Review Article

Positive Technology–A Powerful Partnership between Positive Psychology and Interactive Technology. A discussion of Potential and Challenges

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Abstract

Under the umbrella term "positive computing" concepts of positive psychology are transferred to the domain of human-computer interaction (HCI). In an interdisciplinary community psychologist, computer scientists, designers and others are exploring promising ways how to utilize interactive technology to support wellbeing and human flourishing. Along with this, the recent popularity of smartphone apps aiming at the improvement of health behavior, mindfulness and positive routines, suggests the general acceptance of technology as a facilitator of personal development. Given this, there generally seems a high potential for a technology mediated trigger of positive behavior change, especially in context of positive psychology and resource oriented approaches such as solution-focused coaching. At the same time, there is still a lack of well-founded approaches to design such technology which consider its responsible role as an "interactive coach" and systematically integrate the needed expertise of different disciplines. The present article discusses the general potential and particular challenges to support the goals of positive psychology and human desire for self-improvement through interactive technology and highlights critical steps for a successful partnership between both.

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Under umbrella terms such as "positive computing" or "positive technology" (Calvo & Peters, 2014; Calvo, Vella-Brodrick, Desmet, & Ryan, 2016; Riva, Banos, Botella, Wiederhold, & Gaggioli, 2012), increasing attention is paid to interaction design as a means to promote mental health and wellbeing and concepts of positive psychology are transferred to the domain of human-computer interaction (HCI). As pointed out by (Gaggioli, Riva, Peters, & Calvo, 2017, p. 478), the development of positive technology/computing approaches resulted from the convergence of two main trends: First, a generally increasing recognition of human values and ethical issues in the design, development and use of interactive systems, along with the User Experience (UX) trend in HCI. Second, the emergence of positive psychology and its concern for the conditions and processes behind the "flourishing or optimal functioning of people, groups, and institutions" (Gable & Haidt, 2005, p. 103), thereby providing a basis for the scientific investigation of the conditions for happiness and wellbeing. The positive technology approach aims at combining the objectives of positive psychology with technology design (Botella et al., 2012; Riva et al., 2012). Positive technologies are "designed to manipulate the quality of experience through its structuring, augmentation and/or replacement, with the goal of increasing wellness, and generating strengths and resilience in individuals, organizations, and society" (Botella et al., 2012, p. 78). The positive computing approach defines a similar aim, namely "the study and development of technologies designed to support well-being, wisdom, and human potential" (Calvo & Peters, 2012, p. 29), also mentioning the nod to positive psychology, digital therapies, and behavioral interventions. In addition and more generally it also argues for the "the inclusion of well-being and wisdom into the experience design of all technologies", suggesting that "even companies like Facebook and Apple should be evaluating how their products affect wisdom and well-being as part of the iterative design cycle" (Calvo & Peters, 2012, p. 29). Though starting from a slightly different angle, both concepts, positive technology and positive computing, are often discussed in connection by (Gaggioli et al., 2017) and along with other approaches such as "positive design" (Desmet & Pohlmeyer, 2013), "possibility-driven design" (Desmet & Hassenzahl, 2012) or "designing for wellbeing" (Diefenbach et al., 2017), all referring to the shared goal of improving wellbeing and positive experience through technology design. Thus, there is an interdisciplinary community of psychologists, computer scientists, designers and others, exploring promising ways how to utilize interactive technology to support wellbeing and human flourishing. The different approaches range from virtual environments such as "relaxation island" (Villani, Riva, & Riva, 2007) aiming for eliciting positive emotions, smartphone apps to exercise mindfulness (e.g., headspace, mindfulness daily), internet platforms for the exclusive exchange of positive thoughts (e.g., Posipost), technologies for the improvement of daily routines such as sleeping habits such as the app SleepCare (Beun et al., 2016), or, in a wider sense, interactive technology in form of daily life objects, with the explicit aim to create new meaningful experiences and higher levels of wellbeing. An example is a digital picture frame placed on the office desk with a secret space for a private and meaningful picture. This picture can be enjoyed as a little secret, thereby escaping from the working environment and fulfilling at the same time autonomy needs (Diefenbach et al., 2017). This example demonstrates that the potential of interactive technologies, or daily life objects in general, as an initiator of positive experience and wellbeing goes far beyond providing an alternative channel to transfer established trainings or exercises from face-

to-face coaching. Also, interactive technology must not be regarded as a substitute of traditional coaching, and does not necessarily need to rebuild the structure of traditional interventions. Instead, interactive technology must be understood in its potential to trigger and form the activities that humans engage in, and as a result support "healthy" routines and wellbeing in a more or less explicit sense.

Design as Wellbeing Intervention

Basically, every designed object can be understood as an intervention and a possibility to promote wellbeing (Diefenbach et al., 2017). Consequently, also healthcare providers start to acknowledge the crucial contribution of objects and room architecture for patients' wellbeing, likewise designers do understand their responsible role as initiators of human experience and health (Rehn, 2015).

In general, wellbeing heavily depends on the activities one engages in. About 40% of variance in chronic happiness scores are explained by activity, i.e. the things that people do and think about in their daily lives (Lyubomirsky, Sheldon, & Schkade, 2005). Activities can impact wellbeing in various ways, such as increasing positive emotions, behaviors, thoughts, and fulfilling important psychological needs (Layous & Lyubomirsky, 2012). Thus, a crucial question is how to involve and keep people engaged in such wellbeing-enhancing activities. While positive psychology typically works with specific wellbeing-enhancing activities, trainings and interventions (e.g., Seligman, Steen, Park, & Peterson, 2005), a complementary way is to utilize objects and mundane, everyday activities as creators and mediators of wellbeing. Many of our activities are profoundly shaped by objects, such as morning rituals depend on the coffeemaker, or intimate communication on the apps installed on the smartphone. Based on the insight that objects, and especially interactive technologies, have an enormous potential to create positive experiences, many approaches meanwhile put the experiences mediated by technology as explicit objectives of design, for example 'experience-centered design' (Wright & McCarthy, 2010) or simply 'experience design' (Hassenzahl, 2010).

In this sense, psychological research and approaches in Human-Computer Interaction and Interaction Design (HCI/ID) can be seen as two complementing sources acting towards a shared goal: The support of human flourishing and wellbeing. However, while psychological research on wellbeing was primarily motivated by the need to better understand and improve wellbeing and then afterwards identified activity as a viable mean, approaches in HCI/ID started from the general task to design technology-mediated activities and then identified positive experience and wellbeing as viable design objective (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013). It is important to note, though, that within the broad area of positive technology there is a wide range of strategies and explicitness how to encourage positive behavior. For example, the user dialogue with the SleepCare app (Beun et al., 2016) actually reconstructs coaching process models, and negotiates sleeping times with the user in dialogue style (e.g., "You suggested 6:30 – I suggest 5:30 – do you agree?"). Though users are aware that the advice given by SleepCare is essentially just an algorithm, people accept this technology as "their coach" and even report to develop a bond with it (Beun et al., 2016). Also many commercial apps in the field of practicing mindfulness, sports or healthy nutrition are actually introduced as an interactive coach (e.g., Mindfulness Coach, Freeletics.com), whereas other

interventions slip in the coaching role less explicit or represent just a general way to experience new positive routines. For example, the app Uplifter, with references to psychological research on gratefulness and wellbeing (Emmons & McCullough, 2003; Wood, Froh, & Geraghty, 2010), features positive psychology interventions such as a gratitude journal, mood tracking, daily inspiring and motivational quotes as well as a number of daily practice based on research-based happiness increasing exercises. Besides apps, which still represent some way of formal guidance to increase positive activities and emotions, also everyday objects are already part of daily routines and can be used to shape an activity as well as the consequent experience. For example, JuicyMo, a centrifugal juicer, aims at intensifying the positivity and meaning derived from the mundane activity of juicing (Grosse-Hering, Mason, Aliakseyeu, Bakker, & Desmet, 2013). JuicyMo may not formally offer its users a wellbeing coaching or program and is "just a juicer", but it aims to intensify the experiential outcome gained from an existing activity. Nevertheless, even in cases where objects or interactive technology do not explicitly introduce themselves as a coach or partner in dialogue to the user, they still can convey a message, onto which the user reacts. Given that in general, products can be considered as "arguments in material form" (Redström, 2006), positive technology becomes a "medium of therapeutic interaction", initiating a dialogue about change and ways to enhance wellbeing. "Therapeutic", of course, does not imply an exclusive focus on "serious" matters but relates to the responsibility of intervening in peoples' lives, behaviors, thoughts and feelings. In parallel to the patient practitioner relationship as an important medium and vehicle of change in psychology (Ryan, Patrick, Deci, & Williams, 2008), the emerging dialogue between product and user and its emotional and motivational consequences also appear as a central link between psychology and technology design for wellbeing.

In sum, all the above technologies and many more can be seen as examples of "design as wellbeing intervention", establishing specific activities and a dialogue with the user through objects. Given this, there generally seems a high potential for a technology mediated trigger of positive behavior change, especially in context of positive psychology and resource oriented approaches such as solution-focused coaching (Bamberger, 2011; Greene & Grant, 2003). At the same time, there still is a lack of well-founded approaches to design such as technology, to consider its responsible role as an "interactive coach" and to systematically integrate the needed expertise of different disciplines. As already formulated by Kanis and Brinkman (2009, p. 127), "there is clearly an opportunity to employ technology for positive change, but how this can be achieved is more difficult to determine".

Outlook and Objectives

The present article discusses the general potential and particular challenges to support the goals of positive psychology and human desire for self-improvement through interactive technology and highlights critical steps for a successful partnership between both. In particular, the present analysis focuses on the potential and challenges of technology design linked to positive psychology coaching, which combines the knowledge from positive psychology with the practice of coaching. Note, however, that this is not the only strategy which can be used to deliver positive technology-based interventions. It rather represents a particular lens within the broader idea of positive technology as

the scientifically-informed design and delivery of mediated experiences that promote positive change.

While the potential of technological devices as a digital coach/partner to support psychological, physiological health and self-regulation/learning has already been explored in different contexts and application domains in HCI and psychological research (Bouvier, Hinz, & Schmidt, 2016; Monkaresi et al., 2013; Niess & Diefenbach, 2016), and especially has been highlighted in contexts of optimistic or utopian perspectives of technology (e.g., Negroponte, 1996; Robertson, 1998), the present work expands these by also taking a critical view, and initiates a parallel discussion of potentials and challenges. More specifically, it asserts central concepts and principles of positive psychology related to positive change and explores which current technology offers to them, thereby trying to form a psychologically-sounded theoretical background for the partnership between positive psychology and interactive technology.

The following sections first list a number of specific potentials of positive psychology and resource-oriented approaches, which make them appear as particularly suitable for interactive technology support. After this, existing challenges and shortcomings that need to be considered for a helpful utilization of technology design as wellbeing intervention are highlighted. The conclusions section discusses the most central steps for a fruitful interdisciplinary collaboration in the field of positive technology and outlines a first suggestion for a framework of design for positive change.

Potentials

There are numerous potentials of positive psychology and resource-oriented approaches, which make them appear as particularly suitable for interactive technology support:

Humanistic view on human behavior, general belief in humans' desire and potential for personal growth. A first important fundamental is the humanistic view on human behavior, including a general belief in people's desire and capability to strive towards their ideal self. Based on this view, it is also assumed that people will appreciate and utilize the opportunities for personal development provided by their environment, which may also include potentials provided through technology. The reliance on people's wish for self-improvement and their desire for positive change also builds the basis for approaches such as realized by the above mentioned app SleepCare and the negotiation about sleeping times in a coaching dialogue. The "digital coach" advices the user what amount of sleeping time would be good for his or her long term wellbeing, but leaves it to the user to decide in the end. Such an open dialogue, with the free choice for the user, would hardly make sense if one sees the user as a being that only is able to change if forced to do so. Humanistic approaches to behavior change see change as a function of autonomous motivation (e.g., Ryan et al., 2008), being built on the utilization and revelation of the clients' individual resources (e.g., Bamberger, 2011). The crucial elements, however, are 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.

Though the humanistic view is mainly a conceptual aspect, in the sense of a basic presupposition underlying the idea of supporting voluntary change, a related and empirically studied approach in the field of HCI is that of "transformational technologies" (Hassenzahl & Laschke, 2015; Kehr,

Hassenzahl, Laschke, & Diefenbach, 2012; Laschke, Hassenzahl, Diefenbach, & Tippkämper, 2011). Transformational technologies not only offer ways for self-improvement and support people in their wish to transform, but also place a crucial emphasis on the active role of the individual in the process. Their aim is to engage their users into a playful "dialog loop" about their current Self and potential alternative Selves (Kehr et al., 2012). The approach of transformational technologies has been applied and empirically explored in quite different domains of personal goals such as avoiding procrastination, enhancing physical activity, training self-regulation, or environmentally friendly behavior (see (Hassenzahl & Laschke, 2015) for an overview). Independent from the domain, users explicitly valued and expressed the sensed autonomy and even felt motivated as they felt it was their own will to change. For example, in a field study of the "shower calendar to save water" (Laschke et al., 2011), its users emphasized how important it was that the specific goals were set by oneself and not coerced or demanded by the technology.

Indication independent, no need for detailed insights and analysis of past traumas. Also the future-oriented focus on the positive and possible solutions, rather than on problems and supposed causes of problems in the past, is central for the idea of technology as a mediator of positive change. Also clinical studies suggest support for the indication independent approach of systematic approaches such as solution-focused coaching, showing equal or even better effectiveness of systemic therapy (indication independent) compared to psychodynamic or analytic therapy, in different areas such as (e.g., trauma therapy (Lau & Kristensen, 2007), depression therapy (Knekt & Lindfors, 2004; Knekt, Lindfors, Sares-Jäske, Virtala, & Härkänen, 2013)). Of course, this indication-independent view makes it much easier for technology to set helpful triggers, than if a full analysis of reasons in the past was needed, as for example suggested by psychoanalytical approaches. Instead of an exploration of past traumas and why things developed to the current state, positive psychology and resource-oriented approaches put an emphasis 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. Though positive technologies can and should not replace face-to-face coaching, the future-oriented view and the focus on systematic schemas to reveal solutions are an important prerequisite to generally consider technology as a potential to deliver a helpful perspective towards positive change.

Appreciation of the client/user as expert. Also the client-as-expert view in positive psychology and solution-focused coaching is well compatible with the idea of technology-supported change. In contrast to a psychoanalytic line of thinking, which emphasizes the therapist's personal expertise and interpretation of the patient's reports, and works with phenomena such as transference and countertransference in therapist-patient communication, solution-focused approaches allow a dialogue at eye level, whereby the coach rather takes on the role of a companion. This is also reflected by definitions in the existing literature, denoting the coach as an agent of change and moderator of development (Hermer, 1996), an assistant for self-management (Kanfer, Reinecker, & Schmelzer, 2006) or a supervisor of interaction with the outside world (Schmidt, 1996). Basically, these are role definitions which might also be applicable for a technology, compared against the role of an analytical psychotherapist, whose personal experience and interpretations are considered as central for opening up a way to improve the client's wellbeing. Again, this aspect parallels the above

mentioned approach of "transformational technologies", which assists users in their wish for personal change and transformation, but deliberately assigns a responsible and active role to the user (Hassenzahl & Laschke, 2015; Kehr et al., 2012; Laschke et al., 2011). Though there is "agreement" between user and product about the wish for change, the user is not patronized but retains "expert" for his or her individual way of change. The product trusts the user to choose the individually appropriate dose and speed of change at a particular point in time. As empirical studies of such transformational products in the field showed, users appreciated such room for autonomous decisions and reported an increase in perceived self-control over time (Kehr et al., 2012). In parallel to the client-as-expert view in solution-focused coaching, the user is the one who actually initiates change and experiences the feeling of "I can do it". The technology is a supporter but never takes a patronizing or superior attitude (which might actually cause reactancy).

Appreciation of new experiences and new perspectives, providing a playground to experience how it could be. Another aspect which makes especially positive, resource-oriented approaches suitable for the support through technology is the typical "tool set" of positive approaches, including, for example, positive framing, systematic questioning and reflections on goals and solutions, role plays, sculpture techniques, scaling questions, visualizations and working with metaphors and images (Gamber, 2011; Greene & Grant, 2003). Many of these tools could possibly be translated into technical representations such as online interventions, apps or even gameful approaches. In the simplest form, mobile apps and other representations could trigger helpful perspectives and reflections through interface design, menu titles, or visualizations.

Moreover, interactive technologies provide additional opportunities to intensify the client's experience related to such exercises: They use digital environments and interaction attributes to vividly show and make the clients feel the own scope of action or the power of new perspectives. For example, this could include showing "problem constellations" from different angles (e.g., visualizations) or using touch parameters (e.g., moving resistance of objects on a touch display) as representations of psychological effort related to "heavy" accuses, "heavy" problems, or "high" barriers. Likewise, the sum of moments of gratefulness throughout the day or the amount of positive emotions gained through beneficial activities could be represented in a more impressing and motivating manner by visualizations that emphasis the clients' contributions and the progress achieved. Also, the opportunities of technology to change perspectives in an easy way could be utilized to vividly demonstrate the consequences of a problem focus, and to provide the feeling that it is to some degree in the users hands, how dominant a problem appears and whether alternatives are in visible range. In a gameful application using a touch display this could be represented by the metaphor of a "problem wall". When standing right in front of the problem, one sees nothing but the problem and overlooks all the alternative ways and thereby the possible solutions around it. However, by performing a zoom gesture on the touch display (typically expand fingers to zoom in, move thumb and index finger towards each other to zoom out), one can actually experience the consequences of zooming in and out of a problem, the opportunities to change the perspective and explore diverse paths of positive change. Thus, promising experiences in the general use of digital environments or virtual reality in psychological therapy (Gaggioli, Gorini, & Riva, 2007), could be enhanced by a more deliberate use of the design of the interaction itself. Given that basic interaction

attributes (e.g., slow-fast, gentle-powerful, stepwise-fluent) also convey meaning (e.g., slow: significance, calming, accuracy, care, appreciation, relaxing vs. fast: animating, activating, efficiency, expression of willpower, see (Lenz, Diefenbach, & Hassenzahl, 2013) for a detailed overview), such relations between interaction attributes and experience can also be used as a supporting element in positive technology design with the aim to support a particular experience in the client.

Integration in daily routines, practicing new routines in everyday life. Besides the dialogue between coach and client in face-to-face sessions, an important aspect within positive psychology coaching is the client's everyday practicing and the integration of positive activities in daily routines. Again, interactive technologies provide a useful channel for support. 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. Through their omnipresence, they can serve as effective reminders and collect ratings right in the situation, similar to experience sampling via smartphone (Hofmann & Patel, 2015). The repetitive engagement in positive interventions throughout the day can also increase the sensibility for progress and change. Like many practitioners in coaching report, sensible questioning about details of events and small indicators of change, often reveals a lot more positive progress than initially perceived by the client. If not systematically and constantly documented, small indicators of positive change remain often unnoticed or are simply forgotten. However, especially these first tiny steps towards the solution can be essential to establish self-efficacy and motivate further progress. Consequently, early reactivity, i.e., a rapid increase in positive emotions after starting an intervention, is also discussed as a vital factor for successful positive psychology interventions (Cohn & Fredrickson, 2010; Proyer, Wellenzohn, Gander, & Ruch, 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. Nevertheless, it must be noted that tracking or documentation of a "goal behavior" (e.g., moments of thankfulness, physical activity) does not necessarily create meaningful insights or positive emotions. A study by Epstein, Cordeiro, Bales, Fogarty, and Munson (2014) within the "self-tracking" community revealed that many self-trackers fail to seek meaningful and actionable findings from their self-tracking data. In consequence, the authors developed different types of processing and presentation of such data (so-called "visual cuts"). A user study showed that such high-level visualizations helped users to discover crucial influencing factors and enhanced the experience of making progress towards one's goals. Though the study by Epstein et al. (2014) focused on physical activity, the authors believe that many other potential goals can be supported through similar high-level visualizations. Thus, besides providing an infrastructure for the continuous documentation of positive change within daily routines, the potential of technology also depends on the adequate representation of such data.

A playful, lightweight way of reflection on personal strengths and potentials for change. Finally, interactive technologies provide a lightweight opportunity for a first reflection on personal change. Using an app, for example, provides a lower barrier than consulting a human coach or participating in an organized program (e.g., mindfulness training). Of course, the higher commitment related to the latter options also has some therapeutic value and might improve the chances for staying

committed and pursue personal goals in the long term. At the same time, consulting a coach or an organized training is always a confession of not being fully satisfied with the status quo. By seeking professional support, one enters a potentially uncomfortable situation that may include the confrontation with one's own deficiencies and moments of self-threat, with no guarantee for success and yet unknown outcome. A challenging situation, which, for some people, might appear too threatening or just too time consuming. For those, the noncommittal use of positive technologies can provide a lightweight entry into self-reflection and positive change. Often, after first positive experiences have been gained and the self-reflection has lost its threatening potential, it is much easier for people to commit to further change, and maybe even try out alternative and more intense approaches. Such initial, noncommittal attempt to find solutions, before deciding whether one wants to pursue this path further, is also referred to as "tentative change" in solution-focused coaching (Greene & Grant, 2003).

Challenges

Besides the general potential of positive technology, however, there are also particular challenges and shortcomings within current approaches of technology-mediated support of wellbeing and positive change.

Finding the right communication between coach/technology and client/user, designing a sensible "therapeutic dialogue". As outlined above, if taking the position of positive technology as a coach seriously, also the interaction between technology and user must be sensibly designed and adjusted to the requirements of a "therapeutic dialogue". Just like a human coach, also technology needs to find the right communication. This can refer to verbal formulations such as dialogue boxes or instructions in exercises, or elements of implicit communication through interaction dynamics. For the latter, the following questions could be relevant: Who starts the "conversation" – is it the user who consults the technology or the technology that remembers/instructs the user? Who defines the process of interaction – is there a predefined standard program or can the user adjust a program to his or her special situation, and thereby participates as "expert" for him/herself? Who judges the user behavior – is there a predefined categorization such as good/green and bad/red activities or is there a more flexible and ambiguous categorization scheme that leaves room for individual judgments? For a similar discussion around the expressiveness of design elements as materialized arguments in behavior change technologies in the context of environmental behavior see Laschke et al. (2011).

However, many of the existing commercial self-improvement technologies seem to not acknowledge the aspect of communication sufficiently. As recent studies showed, users of self-improvement technologies (e.g., sports apps, mindfulness apps, activity trackers) are quite sensible for the established communication through interaction and even discriminate between different communication styles, characterizing the technology as demanding, strict, friendly, or supportive (Niess & Diefenbach, 2016). Moreover, the perceived style of communication significantly relates to change success (Diefenbach, Niess, & Mehner, 2016). If users feel not well supported through the technology, this can even lead to cessation and giving up the personal endeavor for change. In fact, in a field study a considerable ratio of users stopped using the technology before making significant progress, due to not feeling well supported (Diefenbach & Niess, 2015). For example, users

complained about the product as being "too dominant", "bossy", "demanding", or "stubborn" and negative emotions while using the product (e.g., "made me constantly feeling guilty", "was getting on my nerves").

Reaching the actual target group, i.e., those who want to change but require support in how to change. While all people probably will profit from approaching their ideals, positive technologies, as well as face-to-face coaching, seem particularly helpful for those who have difficulties in implementing them on their own initiative. However, many behavior change technologies put a high load of self-discipline on the user and seem rather adjusted to those, who already are quite successful in their personal change projects. A helpful taxonomy to reflect on the primary target group, which might be looking for support through positive technology is provided by Stibe (2016), who differentiates between three types of persons: the "self-driven", with comparatively high levels of motivation and skills for self-improvement, the "self-contained", who are satisfied with who they are and not motivated to change, and the "January 1st", i.e., people who would like to change their routines, but rarely succeed in doing so. For the latter, support provided through positive technology could make the crucial difference in actually realizing their endeavor to change, so that these could be considered as the main target group of positive technologies or technologies for behavior change in general. Unfortunately, many of the existing approaches are not ideally adjusted to the self-doubts, motivation and self-regulation problems of the typical January 1st user but rather address the self-driven, who are already passionate and successful in self-optimization. For example, an analysis in the field of mobile health interventions (Yang, Maher, & Conroy, 2015) showed that many existing technologies support intentional self-change through reminders and feedback, and are primarily acknowledged by already active people. In contrast, those who could profit the most (e.g., insufficiently active people), showed as highly sensitive to user experience issues and especially hesitant towards technology as a means for behavior change.

Disregard of the actual potential of digital technology to create helpful insights and experiences through interactivity and dynamic elements. In general, the potential of technology is not yet very established in the field of positive psychology and wellbeing research, which repeatedly has been critiqued by advocates of positive technologies. For example, the article about "The Present and Future of Positive Technologies" by Botella et al. (2012, p. 82) remarks that "Curiously, existing PP [Positive Psychology] manuals do not include a single chapter on the important impact ICTs [Information and Communication Technologies] can have in this field." Besides, even if technology is considered as a channel to support positive change, there is still a disregard of the actual potential provided through interactivity and dynamic elements and only a limited number of utilized technologies (Baños et al., 2017; Mohr, Burns, Schueller, Clarke, & Klinkman, 2013). The actual potential of interactive technologies, namely using the digital environment as a playground to experience how it could be and support the experimentation with new perspectives or reflections through actually "feeling" or "seeing" these in a digital environment (as outlined above in section 3), is not exploited. Instead, established exercises are often just transferred in written form and the potential of technology is reduced to an alternative way of distributing content. As formulated by Mohr et al. (2013, p. 336) "Much of the development of BITs [behavioral intervention technologies] to date has either attempted to adapt accepted intervention paradigms such as cognitive behavioral therapy (CBT)

through new media, such as Web-based CBT, or has adopted new technologies such as SMS to engage patients based on common sense approaches", and further attesting that "current theoretical models are inadequate to inform the development of BITs that can increasingly interact dynamically and adaptively with users."

Disregard of psychological perspectives within the design and conceptualization of technology. While psychologically-based interventions delivered through technology often disregard the actual potential of interaction dynamics, the same occurs the other way round: Many commercial self-improvement technologies are mainly technology-driven and do not make use of psychological knowledge, even though operating in the sensible domain of behavior change. As reported by Conroy, Yang, and Maher (2014, p. 649). "Approximately one in five smartphone users utilize at least one software application (app) to support their health-related goals […but] these apps tend not to be grounded explicitly in theories of health behavior, and the vast majority of commercial apps have not been evaluated using scientific methods". While digital interactive environments provide a valuable potential for the support of positive behavior change, it still requires psychological expertise to use this environment in a beneficial way. There seems to be a general risk to consider interactive technology as a superweapon to initiate any desired development, but thereby neglecting the emerging dynamics in detail. A similar situation presents itself in the area of gamification, i.e., the application of playful elements to trigger and support a desired behavior in "serious" contexts, as for example, health, work, finance, education or sustainability. Though, there generally exists still a high enthusiasm about the possibilities of gamification. The research community also started to critically scrutinize the actual effects of specific gamification elements (Deterding, 2014), by partly revealing dysfunctional effects, supporting behavior change in the opposite direction than intended, so-called paradox effects of gamification (Müssig, 2017). For example, a user study of the gamified task manager Habitica (habitica.com) – a digital environment for task management, using the advertising slogan "motivate yourself to do anything" – identified a number of design elements that either demotivated positive behavior or motivated/rewarded negative behavior (Müssig, 2017). Often, these were related to a disregard of psychological consequences and a lacking representation between digital and real world. For example, especially in times of extreme productivity when a lot of tasks are fulfilled, users often did not find the time to check off tasks in Habitica, or only after midnight. Habitica, however, already counted this as a failure. In consequence, users got punished by the system especially when they were highly productive in the real world (demotivation of positive behavior). On the other hand, the system's reward structure suggested that even small, almost ridiculous tasks (e.g., tooth brushing, doing the dishes) can be defined as to do and consequently get rewarded in Habitica. This, however, took a lot of time and shifted attention away from the important tasks, for which procrastination actually was a problem. Also, it showed that the reward structure motivates users to delay tasks which they could fulfill spontaneously to the next day. This was to "save" unfulfilled tasks to earn rewards, which in effect supports procrastination rather than getting things done (motivation of negative behavior).

Disregard of the potential tension between humanistic and effectiveness oriented approaches. On the one hand, the humanistic view on human behavior and the reliance on humans' ability for self-regulation build one of the fundamentals of positive psychology interventions and make it a

particular suitable starting point for the support through interactive technology (as outlined above). Building on this view, there is no need for coercion to change, strong control or strict rules, relying on the fact that users will use the chance of support to reach their personal goals to their own best. On the other hand, changing routines is always hard work and a high level of self-discipline is required – particularly if no human coach is present, but just a piece of technology which can be easily ignored. If the technology intended to support behavior change does not even use elements such as coercion or strict instructions, the ability required to push yourself and actually stay committed gets even higher. In effect, this level might only be reached by the "self-driven" people mentioned above, with comparatively high levels of motivation and skills for self-improvement.

For example, a similar pattern was revealed in a study on the real-world use of an activity tracker over a ten-month-period (Gouveia, Karapanos, & Hassenzahl, 2015). In effect, it showed 'readiness' to behavior change as an important predictor of the continued use of the tracking device. For users who were strongly motivated to change, the tracker offered a structure to facilitate their goal pursuit. In contrast, users with lower motivation per se, interacted only very briefly with the tracker and showed no interest in their own historical data. Despite the crucial relevance of their own motivation and engagement, many people have high expectations about the effectiveness of self-improvement technologies. Not only designers but also users often regard it as a superweapon, supposing a degree of guaranteed change. Even if this is due to their own undisciplined usage, if little progress happens, users get frustrated and disappointed about the technology, which could not help them.

In contrast to a digital coach, a human coach might foresee critical developments more easily. A human coach, equipped with sensibility for the clients' current state of motivation, is aware of what the client might need to activate the personal resources in terms of taking the next step. As such a human coach can dynamically react to waves of motivation and individually adjust the kind of support required in this situation. For a technology, such kind of dynamic support is much harder to deliver and can only be realized in parts (e.g., by surveying current states of motivation). In the worst case scenario, the technology provides an advice which is perceived as absolutely inappropriate by its user. If a digital coach provides the same "encouraging" comments after each training or lesson, no matter how successful it was, the user's actions become at some point meaningless. Also the "motivational quotes" provided by many fitness apps (e.g., "Be the type of person you want to meet", "I am not here to be average, I am here to be awesome!" Runtastic) can appear inappropriate if the users did not reach what they intended to and can therefore not establish any relation between the over self-confident attitude and the current inner feelings. Especially for the primary target group of such technologies, i.e., January-1st-Users, an always positive, benevolent attitude ("you are the expert …. the technology only makes suggestions, but you will know how to use these and what is good for you") this initial motivation might not be sufficient to initiate change. Even though technologies should not patronize or force the user to change, it is essential to include sufficient triggers that can actually induce breaking off routines and clear implementations beyond the level of vague intentions.

An example of "materialized implementation intentions" is the concept Keymoment, whose aim is to support users in their wish for more physical activity and prefer the bike to the car (Laschke, Diefenbach, Schneider, & Hassenzahl, 2014). Instead of communicating the simple plan of taking

the bike and not the car, this plan is materialized by an interactive technology. The Keymoment is a simple box-shaped key holder mounted on the wall next to the front door. It holds and presents the bike and the car key, side by side, but on separate hooks. This frames the moment of grabbing the keys when leaving the home as a choice: bike or car? If the bike key is taken (the "right" choice), nothing happens. But if the car key is taken, Keymoment chucks out the bike key, which then drops to the floor. Obviously, the user could ignore this and just leave it lying there. However, most people do not like things lying on the floor. Holding the car key in one hand, they pick up the bike key with the remaining free hand. Through this, they literally "pick up" their intention to ride the bike more often. Keymoment thus creates a quite tangible moment of choice, interestingly after a routine against one's good intentions (i.e., taking the car key) has already been executed.

In line with psychological research, underlining the complementation of abstract goals with concrete implementation intentions as key to behavior change (Gollwitzer, 1999), technologies such as Keymoment provide a possible way of material representation of personal goals within daily routines, that can be critical for actually performing behavior in line with one's personal goals. Thus, an important aspect for the conceptualization of positive change technologies seems to find a sensible integration in routines and to consider the potential tension between humanistic and effectiveness oriented approaches for the conceptualization of positive change technologies.

Disregard of potential backfire-effects, the so-called "dark side of positive goals". Finally, and related to the previous aspect, a central challenge within the conceptualization of positive technologies is to find the right level of "positivity". Not only that a too optimistic view on the users' ability to change might not be helpful for actually delivering the needed regulation and decisiveness to change, but also can the sole focus on the positive be dysfunctional. As described by Biswas-Diener (2010), positive psychology interventions can "backfire" and positive goals reveal a "dark side", where the imagined ideal self becomes a source of frustration instead of motivation, and evokes anxiety rather than hope and inspiration. Contrasting the "real you" against the "ideal you" provides crucial feedback for the personal change process and illuminates areas for growth, but at the same time, it can cause people to feel dejected instead of inspired (Biswas-Diener, 2010, p. 47). Indeed, this is to some degree related to any process of change – in most cases, a wish for change is inspired by the insight that some aspect is not considered as ideal yet. However, especially in the sensible domain of personal change and development, closely related to potential self-threats, it is important to be aware of this double-edged effects of positive interventions.

Even if goals per se are positive and considered as worthwhile to follow, the confrontation with these goals all at once can be overwhelming. A similar effect was described by several users in the above cited study of the gamified task-manager Habitica (Müssig, 2017): The confrontation with the large sum of self-set plans caused problems to relax and put them into a mode of "blind" task execution, losing the balance between pragmatic tasks and emotionally meaningful activities. As one participant explained: "As soon as I had defined a new task, I felt the urge to complete it immediately, just to 'clean up' my to do list in Habitica. Thus, instead of spending time with my family, I spent Christmas morning doing the tax declaration for my sister." Another participant explained that through the constant mental confrontation with the activities she had defined as bad habits in Habitica, she actually felt more tempted to engage in those, which additionally boosted the

experienced conflict between "virtues and vices". The conceptualization of technologies for positive change thus requires a frame where also the "bitter" parts related to any change process can be considered and might even be utilized as a motor for positive change.

Conclusions

In conclusion, the field of positive technology offers numerous promising opportunities for the enhancement of human flourishing and wellbeing. Yet, we must be aware of the restrictions and boundaries such an approach comes with, including general limitations and critical aspects of implementing technologies with the intent to support "positive change", not least from a philosophical and ethical point of view.

As already discussed in Feenberg's critical theory of technology (Feenberg, 1991, 2005) as well as its application within the context of design philosophy and processes (Feng & Feenberg, 2008), underlying values and assumptions are critical to the design and construction of a given technology, and historical choices as well as cultural assumptions about technology itself shape the design process. Critical theory emphasizes the general impact of technology on people's everyday life and wellbeing. Thus, the approach also highlights the power of those who design the technology, turning technology design into a clearly political matter (Feenberg, 2005). This resulting argument increasingly gains relevance as all life domains become more and more technology-mediated. As critical theory argues "the real issue is not technology or progress per se but the variety of possible technologies and paths of progress among which we must choose" (Feenberg, 1991, p. 3). Each design decision and designed technology embodies a particular set of values which the critical theory demands to "articulate and judge [these values] in a cultural critique of technology." (Feenberg, 1991, p. 3).

Such considerations are particularly interesting in the present field of focus, i.e., the sensible domain of behavior change, here approached through the combination of the foundations of positive psychology and interactive technologies. Obviously, the expressed ideas for technology design reflect particular values and assumptions. These include assumptions about human nature as well as the nature of technology, here, the humanist view of man and the idea of technology as a possible helpful coach. Such basic assumptions are critical for what is generally considered a human desire or a positive change, for what is helpful to achieve such change and, in return, for to the way design technology facilitates positive change. However, these are all set presuppositions and one can never arrogate designing absolutely in line with people's "true" needs or in the sense of positive change. Thus, varying attitudes towards human nature and respective beneficial changes might lead to the design of quite different kinds of technologies. Besides, even if one considers a particular experience as positive and defines it as a design goal, one cannot directly influence and design the experience itself. Instead, one can only design *for* an *intended* experience, i.e., increase the likelihood for an experience to happen when interacting with the technology (Hassenzahl, 2013). As such, the present discussion also hints at the sensible relation between technology design and the wish to support "positive change" on a more general level.

However, even by setting aside such fundamental reflections, and considering that people generally seek for positive change and accept technology as a possible means for support, there will

still be more or less helpful ways of operationalization. Furthermore, there remains a number of more fine grained and specific issues that require close consideration in order to establish a powerful partnership between positive psychology and interactive technology. Based on the above analysis of potential and challenges related to positive technology, the following aspects appear as most central for a future agenda of research and cooperation.

On the highest level, a more systematic connection of the expertise of different disciplines is required. This pertains to connections between psychology and HCI/ID in both directions: A psychologically-founded conceptualization of design strategies is required, as well as an interactivity-utilizing conceptualization of psychological interventions. In other words, technology needs to be designed in a way that it establishes a helpful and motivating dialogue with the user, by incorporating psychological mechanisms and long gained expertise in face-to-face coaching. However, the special potential of interactive technology goes far beyond a simple copying of exercises from paper booklets to digital environments, as such this potential needs to be systematically considered. For each applied psychological principle, e.g., encouraging new perspectives on daily life problems and challenges, or recollecting moments of gratefulness through the day, technology design experts could advise how the envisioned experience on the clients' side may be additionally supported through interactive or dynamic elements within the applied digital environment. The above listed suggestions, referring to a representation of the relative weight and value of problems and positive activities that one engages in through touch parameters, or experiencing more or less problem-focused perspectives through zoom-in/zoom-out gestures, are just some examples of possible operationalizations.

On a content level, an important prerequisite for such a more systematic integration of interdisciplinary expertise is the common understanding of "design as intervention" and the responsible role of technology as an interactive coach. If the emerging dialogue between technology and user is regarded with the same sensibility as the therapeutic communication and the patient practitioner relationship in face-to-face settings, design decisions about more or less helpful elements can be made on a more profound basis. This also implies an explicit consideration and active acknowledgement of the bitter-sweet character of change.

When focusing on positive psychology, especially the latter bears special relevance. Though the reliance on humans' desire for self-actualization and personal growth builds one of the strong fundamentals of positive psychology, also positive psychology coaches have the experience that the implementation of positive routines and intentions for self-improvement remains a challenge. Interactive technology can assist in this endeavor and push personal goals to the front, animate more persistent goal attainment and remember the user who he or she actually wants to be. However, this requires a high sensibility to address humans' wish for change in such a manner that is actually experienced as strengthening self-efficacy and goal attainment and not as a discouraging confrontation with one's deficiency. In a simplified representation, it requires the right balance between bitter and sweet components to motivate change. So, while generally helpful and possibly more suited than any other psychological strand as a starting point for the design of wellbeing technology (see section 4) there are also specific challenges within the focus on the positive and the reliance on peoples' ability for self-driven improvement. Besides the prevention of backfire effects,

where the imagined ideal self becomes a source of frustration instead of motivation, another challenge is to provide sufficient structure and guidance, even without the support of a human coach that intervenes. While the low threshold related to "seeking advice" from interactive technology generally forms an advantage in the sense of a lightweight possibility for self-reflection, technology also provides a low barrier to quit the personal change project and taking care for one's own wellbeing.

To address the above listed aspects and conceptualize positive technologies in a responsible way, also more theoretical and practical approaches, which explicitly address the cooperation of different disciplines are required. A common frame for different disciplines involved in the field of positive technology is required to delineate relevant relations to psychological theory and mechanisms, and at the same time provide concrete starting points for design and the utilization of technology to support change. It also requires more elaborated approaches about how to "translate" concepts from one discipline to another, as for example, how to consider psychological perspectives in interaction design.

The "bitter-sweet"-concept as a proxy for the ambivalence of change forms a first suggestion in this direction (see also Author, 2017). This strongly simplified representation of change processes and the inherent bitter (e.g., risks of self-threat, frustration) and sweet (e.g., progress, motivating visons) components, allows to delineate users' current position within a change process, relevant psychological forces and mechanisms, the most needed kind of support, and related design strategies. For example, an "alternative connotation of the bitter", related to psychological concepts and coaching techniques such as positive re-framing, de-medicalization, tentative change or scaling questions to relativize problems (Gamber, 2011), could be realized through different elements of interactive technology, such as labels, visualizations, game-like interpretations of change processes as for example a "wellbeing treasure hunt". However, more important than the specific labels, such as bitter or sweet, is the joint endeavor of supporting people in their personal development and wellbeing which requires the possible interdisciplinary synergies to be recognized and used to full effect.

Altogether, it has to be noted that the present discussion about the partnership between positive psychology and interactive technology is still primarily on a conceptual level. Though most of the listed potentials (and challenges) can be connected to empirical explorations or related concepts in HCI (e.g., transformational technologies, paradox effects of gamification) and/or psychology (e.g., early reactivity, implementation intentions), a systematic empirical exploration, of the potential of interactive technology in the field of positive psychology is an important aspect for future research. The present conceptual approach, providing a structured overview of the potentials and challenges of positive technology, hopefully forms a helpful starting point and frame for more intense and systematic research into each of the addressed issues. This will help to a more complete picture and eventually a better design of technology – aligned with peoples' psychological needs and promising ways to wellbeing.

Declaration of Conflicting Interests

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