirical explorations.

Keywords. Positive Technology, theoretical foundations, behavior change, bitter and sweet components, design strategies.

1 Introduction

The idea of positive technology (e.g., Botella et al., 2012; Calvo & Peters, 2014; Gaggioli et al., 2017) is based on the fruitful connection of approaches from positive psychology with the opportunities of interactive technology. I assume that most readers of this book are already aware of what positive psychology is in principle, and can imagine that technology can be a helpful tool to further support human flourishing. Taking this as a common ground, there still remains a lot to discuss and there are many implicitly underlying assumptions, one needs to look at closer, so that the idea of positive technology eventually plays out. In this chapter, I will focus on the idea of positive technology in the sense of technology for positive behavior change, that supports people in reaching personal, meaningful goals. I will outline the foundations of why positive psychology and technology could be a good match, and the related image of humanity, possible challenges related to the bitter and sweet components of change, and insides from initial empirical explorations of bitter and sweet components in change processes related to the use of self-improvement technologies. Thereby, this

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chapter summarizes earlier published work (Diefenbach, 2018a, 2018b) and the keynote presented at the Positive Technology Conference 2023.

2 Foundations — why positive psychology and technology could be a good match

When thinking about technology as a possible supporter of positive change, of course, a very central issue is the underlying image of humanity and related questions and assumptions about what could initiate change. Hence, central questions could be:

- What are humans capable of?
- What do humans strive for?
- What do we need to know about the origin of the problem to solve it?

If, for example, someone wants to do more sports but doesn't manage, or if someone wants to be more relaxed in the relationship— why is that? What do we need to know about the problem to see possible solutions? Do we need to know about the childhood? Do we need to apply complex knowledge about psychological disorders? Do we need experts, therapists or other persons with special knowledge to find a solution?

What about humans' inner potential for positive development? Are humans generally lazy and only change when they are forced to? Or do we have a more positive view on humans? Do we, in general, trust that humans are willing to change, strive for self-actualization and being the best version of themselves, and are, in a way, also the best experts for themselves (as assumed in the foundations of positive psychology and solution-focused coaching, e.g., Biswas-Diener, 2010; Parks & Biswas-Diener, 2013; Vella-Brodrick, 2013; Bamberger 2011; Greene & Grant 2003)?

Obviously, the latter, humanistic perspective on humans' potential for positive development, is more compatible with the role of technology as a supporter of change, and an important foundation for the idea of positive technology. Table 1 summarizes the different aspects of why positive psychology and technology could be a good match, which are laid out in more detail in the following paragraphs.

Table 1. The foundations of positive technology: why positive psychology and technology could be a good match.

The foundations of positive technology	
Foundations in the belief about human nature	Humanistic image of humanity, general belief in humans' potential for personal growth
Foundations in the belief about the relevance of the origin of a problem	Indication independent interventions
Foundations in the belief about the relevance of therapeutic expertise	Client-as-expert-view, coach/therapist as moderator of development
Foundations in the belief about helpful exercises and experiences	Appreciation of new experiences and perspectives Integrating practice into daily routines

2.1 General belief in humans' potential for personal growth

A humanistic image of humanity assumes that people will appreciate and utilize the opportunities for personal development provided by their environment. Humanistic approaches and solution-focused coaching see change as a function of autonomous motivation being built on the utilization and revelation of the clients' individual resources (Ryan et al., 2008; Bamberger, 2011). The crucial element is that the coach introduces the right triggers and questions to activate the client's potential for change. Based on this perspective, it seems well conceivable that also a "digital coach" interactive technology could trigger some of this potential. Following a humanistic image of humanity, people should appreciate and utilize the opportunities for personal development provided through technology. Consequently, many existing product concepts for positive change built on the idea of establishing an open dialogue with the user, where the right level of change is negotiated between user and product (e.g., Beun et al., 2016; Laschke et al., 2011, 2014).

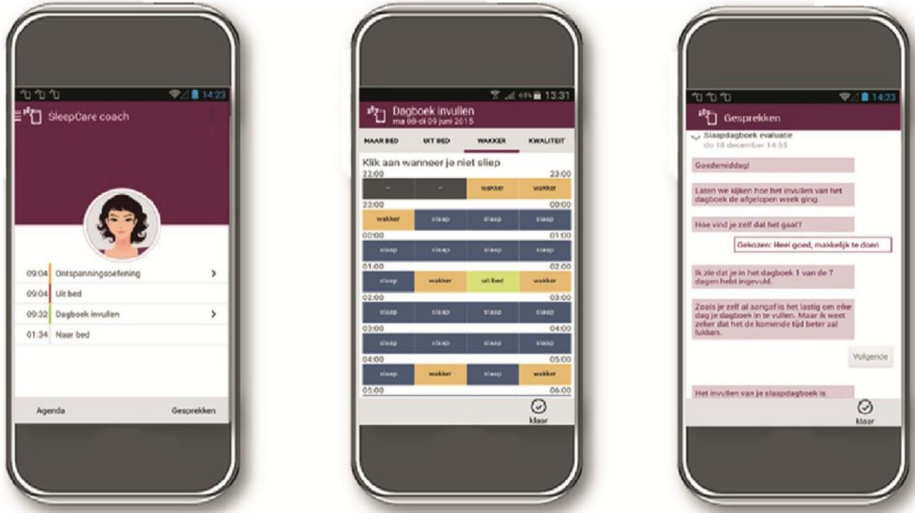
For example, the app SleepCare negotiates with the user about the right time to go to bed and stay up in the morning (Beun et al., 2016, 2018). The product informs the user about the expected positive effects of bedtime restriction in terms of positive sleeping quality, but the user decides whether to agree with the suggested bedtime or not (see Figure 1, top).

The ShowerCalender initiates a dialogue about the appropriate time of showering to feel good and care for responsible water consumption at the same time (Laschke et al., 2011). In order to enhance the consciousness of water consumption, each showering is represented by a colorful dot. The longer you shower, the smaller gets the dot, which could be a little motivation and reminder to not just let the water flow mindlessly. There could be personal, good reasons to still take a long shower, as long as this happens consciously (e.g., relaxation after a long working day). There is no restriction and the water won't stop; autonomy is granted.

The concept Keymoment confronts the user with the choice between taking the car or the bike (Laschke et al., 2014). However, it always remains the user's free choice to implement the product's recommendations without force or restriction. The only severe consequence if not following what the product suggests may be feeling bad about oneself, because one can trick the technology but not oneself.

SleepCare (Beun et al., 2016)

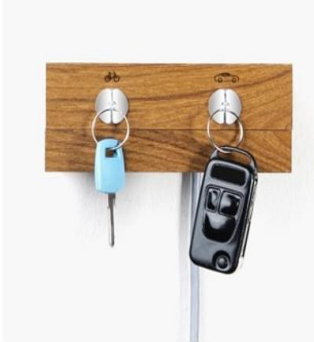
What is the appropriate time to leave bed?



- E *Good morning John.* This week we will start the sleep restriction exercise. You have to keep regular bed times and should shorten the total time in bed. Because you have less time to sleep, you will be more tired and that helps for a better sleep. Would you like to know more before we start?
- C **[Let's start]** [What do I have to do?] [What can I expect?]
- E We will now determine your bedtimes. On the basis of your sleep diary I suggest that the total bedtime will be 5 h. Do you agree?
- C [Yes] **[I prefer longer]**[I don't want to do bedtime restriction]
- E How long do you want to stay in bed?
- C [5.30][6.00][**6.30**]
- E You suggested 6.30 h. The exercise works better when you stay in bed as long as your mean sleeping time last week. I therefore suggest that the total time in bed will be 5.30. Do you agree?
- C [Yes][**I prefer longer**]
- E ...

Keymoment (Laschke et al., 2014)

Do you want to take the bike or the car?



The Shower Calendar (Laschke et al., 2011)

What is the appropriate time of showering?

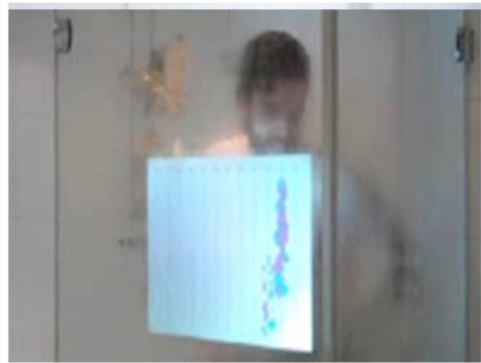


Figure 1. Examples of existing product concepts based on an open dialogue between product and user: SleepCare (Beun et al., 2016, top), Keymoment (Laschke et al., 2014, middle), and Showercalendar (Laschke et al., 2011, bottom).

2.2 Indication independent

Another characteristic of positive psychology interventions making it compatible with a representation through technology is the future-oriented focus on the positive and possible solutions. The approaches to support human flourishing are basically indication independent (de Shazer et al., 1986; de Shazer & Dolan, 2012), there is no need for detailed analysis of past traumas or problems and supposed causes of problems

in the past. Instead, the emphasis is on visions about a possible future. This is supported by different systematic techniques, such as role plays, systematic sets of unusual and inspiring questions, or exercises creating new perspectives and imaginations. Indeed, this future-oriented approach also showed as quite promising in clinical studies, demonstrating an equal or better effectiveness of systemic, indication independent therapy of trauma and depression compared to psychodynamic or analytic therapy (Lau & Kristensen, 2007; Knekt & Lindfors, 2004; Knekt et al., 2013). This the future-oriented, this indication-independent view makes it easier for technology to support, compared to a full analysis of reasons in the past as suggested by psychoanalytical and other therapeutic approaches. Note, however, that positive technologies alone can not replace face-to-face coaching.

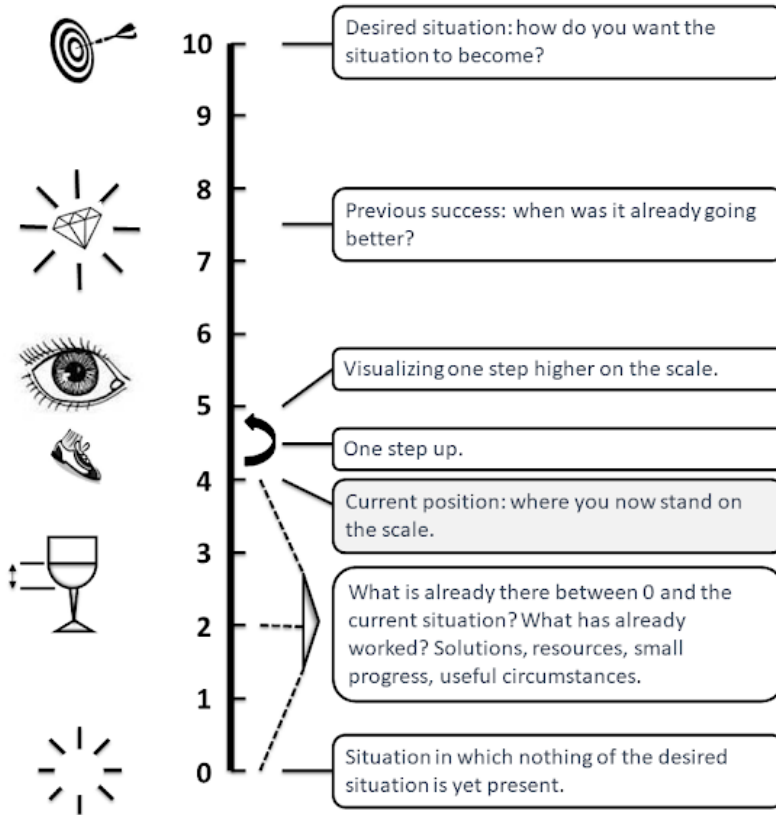
2.3 Client as expert view

The client-as-expert view in positive psychology and solution-focused coaching is also well compatible with the idea of positive technology. While a psychoanalytic line of thinking emphasizes the therapist's personal expertise and interpretation of the patient's reports, solution-focused approaches promote a dialogue at eye level. Instead of phenomena such as transference and countertransference in therapist-patient communication, which are detected and interpreted by the therapist, the coach rather takes on the role of a companion. Accordingly, in the literature the coach is denoted as an agent of change and moderator of development or an assistant for self-management (Hermer, 1996; Kanfer et al., 2006). This aspect parallels the approach of "transformational technologies" (Hassenzahl & Laschke, 2015; Laschke et al., 2011), assisting users in their wish for personal change and transformation, but still assigning them a responsible and active role. While using the product expresses a general agreement about the need and wish for change, the user is not patronized but retains "expert" for his or her individual way of change. Based on the client-as-expert-view, there is confidence that the user will choose the individually appropriate dose and speed of change at a particular point in time.

2.4 Appreciation of new experiences and perspectives

Another aspect which makes technology a helpful tool for positive, resource-oriented approaches is that it can provide new sensations and perspectives, providing a playground to experience how it could be. In solution-focused coaching, the confrontation with new experiences and perspectives is typically supported by different tools such as positive framing, systematic questioning and reflections on goals and solutions, role plays, sculpture techniques, scaling questions, or visualizations (Gamber, 2011; Greene & Grant, 2003; Visser, 2012⁹⁹). For example, scaling progress along a bar (see Figure 2 for an example) prevents the much-simplified differentiation between success (the goal one wants to reach) and failure (all states until that goal has been fully achieved). Instead, scaling questions allow to depict progress along a continuum, which highlights also small steps forward and acknowledges what already works well. Obviously, such visualizations can be perfectly supported by technology and many of these tools could possibly be translated into technical representations helping to intensify the client's experience related to such exercises. This goes beyond a simple

translation into a digital form. For example, moving objects on touch displays or actually "feeling" the weight of different problems (e.g., by touch resistance) can provide a more intense experience of possible alternatives than offered by pen and paper approaches or pure imagination. Hence, digital environments and interaction attributes are an interesting opportunity to vividly show and make the clients feel the own scope of action or the power of new perspectives.



The Scaling Question © 2012, Coert Visser

Figure 2. Scaling progress along a continuum (Visser, 2012). Retrieved from <https://www.progressfocused.com/2012/07/the-scaling-question-flexible-and.html> with permission.

2.5 Integrating practice in daily routines

Finally, also everyday practicing and the integration of positive activities in daily routines is an important aspect within positive psychology coaching. Such everyday

confrontation with the subject of change also increases the sensibility for progress. Sensible questioning about details of events and small indicators of change, often reveal a lot more positive progress than initially perceived by the client. Systematic and constant documentation ensures that small indicators of positive change do not remain unnoticed or are simply forgotten. In fact, especially these first tiny steps towards the solution can be essential to establish self-efficacy and motivate further progress. This is why positive psychology interventions coin early reactivity (e.g., Cohn & Fredrickson, 2010; Proyer et al., 2015).

Obviously, technology can be a valuable tool to heighten the awareness for such early positive developments by highlighting and documenting perceivable effects of one's activities to change. The smartphone and other mobile devices are already constant companions for many. Given this, they can easily be utilized as triggers for positive change and the integration of exercises into daily life. Similar to the approach of experience sampling via smartphone (Hofman & Patel, 2015), smartphones can serve as effective reminders and collect data about the event of interest in the given situation.

3 Challenges — why change is often a bitter-sweet experience

3.1 The dark side of positive goals

Per definition, the field of positive psychology is primarily concerned with the positive and valued experiences, such as flow, happiness, well-being, contentment, satisfaction, hope, and optimism (Seligman & Csikszentmihalyi, 2014). However, as we all know, also challenging or even negative emotions can be part of the progress towards an ultimately positive goal. For example, the ability to delay gratification (e.g., enjoy an ice-cream but only after taking a walk first) can be an important ingredient of long-term well-being (here: improve one's fitness and physical wellbeing). And even in a short-term perspective, strongly positive-focused interventions may not always feel solely positive for the individual. For example, Biswas-Diener (2010, p. 47, 66) points out that there is also a "dark side" of positive goals, where the imagined ideal self rather becomes a source of frustration and can make people feel dejected instead of inspired. Envisioning what will be without really feeling the ability to get there, can become frustrating. Also, the strong focus on the positive may trigger a wrong imagination of how it will feel to get there. People may expect that reaching the goal will be smooth and without any friction and they will feel happy all the time but tend to forget that change is actually hard work. Being shocked about the unexpected bitterness, this may be a reason to stop the project of change, which makes a solely positive framing of change quite risky. Hence, as already argued by others "there is clearly an opportunity to employ technology for positive change, but how this can be achieved is more difficult to determine" (Kanis & Brinkman, 2009, p. 127).

3.2 Bitter and sweet components of change

I suggest to explicitly consider the "bitter components" of change, i.e., the potential hurdles and barriers that might arise when trying to implement positive goals in daily life and the nearly inevitable confrontations with shortcomings. To have full effect,

positive technology must not stay focused on the positive alone but also support people in dealing with challenging situations (see also Sander, 2011).

On an abstract level, this idea of bitter and sweet components, is present in many theories and conceptions of learning and behavior change. One example is the role of positive emotional attractors (e.g., hopes, dreams, possibilities, strengths, optimism) and negative emotional attractors (e.g., fears, problems, shortfalls, pessimism, improvement goals) in personal change with regards to intentional change theory (ICT, Boyatzis, 2006; Howard, 2015). The optimal margin of illusion hypothesis (Baumeister, 1989) suggests a balance between an optimistic, positive view and realistic view of oneself and also the famous flow theory emphasizes the interplay of challenge and skill at the same time (Csikszentmihalyi, 1990).

In sum, we should not forget about the very nature of change: Change means doing something differently than before. Every time we do something new, i.e., a behavior that is not learnt or automated yet, this is hard work for our brain. Trying to brush your teeth with the other hand than you do normally will be an effort. This is not a sign of lacking motivation, it is because you are not used to it and it will not feel that good for the first time you do it.

When delineating positive technology interventions, we must respect human nature and we must acknowledge that change is an effort. Also, we can acknowledge that we might not invest the extra effort to do something different than before without some dissatisfaction with the current state. Hence, the bitter can also be seen as something valuable.

3.3 Key assumptions

In sum, the idea is that in order to change it needs attractors and positive reinforcement (the sweet) but no blindness for the difficulties (the bitter). Change includes sweet components like experiencing skill, possibilities, self-efficacy, autonomy, defining goals and visions, and on the way to there, rewards, in the form of positive emotions and encouraging feedback. But there is also the risk of failure, dissatisfaction, moments of disappointment and self-threat, and the confrontation with deficits, in short, the bitter components.

Possibly, many self-improvements programs may fail because they do not adequately consider the bitter side. Because people wish for a magic receipt, that just makes appear the result without the way. However, one might also critically question whether this is really what we want. If one was just fit and sporty overnight or being beamed on the Mount Everest this also mitigates all of the positive side effects of truly earned success. Without any effort, we could not feel proud or experience self-efficacy. So there are also good reasons for the conscious experience of effort – and hopefully change. Figure 3 summarizes bitter and sweet components of change and possible dynamics along the bitter-sweet continuum.

It is assumed that a wish for change often originates from the bitter experience, in other words, a discrepancy between real and ideal self. However, the interplay between bitter and sweet components is critical to change success.

If the bitter component is too dominant, no change takes place. Even if one becomes aware of a discrepancy between real and ideal self, and catches a glimpse of one's own wish for change, one may quickly close the eyes again, what I call an escape

back into the blind zone. The blind zone is a comfort zone, where the deficits becomes "invisible" again. For example, this could be to deny the discrepancy between real and ideal self (e.g., I actually like myself with this weight – this is really my ideal) or to avoid any confrontation (e.g., banning mirrors) or situations that would reveal the current state as problematic (e.g., a situation where I need to run or climb stairs and could realize that my body is not in best power).

Thus, a first critical stage for change is crossing what I call the barrier for change: A tiny glimpse of hope that the degree of bitterness seems "do-able" and one can actually commit oneself to a wish for change. This is also the starting point for the actual arena of change.

Having arrived at this point, the primary challenge lies in sustained engagement. Only if the first steps are a rewarding experience, one will enter the positive change spiral, where change becomes increasingly sweeter and further fuels the motivation to change. This early reactivity is also emphasized in many positive psychology interventions. If there is not very quickly a positive answer to your efforts, you may not continue. So in this state, the sweet components are very important, like increasing competency, feelings of self-efficacy and approaching one's ideal. All this could add to the experience of positive reinforcement.

In contrast, if one experiences the first steps of change as ineffective, one will fall back into the danger zone around the critical change barrier. If there are no perceptions of success, the perceived bitterness of change can become even stronger than before. A lack of early reactivity forms one of the most severe dangers in the process of change, which is very important to know for therapists but also for designers of technology to support change. If an intervention does not have any tiny positive effects, it is better to acknowledge this and search for another, more promising alternative rather than prevailing in the experience of ineffectiveness and possibly destroy any motivation.

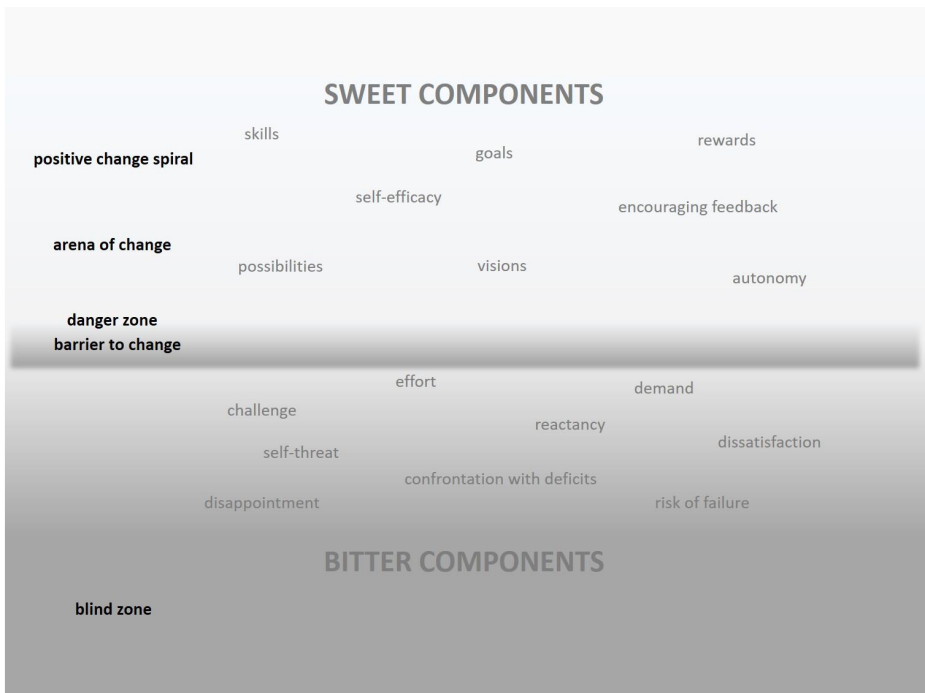


Figure 3. Bitter-sweet continuum of change (Diefenbach, 2018a). Retrieved from <https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00331/full>.

A more detailed presentation of the suggested change dynamics and possible strategies for positive change along the bitter-sweet continuum is given in Diefenbach (2018a).

In sum, the key assumptions are

- **Change always includes bitter and sweet components.** Setting goals includes the risk for failure and self-threat.
- **Change (i.e., breaking up routines) is struggling per se.** Even if the ultimate goal is to enjoy the sweet side like finally experiencing sports as an intrinsically motivating activity that actually feels good, and not as a duty, the bitter side should not be neglected.
- **The bitter can be a vehicle of change.** Without the power of dissatisfaction, the initiation of change becomes less likely.
- **Bitter and sweet components must be in a good ratio.** If the bitter is too dominant, one might rather deny the wish to change than to search for ways to get there.

- **Strategies for change should actively consider its bitter-sweet character.** Instead of solely focusing on the positive and thereby risking unforeseen consequences and backfire effects, the bitter could be rather utilized as an ingredient in change strategies. From a design perspective, this could imply thinking about factors evoking rather bitter/negative (e.g., confrontation with deficits) or sweet/positive emotions (e.g., encouragement)

In first empirical studies on the bitter-sweet model, participants' ratings of bitter and sweet factors in personal reports on change processes confirmed the relevance of both kind of factors. For example, in a study among 177 users of self-improvement technologies (e.g., fitness apps, nutrition apps, language learning apps, fitness gadgets such as step counter wristbands) it was found that both, bitter and sweet factors, were positively correlated to change success (for more details see Diefenbach, 2018a), whereby sweet factors were more important in early changes of chance success, and bitter factors became relatively more important in later phases of change. In perspective of the bitter-sweet continuum, this could mean that in the beginning, bitter factors must remain in low levels to be acceptable and initiate change at all (i.e., cross the barrier of change). Over time, users may experience that some bitterness is actually helpful and motivating to keep on going and lure for further success, and that this can go hand in hand with the sweetness and further motivation resulting from first success (i.e., enter the positive change spiral). While failure and rebounds are still frustrating, the increasing ability to cope with bitter factors may become a rewarding experience itself. This interpretation also parallels insights from learning theories and the role of positive and negative feedback loops overtime (Pekrun, 2006). Control value theory (CVT) differentiates between control appraisals, i.e., the subjective control over achievement activities and their outcomes (e.g., expectations that persistence at studying can be enacted, and that it will lead to success); and (2) value appraisals, i.e., the subjective values of these activities and outcomes (e.g., the perceived importance of success). From the perspective of CVT, the increasing importance of bitter factors over time could also indicate a change of relevant appraisals. If users become more and more capable to take advantage of a product's "bitter" demand and confrontation with deficits, this accords to an increase in control appraisals. Over time, users can be confronted with more differentiated, critical feedback, adjusted to their individual level of coping capacities. Similar to a typical therapy or coaching progress, in the beginning phases, the focus is on building up a relationship, and ensure a basis of rapport and commitment. Once this is established, one can be more critical and focus on concrete progress regarding the desired behavior change.

4 Conclusion

To conclude, I have argued why positive psychology and technology are a particular good match, supporting the general approach of positive technology from a theoretical and analytical basis. In addition, I have laid out that to be successful, the field of positive technology, and any design aimed at supporting people to change, should consider the bitter and sweet components likewise. In the end, the inherent focus on the positive will

be complemented by a more holistic view on all factors related to change, and making use of these ingredients in responsible degree.

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