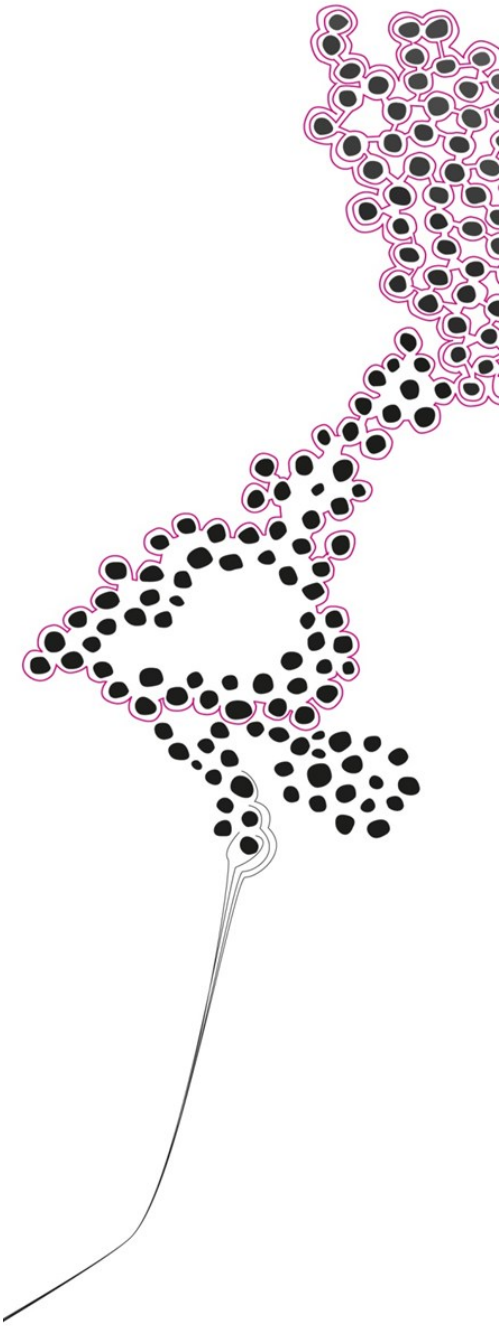

Positive Psychology Apps providing self-help exercises to promote well-being:

A systematic review

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Abstract

Background: Today, many apps are available aimed at the promotion of well-being. However, not much is known about the quality of those apps. Therefore, this study aimed to explore the availability and quality of current positive psychology apps providing self-help exercises to improve well-being. Quality was assessed with regard to the following criteria: (1) theoretical background and (2) incorporation of persuasive design principles. ***Methods*:** A systematic review framework was applied to the search and assessment of apps available in the German iOS app store providing self-help interventions to promote well-being suited for the general population. After checking several in- and exclusion criteria, 16 apps were finally assessed. A theory-based content analysis was conducted using a coding scheme in order to evaluate the theoretical background of the apps. This coding scheme was developed based on literature research indicating which factors contribute to well-being and which interventions or exercises were already proven to be effective. The analysis of the incorporation of persuasive design principles was based on the persuasive system design (PSD) model by Oinas-Kukkonen and Harjumaa (2009). ***Results*:** Apps included on average two evidence-based self-help exercises that promote well-being and three elements of Seligman's well-being theory (PERMA). The element positive emotions was included most, whereas engagement was used the least. Persuasive design principles were moderately employed, ranging from 5 to 19 included elements per app. Principles of the category primary task support were most commonly used, whereas principles of the social support category were the least used ones. ***Conclusion:*** The quality of the theoretical background of the apps seemed to be good, since they widely included evidence-based exercises and elements of PERMA. However, areas of improvement were identified. App developers should put effort into the development of apps that train important competences such as using personal strengths and coping with setbacks. Apps should further provide exercises that are more tailored to the user. Finally, the recommended dosage of self-help exercises should be more taken into account.

Keywords: Positive Psychology, mobile applications, mHealth, well-being, systematic review

Samenvatting

Achtergrond*:** Tegenwoordig zijn vele mobiele applicaties beschikbaar die zich richten op het bevorderen van welbevinden. Er is echter niet veel bekend over de kwaliteit van deze apps. Doel van dit onderzoek was daarom het exploreren van de beschikbaarheid en kwaliteit van mobiele positieve psychologie apps die zich richten op het bevorderen van welbevinden in de algemene bevolking. De kwaliteit van de apps werd geëvalueerd op basis van de volgende criteria: (1) theoretische achtergrond en (2) inclusie van persuasieve design elementen. ***Methoden*:** Een systematische review was toegepast op het zoeken van relevante apps in de Apple App store. Na het controleren van diverse in- en exclusiecriteria zijn er uiteindelijk 16 apps meegenomen in de evaluatie. De theoretische achtergrond van de apps werd geëvalueerd door de inhoud van de apps te coderen. Daarvoor was op basis van literatuuronderzoek een coderingsschema ontwikkeld dat theorieën over het bevorderen van welbevinden en effectief gebleken oefeningen bevatte. ***Resultaten: De theoretische achtergrond van de geëvalueerde apps lijkt goed te zijn, omdat de apps gemiddeld twee effectief gebleken oefeningen en drie elementen van Seligman's welbevinden theorie (PERMA) bevatten die bijdragen aan het bevorderen van welbevinden. Het element positieve emoties was het meest gebruikt, terwijl het element engagement was het minst geïncludeerd. Persuasieve design elementen werden middelmatig gebruikt, variërend van 5 tot 19 elementen per app. Principes uit de categorie primaire taak ondersteuning werden het meest gebruikt, terwijl de categorie sociale ondersteuning werd het minst geïncludeerd. ***Conclusie:*** De theoretische achtergrond van de apps lijkt goed te zijn, omdat ze evidence-based oefeningen en PERMA elementen bevatten. Echter werd ook ruimte voor verbetering geïdentificeerd. Het zou mooi zijn, als app ontwikkelaars meer moeite steken in het creëren van apps die belangrijke competenties aanleren zoals het gebruik maken van persoonlijke sterken en om kunnen gaan met tegenslag. Verder zou het aanreiken van oefeningen beter kunnen worden toegesneden op de behoeften van de app gebruiker en zou er rekening gehouden moeten worden met de dosering van de oefeningen.

Sleutelwoorden: Positieve Psychologie, mobiele applicaties, mHealth, welbevinden, systematische review

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1. Introduction

Positive psychology and the importance of addressing well-being

In the year 2000, Seligman and Csikszentmihalyi, two of the founders of positive psychology, called for a paradigm shift in psychology. Whereas psychology traditionally focused on mental diseases, they explained the importance of focusing on the conditions that lead to flourishing. "Flourishing" can be characterized as optimal functioning in the sense of leading a pleasant, social, successful and meaningful life (Seligman & Csikszentmihalyi, 2000). Positive psychology as a science therefore focuses on factors that contribute to optimal well-being and is thus contrary to the study of pathology, which focuses on repairing damage within a disease-approach (Seligman & Csikszentmihalyi, 2000).

Well-being can be defined as: "multi-dimensional construct that is composed of experiencing pleasure, experiencing personal growth and experiencing societal connectedness" (Bohlmeijer et al, 2013). These components are based on the World Health Organization's (2005) definition of mental health which includes the following aspects: *emotional* (subjective experience of well-being), *psychological* (optimal functioning in the sense of self-realization) and *social* (optimal functioning in society) well-being. Additionally, these concepts can be found in Seligman's well-being theory (2012) which states that well-being is a construct that is made up of five contributing elements: positive emotions, engagement, relationships, meaning and accomplishment (PERMA). In this theory (Seligman, 2012), *positive emotions* is a hedonic element which stands for a pleasant life; *engagement* refers to a retrospective subjective state of flow (both equating with emotional well-being); the *relationships* element represents the contribution of social connectedness to well-being (equates to social well-being); *meaning* refers to the sense of belonging and serving something bigger than one's self and *accomplishment* stands for achievement that people pursue for its own sake (both equating with psychological well-being). Huppert and So (2013) developed a conceptual framework for defining well-being across Europe and their findings were in concordance with Seligman's five elements (PERMA) and the notion that well-being includes both positive feeling (hedonic component) and optimal functioning (eudaimonic component). Therefore, Seligman's definition of well-being was recently supported.

The importance of promoting well-being lies in its value for each individual and the whole society. Many studies have demonstrated several positive outcomes for individuals with high levels of well-being on different domains. De Neve, Diener, Tay and Xuereb (2013) performed a meta-analytical review of different studies and summarized that well-being has a

positive impact on health, longevity, income, productivity, organizational behavior, and on individual and social behavior. In more detail, higher well-being was linked to reduced inflammation, a lowered risk of heart diseases and stroke and associated with a longer life. Further, positive emotions elicited health benefits such as improved cardiovascular, immune and endocrine systems and a faster recovery from harmful physiological effects. Moreover, higher well-being was associated with more pro-social behavior such as donating money or blood and more interest in social activities which leads to higher quality interactions (De Neve et al., 2013). Recently, Howell et al. (2016) also emphasized the positive effects of well-being on health, relationships and the economy. For example, happier people were found to have deeper friendships and more stable marriages. The economy profits from people with high levels of well-being, since positive emotions enhance creativity, cognitive functioning and thereby workplace functioning (Howell, 2016). Finally, Lyubomirsky, Sheldon, & Schkade (2005) found that people with high levels of well-being seemed to boost the well-being of their family members, friends and co-workers. Enhancing well-being of one individual could therefore contribute to the promotion of well-being of several other individuals. As such, it is important to address how well-being of the general population could be promoted.

The importance of addressing well-being was not only recognized by psychologists, but also globally by policy-makers. Because of the diverse benefits of well-being, Seligman (2011) launched the "Flourish 51" project that aims at setting the percentage of people who are flourishing at 51% of the whole population by 2051. Today, the prevalence of flourishing people differs enormously across Europe (Huppert & So, 2013) and a recent study (Schotanus-Dijkstra et al., 2015) found that 37% of the Dutch population flourishes. The United Nations also recognized the importance of increasing well-being, since they incorporated the improvement of mental health and well-being into their development goals for 2015-2030 (Wu, 2015). How well-being could indeed be increased has been examined by many studies. Research in the field of Positive Psychology has demonstrated the efficacy of self-help interventions in increasing well-being (Bolier et al., 2013).

Self-help interventions aimed at promoting well-being

According to Lyubomirsky, Sheldon and Schkade (2005), three major factors contribute to an individual's level of well-being: (1) the genetic happiness set point, (2) the life circumstances and (3) positive cognitive, behavioral and goal-based activities. Lyubomirsky and Layous (2013, p. 57) defined those positive activities as: "simple, intentional, and regular practices"

aiming to simulate the healthy behaviors and thoughts that were associated with happy people, such as "counting one's blessings". Since positive activities may constitute 40% of the individual differences in people's well-being, engaging in them seems promising in promoting well-being. On top of that, positive activities are easy and inexpensive ways to enhance well-being, since they require little time, are self-directed and easy to implement, thus not much resources are needed to perform them (Howell et al., 2016). Therefore, much research was conducted about positive activities and their effects on well-being during the last years.

Seligman, Steen, Park and Peterson (2005) developed six brief and easy **interventions/exercises** suited for the general population which also could be conducted as **self-help**: *utilizing your strengths, thinking of three positive things happening each day, epitaph or life summary, expressing gratitude, active and constructive responding and enjoying one activity each day*. In addition to those interventions, Bohlmeijer and Hulsbergen (2013) described the following competences as important contributors to well-being: *examining personal virtues, intrinsic needs and talents; dealing realistically with goals* and *coping with setbacks and distress*. Those are referred to as **additional competences** contributing to well-being.

Several studies and meta-analytical reviews (Sin & Lyubomirsky, 2009; Bolier, 2013) provided evidence for the effectiveness of the positive interventions described above and showed that they significantly increased well-being of people in the general public and people with psychological problems with small to moderate effect sizes in the short term. Further, small but significant effect sizes were found in follow-up studies, which indicated partly sustaining improvement of well-being in the long-term through the positive self-help interventions (Bolier et al., 2013).

Apparently, several evidence-based interventions to increase well-being such as *expressing gratitude* are available. However, there are obstacles such as limited resources, motivation and non-adherence that impede the achievement of Seligman's Flourish 51 goal (Bolier et al., 2014; Kelders et al., 2012). Solutions that were proposed include the creation of "non-consumable" interventions that can be used repeatedly without being exhausted and that can be spread beyond traditional channels for healthcare (Munoz, 2010). Bolier et al (2014, p. 287) described the internet and new information and communication technologies as "excellent platform" for self-help well-being interventions, since they could be used repeatedly without being "used up". The potential of using the internet as platform for positive interventions was also underlined by Schueller and Parks (2012) who explained that

positive exercises lend themselves to the internet. The reason they named for this was that the techniques of positive interventions were less stigmatizing than those based on a disease-approach. People might therefore engage more in online interventions that include positive exercises, since focusing on strengths and positive emotions might be more enjoyable and acceptable (Schueller & Parks, 2012). Spreading well-being interventions via the internet and new technologies is also referred to as 'mHealth'.

mHealth

During the last years, the exceptional spread of mobile technologies and their increasing potential to address health issues, has led to the emergence of a new field of eHealth: mobile health or mHealth (WHO, 2011). The World Health Organization (2011, p.6) defines mHealth as: "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices". There are several reasons why the field of mHealth offers a great possibility to spread well-being interventions. In 2015, there were more than 7 billion mobile phone subscriptions globally and 3.2 billion people worldwide using the internet (International Telecommunication Union, 2015). These numbers demonstrate the immense expansion of online networking and the large usage of smartphones. Smartphones can be characterized as a type of mobile phone which has a large touchscreen display and the ability to download and run apps, which are small programs that are designed to run on mobile devices (Amor & James, 2015). There is a rapid growth of available apps on the market and currently there are more than 100 000 mHealth apps available focusing on health, medicine and fitness (Xu & Liu, 2015). This shows that mobile devices are not only used for communication and commercial purposes anymore, but that they also offer possibilities for healthcare (Ben-Zeev et al., 2015).

Smartphones have unique possibilities and therefore offer benefits in the context of well-being promotion. As they are widely used among different age groups, incomes and cultures, they offer the opportunity to easily access information about health promotion for a wide range of people (Proudfoot, 2012). Ben-Zeev et al. (2015, p. 157) also described smartphones as "integral parts of our daily lives", which offers the possibility to collect information in real-time and in real-life without disrupting the daily routines of people, which enhances self-monitoring (Proudfoot, 2012; Plaza, 2013). Since smartphones are personal, usually turned on and carried by the user, they allow for using interventions and monitoring progress location independently and receiving personalized prompts (Proudfoot, 2012; Amor

& James, 2015, Boudreaux et al., 2014). According to Proudfoot (2012), smartphones therefore reduce barriers to start and keep using interventions such as limited time. Howell et al. (2016) also recommended using apps for spreading interventions, since even if there was only a small effect for users that download a well-being app, the entire effect could still be vast due to the large number of users that can be reached via apps. Furthermore, smartphone users seem to have a large interest in monitoring and managing their well-being via their smartphone (Proudfoot et al., 2010).

Current state of apps promoting well-being

Research on the evaluation and development of health apps is still in its infancy (Dennison, Morrison, Conway & Yardley, 2013). In 2011, most of the available health apps were related to physical health monitoring and lifestyle interventions (Harrison et al, 2011). Today, by contrast, more and more apps are becoming available which enable the user to monitor their mood and to increase general well-being (Chang, Kaasinen & Kaipainen, 2013). However, many experts have criticized the lack of evidence for mhealth apps. This lack of evidence does not only refer to the effectiveness of apps and a lack of profound information for the user about the apps' quality, but also to the lack of concordance with scientific theories and guidelines. Evaluations and reviews of the quality of mhealth apps (Nicholas et al., 2015; Sunyaev et al., 2014) found that most of the evaluated apps neither referenced to standard psychoeducation information nor to clinical practice guidelines. However, those factors are likely to be important contributors to an app's quality, since the Royal Dutch Medical Association (KNMG) uses them as indicators for an app's content quality.

'KNMG' also faulted the lack of systematic analyses based on quality criteria for mobile medical apps and therefore, they published an 'App Checker', a set of questions that enables a more qualitative evaluation of medical apps. In order to evaluate the content quality and relevance of an app, 'KNMG' suggested assessing whether the content of the app was based on recent subject-matter knowledge and in line with relevant guidelines (Medical App Checker, 2016). Other experts also stressed the importance of a theory base for interventions, since they found that the most effective web-based interventions were the ones with the most extensive theoretical background (Bolier et al., 2014; Webb, Joseph, Yardley, & Michie, 2010). This finding might be also applicable to apps including self-help interventions to promote well-being, since they are also types of eHealth interventions.

Assessing the theoretical background of apps is further important because they could be developed by everybody who has the skills of creating an app regardless of his/her

knowledge about well-being. Since interventions are more effective when they are based on high-quality research and theoretical knowledge (Bolier et al., 2014), the theoretical background of an app presents an important quality criterion. To the researchers' knowledge no study has explored the extent to which relevant apps are based on psychological theories about well-being before.

Aspects that were already assessed in the context of apps promoting well-being are user acceptance, mobile intervention design and persuasive design (Chang et al., 2013). In 2013, Chang et al. did an expert review of twelve available apps aimed at promoting well-being and scored all twelve apps as moderately good. However, they also identified shortcomings such as deficiencies in making use of monitoring capabilities, social support functions, interactivity and a personalized approach. Furthermore, the evaluated apps did not use persuasive design elements widely (Chang et al., 2013). This finding is regrettable, since many studies emphasized the importance of incorporating persuasive design elements in interventions.

Importance of persuasive system design

The model of well-being change (Lyubomirsky et al., 2011) emphasizes the importance of people's motivation to perform positive activities and also their persistence in practicing them. Especially, the user's persistence in performing the positive activities is said to be crucial to the success of the exercises (Lyubomirsky et al., 2011). However, users often do not keep using interventions in the desired way. Kelders et al. (2013, p. 2) introduced the concept of "intended usage" that represents the extent to which users should use an intervention in order to gain maximum benefit of it. According to different studies (Kelders et al., 2013, Bolier & Martin Abello, 2014) the effectiveness of many interventions is limited, among others because they are not used as intended. Thus, non-adherence to interventions is a big issue. A suggested solution is the incorporation of persuasive design elements, since they enhance effectiveness by helping the users to keep using the intervention, thus boosting adherence (Bolier et al., 2014; Kelders et al., 2012).

The persuasive system design model (PSD) was developed by Oinas-Kukkonen and Harjumaa (2009) as a framework for developing and evaluating how persuasive design principles and categories are used in persuasive systems. Persuasive systems are "computerized software or information systems designed to reinforce, change or shape attitudes and/or behaviors without using coercion or deception" (Oinas-Kukkonen et al., 2009, p. 486). Apps aimed at the promotion of well-being can also be regarded as persuasive

systems, since they try to establish attitudes and behaviors that improve the user's well-being. The PSD model provides four categories including design principles that support the user in reaching his/her goal via offering support in conducting the primary tasks of the system (Primary Task support), enhancing the interaction between the user and the system (Dialogue support), improving the reliability of the system (Credibility support) and motivating the user by providing social support (Social support) (Oinas-Kukkonen et al., 2009). Since the usage of persuasive design principles improves the persuasiveness of apps and may contribute to the success of the provided interventions by helping people to stay involved (Kelders et al., 2012), they were incorporated in this study as important quality criterion of the apps.

Research questions

The importance of increasing well-being is not only underlined by positive psychologists, but also recognized globally by policy-makers and organizations such as the United Nations. Since the field of mhealth has reached immense relevance in today's networked society, mobile health apps offer great opportunities to contribute to Seligman's goal of a flourishing society (Bolier et al., 2014). However, evidence is often lacking for the quality of those apps and therefore, the purpose of this paper was to systematically investigate the availability and quality of apps aimed at the promotion of well-being via self-help interventions. Quality was assessed based on the important quality criteria *theoretical background* and *inclusion of persuasive system design elements*. Since the market of health apps is growing rapidly, this study could contribute to research in the field of eHealth by giving information about the quality of currently available apps. Moreover, several researchers (Fogg, 2009; Powell, 2014) emphasized that by evaluating existing apps, new insights could be gained for the development of other apps. Thus, the research question of this study was: "Which apps providing self-help exercises to promote well-being are available in the iOs App store and what is their quality? " In order to answer this question, the following sub-questions had to be answered:

1. Which apps providing self-help exercises to promote well-being are available in the iOs App store?
2. To what extent are these apps based on evidence-based theories and exercises concerning the improvement of well-being?
3. Which persuasive design elements are implemented in the available apps?

2. Methods

2.1 Search Criteria and Selection

A systematic review framework was applied to the search and assessment of apps available in the German iOS app store providing self-help interventions to promote well-being suited for the general population. The iOS app store offers no possibilities to refine the search with specific criteria such as category or language. Therefore, the selection of apps was conducted manually and in an iterative manner.

Broad search terms to identify apps that focus on well-being were derived through a preliminary search of the iOS app store. Preliminary search terms included general terms in English and Dutch such as "well-being", "positive psychology", "flourish", "welbevinden" and "positieve psychologie". The Dutch terms were not used as final search terms, since each provided only one app. This search result could be biased by using the Dutch language in the German iOs store. The term "flourish" was not used as final search term, since it mostly provided game apps that were not related to positive psychology and did not provide any relevant apps. In addition, the categories 'Health and fitness: healthy habits' and 'Health and fitness: medicine' were screened, but they did not provide new relevant apps. Moreover, relevant terms were extracted from interventions that are known to improve well-being and used as search terms: "making use of strengths", "life summary", "gratitude", "responding active" and "enjoying activities". None of these terms was used as final search term, since they were too specific and mostly provided no search results at all. Additionally, a layperson alternative ("feel good") was included, since the aim of this study was to evaluate apps that are targeted at the general population and they might use common speech as search terms. Therefore, the following terms were used as final search terms: "positive psychology" (42), "wellbeing" (100) and "feel good" (100). The German iOS app store did not show more than 100 apps per search term and declared that apps with less relevance were not displayed. On February, 24 and 25, 2016 the final search terms were used to identify publically available apps aimed at promoting well-being via Apple's iOS app store and 242 apps were found. An overview of the 242 apps is presented in the appendix. Afterwards, all apps were screened for the in- and exclusion criteria.

Apps were selected based on the following inclusion criteria: (1) focus on well-being (2) English or Dutch language (3) price: up to 2 €. Exclusion criteria were: (1) price > 2€ (2) targeted at a special patient group, since the focus of this study was on apps suited for the general population (3) duplicates (4) no link to positive psychology (5) only offering

information (online magazine, quotations), since the focus of this study was on interactive apps (6) registration through health professional required (7) in-app purchases higher than 2€ needed to complete more than 5 exercises in the app.

The selection process was done in three steps per search term. First, the titles of the apps were screened for eligibility. In this step, 114 apps were excluded, since they were not related to positive psychology (n=65), had another language than English or Dutch (n= 22), their price was higher than 2€ (n= 23), or the apps were duplicates (n= 4). Second, the app store descriptions of the remaining apps were screened for eligibility. 102 apps were excluded, since they only offered information or quotations but no exercises such as an online magazine (n=21), were not related to positive psychology (n=71), directed at specific patient groups (n=7), or a registration through a health professional was required (n=3). Finally, the apps were downloaded to an iPhone 5s and 10 apps were excluded, because they required in-app purchases higher than 2€ in order to complete more than five exercises (n=9) or crashed after download (n=1). In total, 16 apps remained available for analysis. *Figures 1-3* present the selection process of relevant apps.

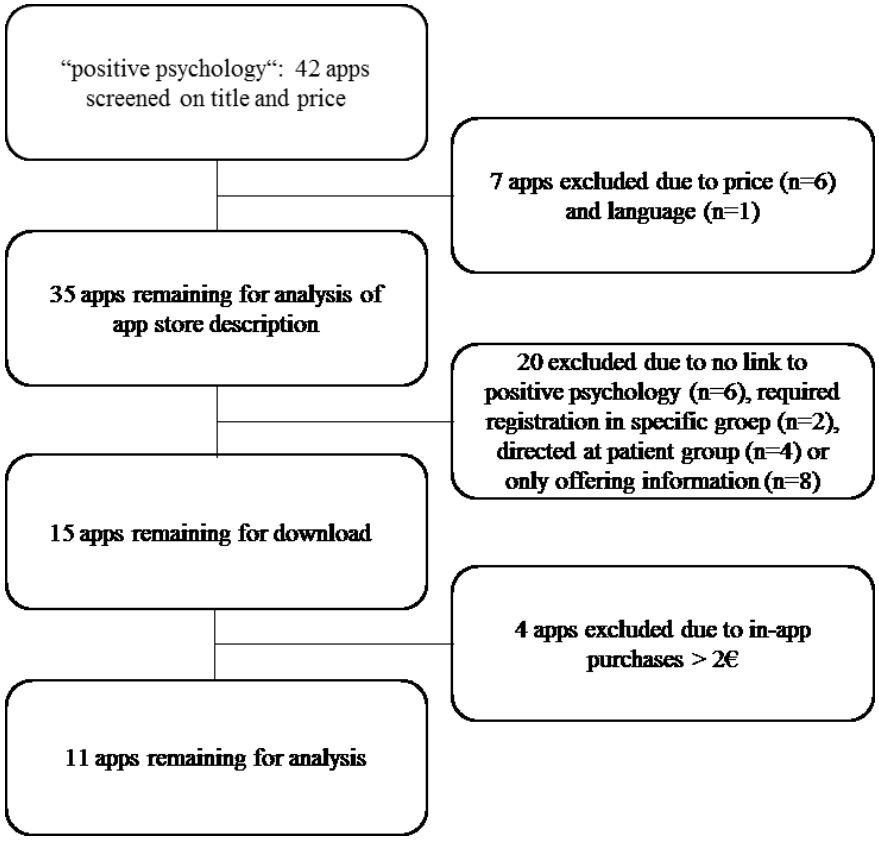


Figure 1. *Selection process of relevant apps for first search term*

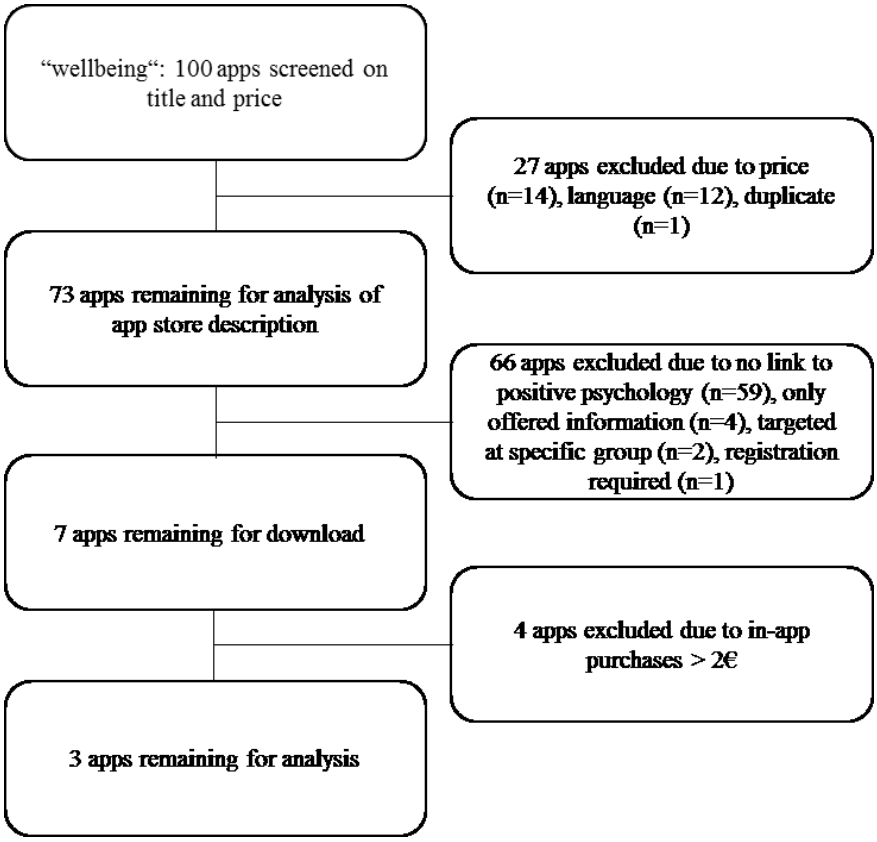


Figure 2. *Selection process of relevant apps for second search term*

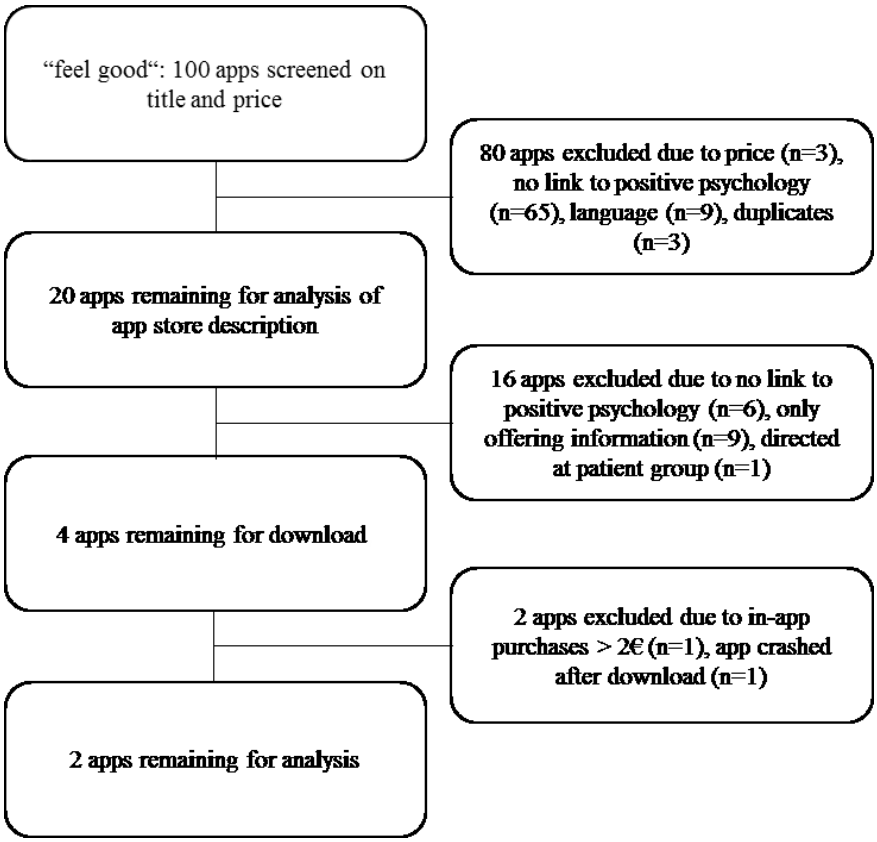


Figure 3. *Selection process of relevant apps for third search term*

2.2 Evaluation of apps

After the apps were downloaded on an iPhone 5s, they were tested over a period of 10 days by conducting the provided tasks or exercises and trying out all options of the apps. The content of the apps was recorded in a table presented in Appendix B. Their quality was evaluated with regard to the following aspects: (1) theoretical background and (2) incorporation of persuasive system design elements.

2.2.1 Theoretical background

In order to evaluate the quality of contents of the apps, it was important to identify whether they were based on scientific theories related to positive psychology and well-being. To answer this question, the description of each app was screened in order to identify whether a scientific background was named. Afterwards, a theory-based content analysis was conducted with the help of a deductive coding scheme. This coding scheme was developed based on literature research indicating which factors contribute to well-being and which interventions were already proven to be effective. Each app was assessed separately and checked for incorporation of features consistent with relevant theories. During evaluation the coding scheme with categories was further expanded inductively in order to compare the content of the apps. Therefore, the analysis was an iterative process. *Table 1* presents the chart including the categories and codes that were derived deductively. Codes that were derived inductively are also included in the chart and are printed italic.

Table 1. Deductive and *inductive* categories and codes

Code	Theory and source that supports effectiveness and/or relevance
Elements of well-being: PERMA	
Positive emotions	Well-being theory, Seligman (2012)
Engagement	Well-being theory, Seligman (2012)
Relationships	Well-being theory, Seligman (2012)
Meaning	Well-being theory, Seligman (2012)
Accomplishment	Well-being theory, Seligman (2012)
Self-help exercises promoting well-being	
Making use of your strengths	Positive psychology interventions (PPI), Bolier et al. (2013)
Three positive things	PPI, Bolier et al. (2013)
Epitaph/Life Summary	PPI, Bolier et al. (2013)
Practicing/Expressing gratitude	PPI, Bolier et al. (2013)
Active constructive responding	PPI, Bolier et al. (2013)
Enjoying one activity	PPI, Bolier et al. (2013)
Acts of kindness	PPI, Bolier et al. (2013)
Savoring the moment	PPI, Bolier et al. (2013)
Expressing optimism	PPI, Bolier et al. (2013)
Additional competences contributing to well-being	
Examining personal virtues and talents	Bohlmeijer and Hulsbergen (2013)
Dealing realistically with goals	Bohlmeijer and Hulsbergen (2013)
Coping with setbacks and distress	Bohlmeijer and Hulsbergen (2013)
Type of exercise	
Reflective-cognitive exercises	Lyubomirsky & Layous (2013)
Social-behavioral exercises	Lyubomirsky & Layous (2013)
self-oriented vs. other-oriented	Lyubomirsky & Layous (2013)
eudaimonic	Riva et al. (2012)
hedonic	Riva et al. (2012)
Psychoeducation part	Model of well-being change, Lyubomirsky et al. (2011)

2.2.2 Persuasive system design

Besides a theoretical background, the incorporation of persuasive software features is an important factor that contributes to the quality of persuasive apps (Langrial, Lehto, Oinas-Kukkonen, Harjumaa, Karppinen; 2012). Therefore, apps were checked on their inclusion of persuasive system features. The evaluation was based on the persuasive system design (PSD) model by Oinas-Kukkonen and Harjumaa (2009). This model provides design principles that can be divided into four categories: (1) primary task support, (2) dialogue support, (3) system credibility support and (4) social support. The principles in the category 'primary task support' help the user to reach his/her goal by offering support in conducting the primary task of the system or the app, which is improving well-being via self-help exercises. The category 'dialogue support' includes principles that help the user to move towards his goal or target behavior by enhancing the interaction with the app. The category 'credibility support' includes principles that increase the credibility of the system and thereby increase the persuasiveness. The category 'social support' includes principles that increase the motivation of the user by social influence (Oinas-Kukkonen & Harjumaa, 2009). *Table 2* presents the 28 persuasive system features that belong to the four categories described above. For each app, a category score and a total score representing the amount of all included PSD features was calculated. A table including examples of the design principles is provided in Appendix B.

Table 2. Persuasive system features

Primary task support	Dialogue support	Credibility support	Social support
Self-monitoring	Reminders	Trustworthiness	Social learning
Reduction	Praise	Real-world feel	Social comparison
Personalization	Suggestion	Expertise	Normative influence
Rehearsal	Rewards	Verifiability	Social facilitation
Tunneling	Similarity	Authority	Cooperation
Simulation	Social role	3rd party endorsements	Competition
Tailoring	Liking	Surface credibility	Recognition

3. Results

3.1 Available apps in iOs app store providing self-help exercises to improve well-being

Table 3 presents an overview and description of the 16 apps that remained from the search results in Apple's app store, after checking each of them with regard to the in- and exclusion criteria. Information about the creator and version number of the apps is provided in Appendix B. Paragraphs 3.3 and 3.4 give detailed information about the theoretical background and the persuasive design of the evaluated apps.

Table 3. Description of apps providing self-help exercises to improve well-being

Number	Name of the App	Description	Price
1	Happiness Wizzard	follow principles of happiness; exercises related to life priorities, time, relationships, influences, gratitude, love, daily focus, daily reflections	free version
2	The emotion diary	tracking of emotions, positives for today and writing: what went well, I was grateful for, my acts of kindness, strengths	1,99 €
3	Smiley alarm clock: smile and wake up	alarm clock that can only be set off by smiling into the camera	1,99 €
4	Instar Affirmation writer	writing down your personal affirmations and repeating them each morning, evening and in between	free
5	Feed your Happy	receiving diverse activities related to gratitude, savoring, acts of kindness, fostering relationships and goal achievement that have to be done during a specific time period	free
6	DayMinder	recording things that happened, how you felt over day and what you are grateful for	free
7	Unithrive wellbeing	tracking your mood, inspiration for relaxation, planning activities and gratitude journal	free
8	Daily Doses of Positivity	you receive a new inspiring message daily regarding positivity and a new exercise	free
9	Thankful	journal with remind-option, where you can daily write down what you are thankful for	free
10	Happier2015	track your emotions, happiness and gratefulness in journal, tool for setting and tracking your goals, receiving tips for more happiness	0,99 €
11	Gratitude Challenge21	over 21 days, each day a new 5 minute gratitude challenge	free
12	Daily Challenge wellbeing	everyday new challenges that increase "everyday well-being"	free
13	YOU	positive community in which you receive small challenges daily and share pictures of your activities if you like	free
14	Rezolute	setting and recording your goals in different domains	free
15	FeelGood tracker	record and rate your activities, memorize them via pictures and highlight your favorite places	0,99 €
16	TheHappyApp	reminds you to write down one thing that went well during your day, describe those things or upload a picture	free

3.2 Overall findings

As *table 4* shows, Seligman's well-being theory (2012) and Positive Psychology Interventions that can be conducted as self-help were widely employed in the apps. On average, exercises that contributed to the additional competences of well-being were incorporated the least. The inclusion of persuasive design principles varied from 5-19 elements per app.

Table 4 lists the 16 evaluated apps, their theoretical background and their total score on the PSD model. A table including detailed information about examples of each column is provided in appendix B and C.

Table 4. Characteristics of the apps

Name app	Theoretical background	Total score PSD model, score 0-28
1. The Happiness Wizzard	seemingly: all 5 elements of **well-being theory**: PERMA and 1 **competence that contributes to well-being**: coping with setbacks and distress and 4 **Positive Psychology interventions**: practicing gratitude, expressing optimism, three positive things, acts of kindness and enjoying activities	11
2. The emotion diary	all 5 elements of **well-being theory**: PERMA, **Broaden-and-build–theory** and 3 **Positive Psychology Interventions**: three positive things, acts of kindness, practicing gratitude, 1 **competence that contributes to wellbeing**: examining personal virtues, **Broaden-and-build theory**	9
3. Smiley alarm clock	**Facial Feedback Hypothesis,** 1 element of **well-being theory:** positive emotions	5
4. Instar Affirmation writer	**Cognitive Psychology** and seemingly all 5 elements of **well-being theory:** PERMA, 1 **competence that contributes to well-being**: dealing realistically with goals	10
5. Feed Your Happy	all 5 elements of **well-being theory**: PERMA, 4 **Positive Psychology Interventions:** expressing and practicing gratitude, making use of your strengths, enjoying one activity; and **Facial-Feedback-Hypothesis**	14
6.DayMinder	2 element of **well-being theory**: positive emotions and engagement, and 1 **Positive Psychology Intervention**: three positive things	5
7.UniThrive wellbeing	**Positive psychology**, seemingly: 2 elements of **well-being theory:** positive emotions and accomplishment, 2 **Positive Psychology Interventions**: three positive things, practicing gratitude, 1 **competence that contributes to well-being**: dealing realistically with goals, **Broaden-and-Build theory**	14

8. Daily Doses of Positivity	Positive Psychology, Cognitive/rational emotive behavior; nurtured heart approach, seemingly: 4 elements of **well-being theory**: positive emotions, relationships, meaning, accomplishment;1 **Positive Psychology Interventions**: expressing optimism, 1 **competence that contributes to well-being**: examining personal virtues and talents	8
9.Thankful	explicitly: **Losada ratio, Positive Psychology**, seemingly: 1 element of **well-being theory**: positive emotions, 1 **Positive Psychology Intervention:** practicing gratitude, **Broaden-and-Build theory**	7
10.Happier2015	Positive Psychology, seemingly: 4 elements of **well-being theory:** positive emotions, engagement, meaning, accomplishment, 1 **competence that contributes to well-being**: dealing realistically with goals, 3 **Positive Psychology Interventions**: practicing gratitude, three positive things, acts of kindness	5
11. Gratitude Challenge 21	Positive Psychology, research of Robert Emmons about gratitude, seemingly: 2 elements of **well-being theory**: positive emotions and relationships, 2 **competences that contribute to well-being**: coping with setbacks, examining personal strengths, 4 **Positive Psychology Interventions**: three positive things, practicing gratitude, acts of kindness, savoring	11
12. Daily Challenge wellbeing	explicitly: scientific literature about behavior change, public health, and social networks and Small Steps approach by Dr. James Hill; seemingly: 3 elements of **well-being theory**: positive emotions , relationships and meaning, 1 **Positive Psychology Intervention:** enjoying one activity	18
13.YOU	explicitly: based on advise of Dr. Tara Swart to embed knowledge from neuroscience, change and learning, seemingly: 4 elements of **well-being theory**:positive emotions, relationships, meaning, accomplishment; 2 **Positive Psychology Interventions**: expressing and practicing gratitude, enjoying one activity, 2 **competences that contribute to well-being**: dealing realistically with goals, dealing with setbacks	19
14.Rezolute	seemingly: 2 elements of **well-being theory** accomplishment and relationships; 1 **Positive Psychology Intervention**: acts of kindness, 1 **competence that contributes to well-being**: dealing realistically with goals	10
15. FeelGood tracker	seemingly: 2 elements of **well-being theory:** positive emotions, accomplishment, 1 **Positive Psychology Intervention**: savoring, 1 **competence that contributes to well-being:** dealing realistically with goals	5
16. TheHappy App	seemingly: 1 element of **well-being theory:** positive emotions, 1 **Positive Psychology exercise**: practicing gratitude	11

3.3 Theoretical background

3.3.1 Concordance with scientific theories

In general, 11 of the 16 evaluated apps explicitly mentioned to be based on a scientific background. Most of the apps (n=7) explained to be based on Positive Psychology but nearly none explicitly referred to a specific theory. However, one of those apps (**Gratitude Challenge 21**, nr.11) specified its science base by explicitly mentioning the research of Robert Emmons about gratitude as its theoretical background. The other four apps explained to be based on other fields such as Cognitive Psychology and Neuroscience, on scientific literature about Behavior Change and on the Facial-Feedback hypothesis without explicitly using this term. Although none of the apps explicitly stated the name of the theory, all apps incorporated at least one element of Seligman's well-being theory (2012). Furthermore, nearly all apps (n=14) were based on positive psychology interventions and the names of the exercises were mostly in concordance with the terminology of the literature. The additional competences that contribute to well-being were incorporated the least (n=10) and none of the apps explicitly referred to Bohlmeijer and Hulsbergen (2013) who introduced them. None of the apps had no theoretical background at all. *Table 5* lists the theoretical background, the types of the exercises, inductively identified theories and the number and percentage of apps that covered the elements and exercises.

Table 5. Quality of theory base: Concordance with scientific theories

Theoretical background	Apps covering element, n (%)
Well-being theory by Seligman	
Positive emotions	15 (93.75)
Engagement	6 (37.5)
Relationships	9 (56.25)
Meaning	8 (50)
Accomplishment	10 (62.5)
PPI/Self-help exercises promoting well-being	
Making use of your strengths	1 (6.25)
Three positive things	6 (37.5)
Epitaph/Life summary	0 (0)
Practicing/Expressing gratitude	11 (68.75)
Active constructive responding	0 (0)
Enjoying one activity	3 (18.75)
Acts of kindness	5 (31.25)
Savoring the moment	2 (12.5)
Expressing optimism	2 (12.5)
Additional competences that contribute to well-being	
Examining personal virtues and talents	3 (18.75)
Dealing realistically with goals	6 (37.5)
Coping with setbacks and distress	3 (18.75)
Types of exercises	
Reflective-cognitive	12 (75)
Social-behavioral	8 (50)
self-oriented	16 (100)
other-oriented	8 (50)
eudaimonic	12 (75)
hedonic	15 (93.75)
Psychoeducation part	13 (81.25)
Inductively derived theories	2 (6.25)
Facial-feedback-hypothesis	
Broaden-and-build theory	3 (18.75)

Well-being theory by Seligman

Strikingly, none of the apps explicitly mentioned Seligman's well-being theory (2012) as their theory base, although all of the apps (n=16) included at least one of the five elements that contribute to well-being. In total, a quarter of the apps (n=4) used all five elements (PERMA) of Seligman's well-being theory: **The Happiness Wizzard** (nr. 1), **The emotion diary** (nr. 2), **Instar Affirmation writer** (nr. 4) and **Feed Your Happy** (nr. 5). Moreover, three apps were based on three elements, five apps were based on two elements and three apps were based on one element. Thus, on average three elements (M = 3, SD = 1.43) were incorporated per app.

The element **'positive emotions'** was included most, since 15 apps contributed to experiencing pleasure. Apps elicited positive emotions by encouraging the user to take time for him-/herself or to do things that he/she enjoys, to reflect on positive things that happened over the day, to be grateful, to foster relationships, to smile and to be kind to others.

The element **'accomplishment'** was incorporated second most, since 10 apps supported the user in achieving his/her goals. Apps implemented this element by explicitly encouraging the user to pursue his goals and to improve daily, by offering the possibility to plan and schedule activities in a calendar and by giving the task to think about and write down small actions that the user could do in order to reach his goals.

About half of the apps incorporated the elements **'relationships'** (n=9) and **'meaning'** (n=8). The **'relationships'** element was mostly implemented by explicitly encouraging the user to "devote more time to family and friends", by giving him/her tasks such as "expressing love to those you care about" or "call an old high school friend" and by suggesting to thank people that are important to the user. By asking the user if he/she spends enough time on things that are meaningful to him/her, to recall fond memories or by providing tasks such as reflecting on bad things that happened in the user's life and then to think about positive things that grew out of that situation, the apps incorporated the element **'meaning'**.

The element '**engagement'** was incorporated the least, since six of the 16 evaluated apps supported the user to engage in activities that fully capture their attention and put them in a state of 'flow'. This element was mostly implemented by tasks that explicitly encouraged the user to engage more in activities in which they could use their personal strengths and in which they flourish.

Positive Psychology Interventions/Self-help exercises promoting well-being

In general, most of the apps (n=14) were based on well-known positive psychology interventions/self-help exercises aimed at the promotion of well-being. On average, about two exercises (M = 1.88, SD = 1.33) were included per app. The apps **The Happiness Wizzard** (nr.1), **Feed Your Happy** (nr. 5) and **Gratitude Challenge 21** (nr.11) provided most of the well-known self-help exercises to promote well-being (n=4). In contrast, the apps **Thankful** (nr. 9) and **The Happy App** (nr. 16) included the fewest self-help exercises (n=1).

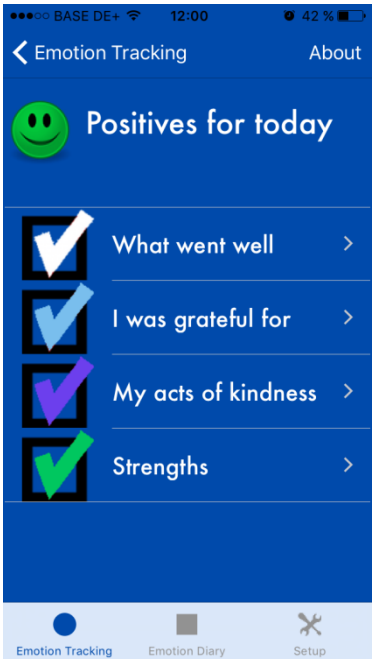
More than half of the apps (n=9) included the exercise **'practicing gratitude'**. This exercise was mostly implemented in the form of a daily gratitude journal ("write down what you are grateful for; fill in your gratitude list"). Additionally, two apps included **'expressing**

gratitude' which was more active and other-oriented, since the apps provided tasks as "remember a woman who was important in your life and give her a proof of appreciation".

The exercise **'three positive things'** was used second most (n=6) in the form of prompting the user to daily write down "what went well and why" or sending push notifications with the question "what went well today?".

About a third of the apps (n=5) included the exercise **'acts of kindness'** by explicitly giving the user the task to "do a good deed" or by providing a diary in which the acts of kindness should be noted. *Figure 4* presents a screenshot of the app **The emotion diary** (nr. 2) that illustrates a positive example of the inclusion of several exercises. The exercises **'making use of your strengths'** (n=1), **'enjoying one activity'** (n=3), **'savoring the moment'** (n=2) and **'expressing optimism'** (n=2) were scarcely incorporated. None of the apps included the exercises **'epitaph/life summary'** and **'active constructive responding'**.

Figure 4. Screenshot of the diary function for several self-help exercises

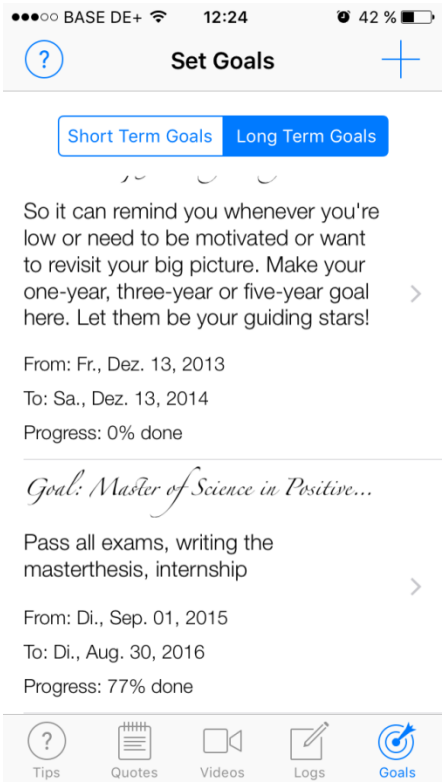


Competences that contribute to well-being

In general, 10 of the 16 evaluated apps supported competences that contribute to well-being and on average, less than one competence (M = 0.75, SD = 0.66) was included per app. The apps **Gratitude Challenge 21** (nr. 11) and **YOU** (nr. 13) included most of the additional competences that contribute to well-being (n=2). The competence **'dealing realistically with goals'** was the one implemented most (n=6). Apps supported this competence by providing a journal in which the user could set and track his/her short-term and long-term goals, by asking

the user to reflect on his goals and actions ("what's one small change you can make and commit to?") and by providing a calendar feature to schedule activities that contribute to reaching the goals. *Figure 5* presents a screenshot of the app **Happier2015** (nr. 10) that illustrates a good example of how apps enabled the user to set and track goals. Less than a fifth of the apps (n=5) contributed to the competences **'examining personal virtues and talents'** ("take time to honor yourself, reflect back to your strengths, what are your talents?") and **'coping with setbacks and distress'** ("get emotional and try to find meaning, write down what you can learn from this experience and how it was useful").

Figure 5. Screenshot of a goal-setting and –tracking function



Inductively derived theory base

Two theories were identified inductively as theory base for some of the apps. Although the theories' names were not explicitly mentioned, they could clearly be identified based on their description. One of the apps (**The emotion diary**, nr. 2) explicitly stated: "greater well-being enhances learning. A positive mood provides a broader attention, more creative thinking, more holistic thinking and the ability to learn new things". This description outlines the **Broaden-and-build-theory** by Barbara Fredrickson (1998). Two other apps also seemed to be based on this theory. One of them (**Unithrive wellbeing**, nr. 7) enhanced learning of the

user by providing a combination of relaxation tools and a study timer. Since the relaxation tools elicit positive emotions which broad the attention and increase creativity, the user was supported in using his/her planned study time effectively. The other app (**Thankful**, nr. 9) explicitly aimed at transferring the 'Losada ratio', which is a concept introduced by Losada and Fredrickson (2005). It states that a ratio of positive to negative emotions of 2.9013 distinguished flourishing people from other people (Losada & Fredrickson, 2005). The app **Thankful** (nr. 9) tried to elicit positive emotions by encouraging the user to daily write down what he was grateful for. Since the 'Losada ratio' is an extension of Fredrickson's **Broaden-and-Build theory** (1998), this theory could also be identified as a theoretical background of the app.

The other inductively identified theory was the **Facial-Feedback hypothesis** by Strack, Martin and Stepper (1998). It states that specific facial movements elicit specific emotions and it was implemented by two apps. The app **Smiley alarm clock** (nr. 3) was based on this theory, since it provided an alarm clock that could only be set off by smiling into the front camera and explained that "scientists proved that smile does good for your entire body: stress hormones lower and happiness hormones raise". The second app (**Feed Your Happy**, nr. 5) included the **Facial-Feedback hypothesis** (Strack et al., 1998) by giving the task to "place a pen sideways in your mouth for two minutes" and by explaining that this "pen/chopstick technique produces a Duchenne smile and researchers found that this leads to lower heart rates during stress recovery".

Types of exercises

With regard to Lyubomirsky's and Layous' positive-activity-model (2013), all apps (n=16) included '**self-oriented'** exercises ("how did *you* feel?", "what did *you* do?", "what are *your* strengths?"). Half of the apps (n=8) also provided tasks or exercises that were **'other-oriented'** ("how can I be more helpful to others today?", "give somebody a compliment"). Moreover, most of the apps (n=12) suggested exercises that were **'reflective-cognitive'** ("by altering the ways you think, you can (…)","reflect on (…), write your thoughts in your journal"). On top of that, half of the apps (n=8) also included **'social-behavioral'** exercises ("call a friend", "introduce yourself to a neighbor", "practice random acts of kindness"). Nearly all of the apps (n=15) included **'hedonic'** exercises, since they provided tasks that elicited positive emotions and pleasure ("do more of the activities you rated highly", "place a pen sideways in your mouth"). Many of the apps (n=12) also included **'eudaimonic'** exercises that contributed to engagement and meaning. Those exercises were implemented in

forms of a diary in which the user could note which of his/her personal strengths he/she had used during the day, a daily challenge to engage in activities in which the user can use his/her strengths and in the form of tasks that were related to achievement.

Psychoeducation

Nearly all of the apps (n=13) included psychoeducation, since they explained the benefits of high levels of well-being and described the importance and/or effect of the exercises. However, in nine of the 16 evaluated apps the psychoeducation was *very short* ("the app reminds you about the good stuff, so you feel better", "by being thankful you are focusing on positive things (…), this is a good practice based on positive psychology"). Strikingly, only two apps (**Feed your Happy, YOU**) included a *detailed* psychoeducation part. The app **Feed your Happy** (nr. 5) provided a 'Knowledge' center in which comprehensive scientific information was given about the foundation skill of each exercise ("gratitude is known as the universal happiness skill; (…); studies show that strong social support can positively impact health"). The app **YOU** (nr. 13) described every daily action in combination with the importance and/ or effect of it ("social connection is proven to be one of the strongest determinants of happiness").

3.4 Persuasive design

The results regarding the incorporation of persuasive design elements are summarized in *table 6*. The table includes the scores of each app on the four categories of the PSD model and the total score. The scores of the apps on each principle with explanations are presented in appendix C. From the four categories of the PSD model, the principles in *primary task support* were most used, whereas the principles in the *social support* category were used the least.

Table 6. Scores on the categories of the PSD model

App	Primary task support (score 0-7)	Dialogue support (score 0-7)	Social support (score 0-7)	System Credibility support (score 0-7)	total score (0-28)
1	4 (Rd, P, Sm, Rh)	3 (Rm, Su, L)	0	4 (Tr, E, S, R)	11
2	4 (Rd, P, Sm, Rh)	2 (Su, L)	0	3 (Tr, E, S)	9
3	3 (Rd, P, Rh)	1 (Rm)	0	1 (R)	5
4	4 (Rd, P, Sm, Rh)	3 (Rm, Su, L)	0	3 (Tr, E, S)	10
5	5 (Rd, Tu, P, Sm, Rh)	5 (P, Rw, Rm, Su, L)	0	4 (Tr, E, S, A)	14
6	3 (Rd, Sm, Rh)	1 (L)	0	1 (Tr)	5
7	5 (Rd, Ta, P, Sm, Rh)	4 (Rm, Su, L, Sr)	0	5 (Tr, E, S, R, A)	14
8	4 (Rd, P, Sm, Rh)	2 (Rm, Su)	0	2 (E, R)	8
9	4 (Rd, P, Sm, Rh)	1 (Rm)	0	2 (Tr, S)	7
10	3 (Rd, Sm, Rh)	0	0	2 (Tr, R)	5
11	3 (Rd, Sm, Rh)	4 (P, Rm, Su, L)	0	4 (Tr, E, S, A)	11
12	4 (Rd, Ta, P, Sm)	5 (P, Rw, Rm,Su,L)	4 (Sl, Sc, Sf, Cm)	5 (Tr, E, S, R, Tp)	18
13	6 (Rd,Tu,Ta,P,Sm,Rh)	4 (P, Rm ,Su, L)	3 (Sl, Sc, Sf)	6 (Tr,E,S,R,Tp,V)	19
14	4 (Rd, P, Sm, Rh)	3 (P, Rm, L)	0	3 (Tr, S, R)	10
15	4 (Rd, P, Sm, Rh)	1 (L)	0	0	5
16	4 (Rd, P, Sm, Rh)	2 (Rm, L)	1 (Sf)	4 (Tr, E, S, R)	11
mean	4	2,38	0,44	2,8	10,12

Note: Principles of the four categories were abbreviated as follows:

Primary Task support: Reduction (Rd), Tunneling (Tu), Tailoring (Ta), Personalization (P), Self-monitoring (Sm), Simulation (Si), Rehearsal (Rh).

Dialogue support: Praise (P), Rewards (Rw), Reminders (R), Suggestion (Su), Similarity (Si), Liking (L), Social role (Sr).

Social Support: Social Learning (Sl), Social comparison (Sc), Normative influence (N), Social facilitation (Sf), Cooperation (Co), Competition (Cm), Recognition (R).

System Credibility Support: Trustworthiness (Tr), Expertise (E), Surface credibility (S), Real-world feel (R), Authority (A), Third-party endorsement (Tp), Verifiability (V).

3.4.1 Primary Task support

The category ***'Primary Task support'*** was used most in the apps. The app **YOU** (nr. 13) used the most principles (n=6) of this category. On average, apps included four out of seven possible principles. Within this category the principle *'Reduction'* was used most, since all of the apps divided the target behavior (increasing well-being) into small and simple steps ("list with my goals for today and today's focus"; daily tracking of different dimensions: "stuff that happened, when, what, which feeling, counting blessings, rating day in total", "daily receiving one small, manageable task that improves well-being").

The principles *'Self-monitoring'* and *'Rehearsal'* were also widely used (n=15). The principle *'Rehearsal'* was mostly implemented by stimulating the user to daily write down what he/she was grateful for, what went well during the day and how he/she felt during the day. *'Self-monitoring'* was implemented by providing a diary, journal or challenge history that showed the user's status of the exercises or tasks. Thirteen apps included the principle *'Personalization'* by providing content or services that were adapted to the user. Most of the apps (n=5) implemented *'Personalization'* by letting the user choose which activities he/she wants to do and create personal activity lists. Other apps provided personalized profile pages with the user's name and picture, the possibility to choose the user's favorite time at which he/she wanted to be reminded about doing the exercises, or other personalized content such as a list of all personal entries as the front page. The principles *'Tunneling'* (n= 2) and *'Tailoring'* (n= 3) were used very scarcely. Strikingly, none of the apps included the principle *'Simulation'*.

3.4.2 System credibility support

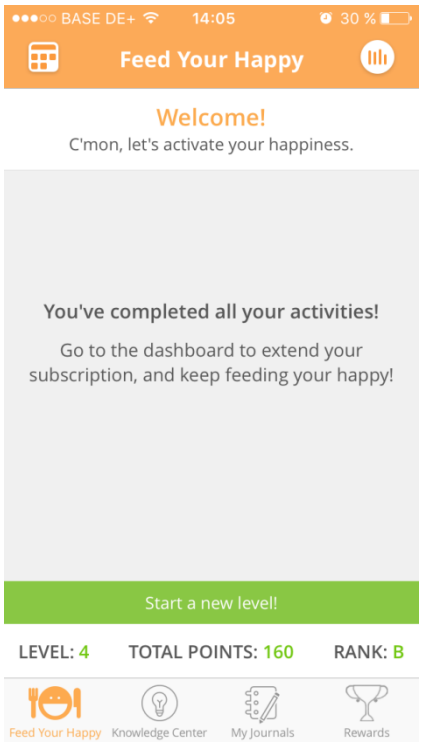
The category ***'System Credibility support'*** was used second most. Again, the app **YOU** (nr. 13) included the most principles (n=6) of this category. On average, the apps implemented nearly three of seven possible principles. Within this category the principle *'Trustworthiness'* was used most, since 13 of the 16 evaluated apps provided information that was related to the improvement of well-being and did not include biased advertising or marketing information. The principles *'Expertise'* (n=10), '*Surface Credibility'* (n=11) and *'Real-world feel'* (n=9) were included moderately. The principle *'Expertise'* was implemented by providing information about studies that supported positive effects of the exercises ("studies have shown that 5 acts of kindness per week over 6 weeks resulted in an increase in well-being") or information about the science base of the exercises ("the challenges are based on research of Professor Robert Emmons").

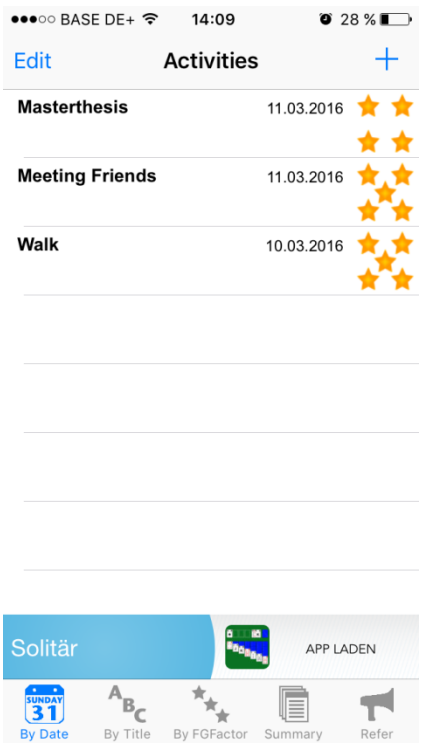
The principle *'Authority'* was only included by four of the 16 evaluated apps, since they were the only ones that referred to people in the role of authority ("Professor Robert Emmons", "Dr. Tara Swart", "Ed Diener", "counselor of the University of Adelaide"). Strikingly, the principles *'Third-party endorsements'* and *'Verifiability'* were only implemented by one of the 16 evaluated apps. The app **YOU** (nr. 13) was the only app that made use of the principle *'Verifiability'* by providing outside sources that could verify the content of the app.

3.4.3 Dialogue support

The category ***'Dialogue support'*** was used sparsely. The app **Daily Challenge wellbeing** (nr.12) implemented most (n=5) of the related principles. On average, the apps included 2.4 of seven possible principles. Within this category the principle *'Reminders'* was used most, since 12 of the 16 apps sent automatic reminders about the use of the app in form of e-mail reminders or push-notifications on the smartphone ("Time for your affirmation", "What went well today?", "Complete your daily challenge"). The principle *'Liking'* was also included by 12 apps, since the researcher assessed their design as visually attractive. *Figure 6* presents two screenshots of the apps that were assessed as visually most (**Feed Your Happy**, nr. 5) respectively least (**FeelGood tracker**, nr. 15) attractive.

Figure 7. Screenshots of the most *(left)* and least *(right)* attractive apps

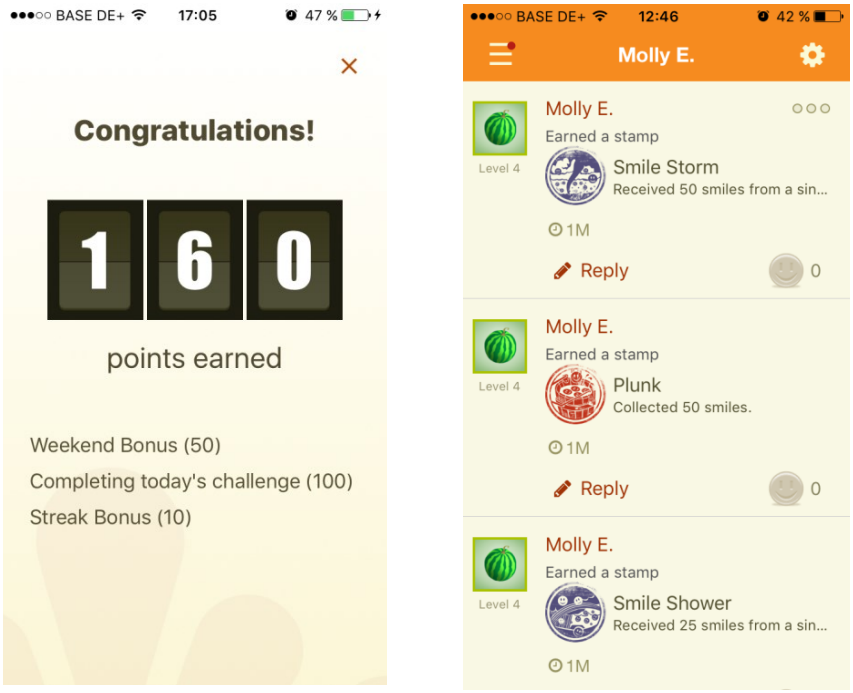




The principle *'Suggestion'* (n=9) was moderately included. Apps implemented this principle by offering examples of how to fulfill the tasks ("dropping in on a sick friend or elderly neighbor" as suggestion for acts of kindness in order to increase well-being; "foster relationships by calling an old high school friend"; videos showing relaxation methods as suggestions for self-care activities). Only few of the apps (n=5) included the principle *'Praise'*, since they complimented the user after completing a task or exercise ("Congratulations! You did a good job!").

Only two apps (**Feed Your Happy**, **Daily Challenge wellbeing**) implemented the principle *'Rewards'*, since they gave points to the user after finishing the daily challenge. The user could gain new levels through the earned points. *Figure 7* presents screenshots of the rewards functions of the two apps. The principle *'Social role'* was only used by one app. The app **Unithrive wellbeing** (nr. 7) implemented this principle by incorporating a sheep that acted as a buddy. This sheep asked the user to monitor his/her mood and gave daily tips related to the selected mood. None of the apps included the principle *'Similarity'*.

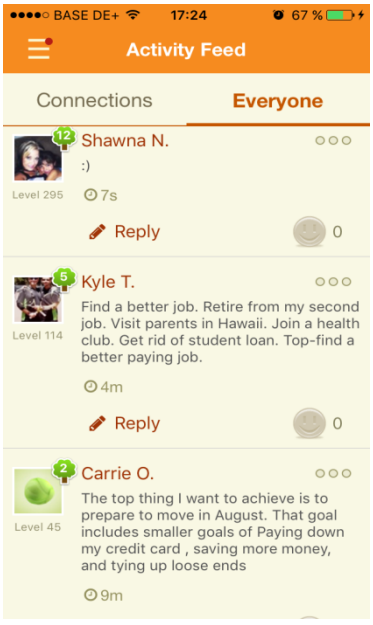
Figure 7. Screenshots of the two apps that included the principle 'Rewards'



3.4.4 Social Support

The category ***'Social Support'*** was only used by three of the 16 evaluated apps. The app **Daily Challenge wellbeing** (nr. 12) implemented most of the related principles (n=4). Within this category all three apps included the principle *'Social facilitation'* by providing the opportunity to see in the "We part" or "Activity Feed" whether there were other participants using the app. Since this feature also showed how other users completed the tasks or exercises and users were encouraged to comment on each other's performance, the apps **Daily Challenge well-being** (nr. 12) and **YOU** (nr.13) also included the principles *'Social Comparison'* (n=2) and *'Social learning'* (n=2). Screenshots of the "We part" and "Activity Feed" are presented in *figure 8* to illustrate how other apps could implement the principles *'Social learning'* and *'Social Comparison'*. The principle *'Competition'* was only implemented by the app **Daily Challenge wellbeing** (nr. 12) by recommending to make at least three 'connections' with friends or other users and to compare who achieved the most points. Strikingly, none of the apps included the principles *'Normative Influence'*, '*Cooperation'* and *'Recognition'*.

Figure 8. Screenshots that illustrate the inclusion of *Social comparison* and *learning*



Altogether, the apps **YOU** (nr. 13) and **Daily Challenge wellbeing** (nr. 12) received the highest total scores (n=19, n=18) on the PSD model. The apps **Feed Your Happy** (nr. 5) and **UniThrive wellbeing** (nr. 7), both included the second most (n=14) persuasive design principles. The apps **The Smiley Alarm Clock** (nr. 3), **DayMinder** (nr. 6), **Happier2015** (nr. 10) and **FeelGood tracker** (nr. 15) had the lowest total persuasiveness score (n=5).

3.5 Combined results

Combining the results of the theoretical background and persuasive design elements analysis, no striking relationships were found. However, the app **Feed Your Happy** (nr. 5) remarkably included most elements of Seligman's well-being theory (n=5), most of the self-help exercises (n=4), as well as the second most persuasive design principles (n=14). The app **Gratitude Challenge 21** (nr. 11) which also included most of the self-help exercises (n=4) and most of the additional competences that contribute to well-being (n=2), though scored average (n=11) on the PSD model. Apps including the least persuasive design principles (**The Smiley Alarm clock, DayMinder, Happier2015, FeelGood tracker**), partly included the least elements of Seligman's well-being theory (2012) or fewest self-help exercises. The **Smiley Alarm clock** (nr. 3) included only one element of Seligman's well-being theory and the apps **DayMinder** (nr. 6) and **FeelGood tracker** (nr. 15) provided only one self-help exercise. However, the app **Happier2015** (nr. 10) which also had a low total score on the PSD model, included several elements of Seligman's well-being theory (n=4) and several self-help exercises (n=3).

4. Discussion & Conclusion

Principal findings and comparison with prior work

This study aimed to give insight into the availability and quality of positive psychology apps providing self-help exercises to promote well-being. On average, the results suggest that the evaluated apps had a relative good theoretical quality, since they included several evidence-based exercises and were based on a variety of scientific theories related to well-being. Especially the elements of Seligman's well-being theory (2012) were widely employed. Principles of persuasive system design were moderately included.

Overall, much overlap was found between the content of the apps. The five apps that provided daily new tasks for the user (**Feed your Happy, Daily Doses of Positivity, Gratitude Challenge 21, Daily Challenge wellbeing, YOU**) included resembling exercises related to

being grateful, fostering relationships and doing acts of kindness. Additional apps (**The Happy App, Thankful, The emotion diary, Happier2015, DayMinder**) also resembled each other, since they encouraged the users to daily write down what went well during the day, what they were grateful for, which acts of kindness they performed, and which strengths they have used. Moreover, five other apps (**The Hapiness Wizzard, Instar Affirmation writer, Rezolute, Unithrive wellbeing, FeelGood tracker**) also partly included a journal of gratitude or emotions, but compared to the other apps they were more focused on recording and planning daily activities in order to reach goals and to engage more in activities that the user enjoys. The app **Smiley alarm clock** (nr. 3) was an exceptional case, since it was the only app that simply provided a daily alarm that could be set off by smiling into the front camera of the smartphone in order to elicit positive emotions.

An app that represents a prototypical well-being app currently on the market was **Unithrive well-being** (nr. 7), since it scored average on the inclusion of theoretical elements and evidence-based exercises. On top of that, it exactly included half of the possible persuasive design elements, which was slightly above the average of the other evaluated apps. Drawing on the assumption that apps including several persuasive design principles are more effective than other apps, the currently available apps could possibly be improved by including more persuasive design features.

Contrary to a prior study (Nicholas et al., 2015) that criticized the lack of concordance with scientific theories, the evaluated apps were indeed based on scientific theories, since all of them included at least one element of Seligman's well-being theory (2012) and on average two evidence-based self-help exercises. The provision of evidence-based exercises and the scientific theory base of the apps were further remarkable, since they could have been developed by everybody who has the skills to create an app, independent from his/her knowledge about well-being.

Although all apps seemed to have a good theoretical background, three of the apps seemed to be extraordinarily good, since they also included many persuasive design principles. Remarkably, the app **Feed your Happy** (nr. 5) employed all five elements of Seligman's well-being theory (2012), the most self-help exercises to promote well-being and more persuasive design elements than the apps did on average. On top of that, the app **Feed Your Happy** (nr. 5) was one of the only two apps that included a *detailed* psychoeducation part. Furthermore, the app **Gratitude Challenge 21** (nr. 11) seemed to be very good with regard to the two evaluated quality criteria, since it also provided most of the self-help

exercises and most of the *additional competences* that contribute to well-being (n=2). Moreover, the app **Gratitude Challenge 21** (nr. 11) was the only app that specified its theory base, since it explicitly stated to be based on research about gratitude by Robert Emmons. However, the app scored average on the overall inclusion of persuasive design elements. Additionally, the app **YOU** (nr. 13) included most of the persuasive design elements and most of the additional competences that contribute to well-being. On top of that, it was one of the only two apps that provided *detailed* psychoeducation.

Those seemingly very good apps had in common that all of them provided daily new activities or exercises that the user should do and that they explained the benefits of those exercises directly together with the task description. This finding suggests that the provision of daily new content and psychoeducation may be important contributors to an app's quality.

With regard to the amount of incorporated theoretical elements, the apps **The Happy App** (nr. 16), **The smiley alarm clock** (nr. 3), **Instar Affirmation writer** (nr. 4) and **Thankful** (nr. 9) seemed to have a worse theory base than the other apps, since they only included one exercise that was related to positive emotions. However, all of the exercises were science-based and positive emotions do not only have positive short-term effects, but also positive long-term effects (Fredrickson, 1998). Further, two of the apps (**Instar Affirmation writer, The Happy App**) had an average total persuasiveness score. Therefore, those apps could also contribute to the promotion of well-being and might not have to be regarded as worse in comparison with the other apps.

However, two apps indeed seemed to have a worse theory base (Daily Doses of Positivity, Daily Challenge well-being), since both of them additionally included exercises or tasks that were not science-based or not related to Positive Psychology. Although the apps **Daily Doses of Positivity** (nr. 8) and **Daily Challenge well-being** (nr. 12) included several evidence-based exercises, they also provided tasks that had no science-base and were not related to positive psychology ("How will you channel your Inner Mandela?"; "get up to date for the recycling guidelines of your city"). The results of the content analysis of those two apps are therefore partly in line with the prior finding that mhealth apps lack concordance with scientific theories (Nicholas et al., 2015). On top of that, the app **Thankful** (nr. 9) mentioned the 'Losada ratio' as theoretical background. However, this concept has already been discredited (Brown, Sokal, & Friedman, 2014). Nevertheless, the app provided a gratitude journal and therefore included an evidence-based exercise, even though the explicit theoretical background of the app was questionable.

Nearly all apps were based on positive psychology interventions and on average about two different exercises were incorporated per app. This number seems reasonable, since users might become overwhelmed by a too high number of choices (Schueller & Parks, 2012). In contrast to this finding, Sin and Lyubomirsky (2009, p.17) stressed that a "shotgun" approach, the provision of multiple positive psychology exercises might be more effective in enhancing well-being than the provision of only one exercise. Regarding this finding, apps that only included one exercise (**The Happy App, Thankful, Instar affirmation writer, The smiley alarm clock**) might not be as effective in improving well-being than the other apps that included multiple exercises. However, taking the broaden- and build-effects of positive emotions (Fredrickson, 1998) into account, it could be assumed that the apps that elicit positive emotions through one exercise, for example the **Smiley alarm clock** (nr. 3) that encourages the user to start each day with a smile, are as effective as the other evaluated apps in promoting well-being. Conclusively, there is no strong evidence for a specific amount of exercises that increases the effectiveness of the apps. The quality of the theoretical background of apps might therefore not be represented by the number of included exercises or theoretical elements. Rather, it might depend on the user's characteristics and needs.

The exercise '*practicing gratitude'* was provided most by nine of the 16 evaluated apps. This finding is not surprising, since it is one of the most frequently used and most empirical evidence-based positive psychology interventions (Baños, Etchemendy, Carrillo-Vega, & Botella, 2016). However, Sergeant and Mongrain (2011) cautioned that people with a strong feeling of helplessness did not benefit from this exercise or even got more depressed. Although this study evaluated apps suited for the general population, apps were accessible for everyone and therefore the ones containing gratitude exercises should provide a warning message for people with a depression. Furthermore, the exercise *'practicing gratitude'* was mostly implemented in the form of a daily gratitude journal. Considering the findings of Lyubomirsky et al. (2005) and Emmons and McCullough (2003), this dosage of encouraging the user to do this exercise daily might be counterproductive. Lyubomirsky et al. (2005) explained that participants who filled in the gratitude journal more frequent than once a week experienced it as overdone and depleted. Participants who kept the diary once per week, benefited most from the gratitude journal. Conclusively, app developers did not take the recommended dosage of this exercise into account, although it is an important issue that influences the effectiveness of the exercise.

The exercise *'three positive things'* was included second most. In contrast to the recommended dosage of the gratitude journal, the *'three positive things'* exercise should be

conducted daily in order to gain maximum benefit of it (Parks & Biswas-Diener, 2013). Conclusively, nearly all apps provided the recommended dosage of this exercise. An exception was the app **Gratitude Challenge 21** (nr. 11), since it suggested the user to do the exercise once a week.

About a third of the apps included the exercise *'acts of kindness'* by providing a journal in which the user should note his good deeds, or by explicitly giving him the task to act kindly. Lyubomirsky et al. (2005) showed that engaging in an act of kindness per day for one week does not lead to increased well-being, whereas five acts on one day do. However, none of the evaluated apps specified an amount of five acts of kindness on a single day. Rather, they provided the task to do one act of kindness or to daily note down an unspecified amount of conducted acts. Conclusively, app developers did not take the recommended dosage of this exercise into account and could thus better adapt their form of provision. The exercise *'making use of your strengths'* was only scarcely employed. This finding shows another potential area of improvement, since the exercise might be of great importance with regard to the promotion of well-being. Seligman (2012) namely found that the most satisfied and upbeat people are those who identified their strengths and employed them in their lives. This exercise might not be employed because of the same reasons that hindered app developers in including the additional competences that contribute to well-being.

The additional competences that contribute to well-being were namely incorporated the least and none of the apps explicitly referred to Bohlmeijer and Hulsbergen (2013) who introduced them. It may be that training competences such as '*coping with setbacks'* require more time and effort than for example creating the exercise *'practicing gratitude'*. The idea that app developers might have chosen to create apps that are easy to develop can also be related to the finding that the element 'positive emotions' was included most. Therefore, most of the apps provided hedonic instead of eudaimonic exercises. Apparently, the creation of a gratitude journal is easier than the creation of a questionnaire that identifies the user's strengths in combination with the provision of the task to make use of those strengths. However, the important competence *'examining personal virtues and strengths'* could for example be implemented by providing the VIA inventory of strengths, a questionnaire that enables the user to identify his personal character strengths (Linley et al., 2007).

Furthermore, all of the apps included *self-oriented* exercises. This finding seems reasonable, since the user of the app is thereby the focus of the exercises and the aim is to promote his/her well-being. Results of a prior study (Sin & Lyubomirsky, 2009) showed that apps that offer more *other-oriented* and *social-behavioral* exercises could be more beneficial

for users from a more collectivist culture. Since only half of the evaluated apps employed *other-oriented* and *social-behavioral exercises*, this study identified a potential area of improvement for future apps.

With regard to the question to what extent the apps incorporated persuasive design principles, the findings revealed that these principles were only moderately employed. Primary task elements were most commonly included. However, within this category the principle *'Tailoring'* was seldom employed. This finding is in line with a prior study (Chang et al., 2013) that assessed apps aimed at promoting well-being and that recommended a wider employment of features tailored to the user. Apps aimed at the promotion of well-being could indeed employ the principle *'Tailoring'* more often, since personalized content increases the adherence to interventions (Ludden et al., 2015). Adherence is an important issue in the context of well-being promotion, since the exercises have to be conducted regularly in order to gain maximum benefit of them (Lyubomirsky et al., 2013). Especially the provision of exercises should be tailored to the user, since users might have different skills and needs that require different exercises. For example, a user that has several positive and supportive relationships but no time for him- or herself, might not need exercises that foster relationships but instead exercises that are related to self-care. Halko and Kientz (2010) also underlined the importance of personalization, since they demonstrated relationships between the personality of people and the effectiveness of specific persuasive strategies.

The category 'System Credibility support' was used second most. This finding is surprising, since a prior study (Chang et al., 2013) that assessed the inclusion of persuasive design elements in well-being apps found that principles of this category were seldom employed. However, the principles *'Third-party endorsements'* and *'Verifiability'* were only implemented by one of the apps. Especially the principle *'Verifiability'* seems important in the context of apps providing self-help exercises, since users might be more motivated to perform the tasks if they could be sure that the provided exercises are validated.

Only a few dialogue support elements were included per app. This finding shows room for potential improvement, since a wide use of this category is related to better adherence, which is very important in the context of self-help exercises (Kelders et al., 2012; Lyubomirsky et al., 2013). Within this category the principle *'Reminders'* was employed most. These findings are in line with a study of Kelders et al. (2012) that showed that principles of this category were scarcely employed in web-based interventions and that reminders were most frequently used.

Social support elements were seldom employed. This finding is in line with prior studies (Chang et al., 2013; Kelders et al., 2012) that also found that principles of this category were included the least in apps aimed at the promotion of well-being and in web-based interventions. Since emotional support was found to have a great influence on the user's motivation to make life style changes (Munson, 2011) and could therefore help users in regularly engaging in positive activities, not widely making use of this category can be identified as shortcoming of the evaluated apps. Overall, the category social support might be of high relevance in the context of well-being promotion, since it does not only increase the persuasiveness of apps (Oinas-Kukkonen & Harjumaa, 2012) but also represents an important contributor to well-being itself (Howell et al., 2016; Seligman, 2012). Therefore, the employment of more social support elements presents a further area of potential improvement. App developers could learn from the positive example **Daily Challenge wellbeing** (nr. 12) that incorporated an *'Activity Feed'* in which the user was encouraged to make connections with at least 3 other users and to exchange experiences with the whole community, in order to gain social support, to learn from each other and to get motivated by competing with other users for the most earned points.

Implications and Recommendations

First of all, the results showed that the evaluated apps included several evidence-based exercises, elements that contribute to well-being and different persuasive design principles. Especially the apps **Feed your Happy** (nr. 5), **Gratitude Challenge 21** (nr. 11) and **YOU** (nr. 13) seemed to perform well on both evaluated quality criteria. People that are interested in improving their well-being via engaging more in specific activities or achieving goals might profit from using the apps **The Hapiness Wizzard** (nr. 1), **Rezolute** (nr. 14), **Unithrive wellbeing** (nr. 7) and **FeelGood tracker** (nr. 15). However, future research that investigates the effectiveness of the apps, for example real life studies or randomized controlled trials are needed, before the usage of the apps could possibly be recommended.

Furthermore, this study also identified possible areas of improvement. First of all, app developers did not take the recommended dosage of exercises into account, leading to a limited potential. Therefore, current literature could be better taken into account in order to adapt the provision of exercises to the recommended dosage. Another important area of potential improvement is the inclusion of 'Tailoring'. With regard to the theoretical background, apps could better tailor the provision of exercises to the characteristics and needs of the user. Apparently, personalized content is strongly connected to the incorporation of the

persuasive design principle *'Tailoring'*. In order to provide personalized content, apps could include a pre-test that identifies the needs of the user and provide exercises that fit the users' needs. Otherwise, apps could provide information about the characteristics of their exercises including recommendations which exercises are appropriate for which user characteristics. Thereby, they would take the positive-activity-model (Lyubomirsky & Layous, 2013) into account, which stresses that the success of a positive activity depends on the fit between the person and the activity feature. On top of that, the results revealed that the additional competences introduced by Bohlmeijer and Hulsbergen were seldom employed. Especially the exercise *'examining personal virtues and strengths'* is essential for a meaningful life (Seligman, 2012). Therefore, more effort could be inserted into the development of apps in order to employ this important contributor to well-being.

Moreover, app developers could put more effort into the provision of psychoeducation. Although many apps provided a short description of the beneficial effects of the exercises, only two apps provided detailed information and referred to studies that supported the effects of the provided exercises. It may be that some users require profound knowledge in order to be strongly motivated to perform the exercises. Lyubomirsky and Layous (2013) stressed the importance of people's motivation to perform self-help exercises, in order to benefit from them. Moreover, the provision of detailed psychoeducation is linked to the persuasive design principle *'Simulation'*. This principle can persuade the user to perform the provided exercises by showing him/her the positive consequences of performing them. However, the principle 'Simulation' was not included in the apps. It may be that the cause-effect relationship between the exercises and the benefits of them are too complex for displaying them due to their dependence on other factors (Lyubomirsky & Layous, 2013). Therefore, a good alternative might be the provision of detailed psychoeducation in an extra part of the app (such as the *Knowledge Center* in app nr. 5) in order to motivate people by informing them about the benefits of the exercises. Next to more references to outside sources, the provision of psychoeducation could further increase the system's credibility. On top of that, the employment of social support elements could possibly be improved. The employment of this category was very seldom, although social support respectively positive relationships are factors that not only increase the persuasiveness of an app, but particularly make up one of Seligman's elements of well-being (2012). Therefore, the inclusion of more social support elements in apps aimed at the promotion of well-being could contribute to well-being in two different manners.

In general, it was noted that many of the apps suggested by the iOS app store had to be excluded due to non-relevance and it might be difficult for laypersons to identify suited apps. Therefore, users could be better informed about the evidence base of an app. The Royal Dutch Medical Association (KNMG, 2016) already made a first step, since they published an 'App Checker', a set of questions that enables a more qualitative evaluation of medical apps. However, this checklist was mainly developed for professionals in order to help them with identifying health apps which they could recommend their patients. It may be difficult for users to apply the checklist accurately to the wide range of apps on the market. KNMG (Medical App Checker, 2016, p. 10) also explained that the European Commission is working on a "Code of Conduct" on privacy for mobile health apps. It would be desirable that next to the important issue of privacy policies, an independent commission would be established that officially recommends apps with regard to their theory base and incorporation of persuasive design principles or even develops apps with more specific goals for different user needs. The important issues of providing tailored content, exercises that train the additional competences contributing to well-being, a suited dosage of the exercises and references to outside sources could thereby receive extra attention. On top of that, such a commission or institution should consist of a multidisciplinary team of psychologists, therapists and design experts that work closely together with the target group of the apps, the general population. Thereby, a holistic framework as was suggested by van Gemert-Pijnen et al. (2011) could serve as a base. Finally, the coding scheme provided in this study could serve as mini-checklist that provides an orientation of which theoretical elements and evidence-based exercises should be employed in the apps.

Limitations

Certain limitations of this study should be considered. First of all, apps were searched in Apple's iOs app store only. This could have led to biased findings in two different ways. On the one hand, the iOs app store does not offer possibilities to refine search terms and therefore impedes a systematic selection of apps. On the other hand, app stores of other operating systems such as Android's Play Store were not included in this study. Consequently, some relevant apps might not have been included, possibly leading to biased results. However, the iOs app store is the most popular one (Cisco, 2016), therefore the results of this study might be valid for the majority of smartphone users.

Another limitation is the lack of an inter-rater reliability, since only one researcher assessed the apps. Other researchers might have recognized other scientific theories as

theoretical background of the apps or rated the incorporation of some persuasive design principles differently. Therefore, it would be desirable that further studies include at least two researchers in order to assess the inter-rater-reliability.

On top of that it should be considered that the included search terms were in English and Dutch. Since apps were searched in the German iOs store, it might be expected that more relevant apps would have been found, if German search terms were included. However, the German search terms "Positive Psychologie", "Wohlbefinden" and "wohlfühlen" were checked and no apps that met the inclusion criteria were found. A possible explanation could be that the field of Positive Psychology is not as popular in Germany as in other countries such as the Netherlands or America (German-speaking Association of Positive Psychology, 2016).

Moreover it has to be considered that the 16 evaluated apps were coded within a period of 10 days. Since some of the apps daily provide new content, it might be that some elements of Seligman's well-being theory (2012) and self-help exercises had been missed. This might have led to a biased picture of some apps.

Finally, apps that costed more than 2€ were excluded from this study. It may be that apps with higher development costs have a higher quality, since more effort was put into their development. Therefore, it would be desirable that future research assess apps independently from their costs.

Future research

The results of this study lead to some directions for future research. It would be desirable that more than one researcher analyzes apps from different app stores in all price categories for a longer time period in order to balance the limitations of this study. Future research could further investigate which amount of positive psychology exercises seems reasonable in the context of promoting well-being of the general population. Additionally, it could be examined if a detailed psychoeducation part in the apps about the beneficial effects of well-being in general and the positive effects of the provided exercises contributes to more motivation of the user to keep performing the exercises. Finally, it could be evaluated to what extent available apps aimed at promoting well-being make use of other important factors that contribute to adherence. A possible point of departure could be to evaluate the incorporation of personalization, use of metaphors and ambient information in apps aimed at the promotion of well-being, since Ludden et al. (2015) suggested these approaches as promoters of adherence.

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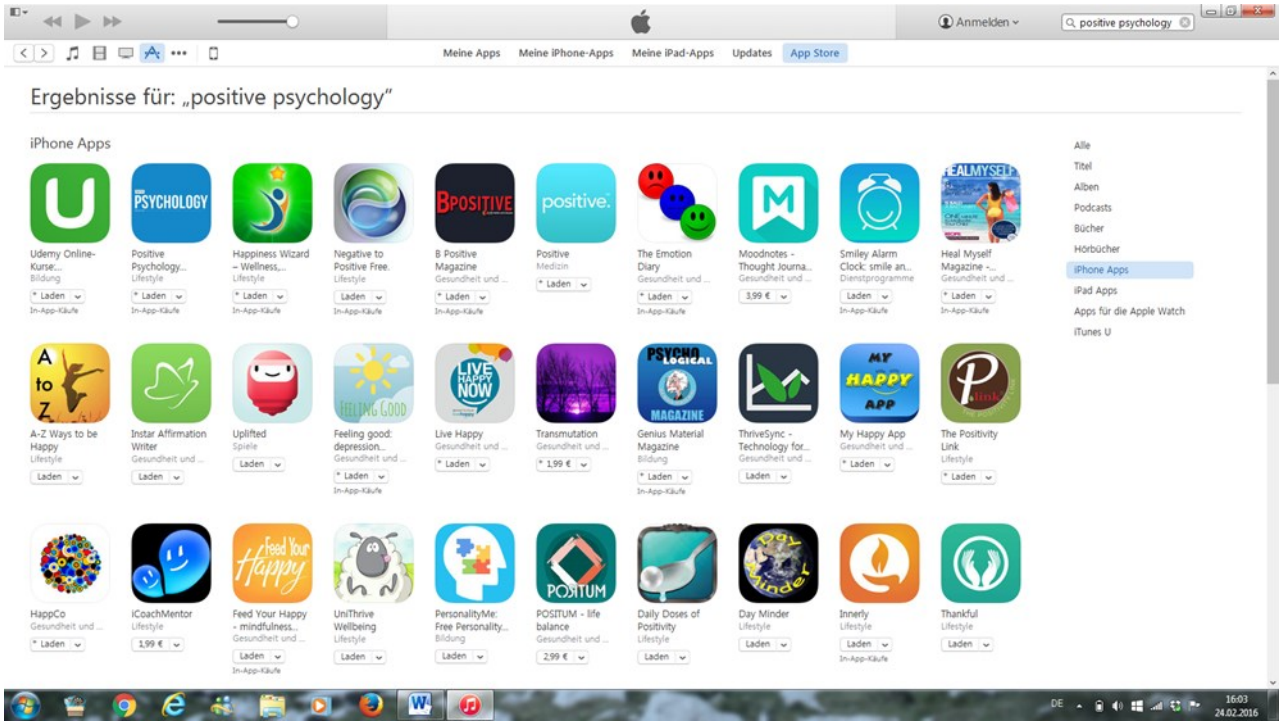
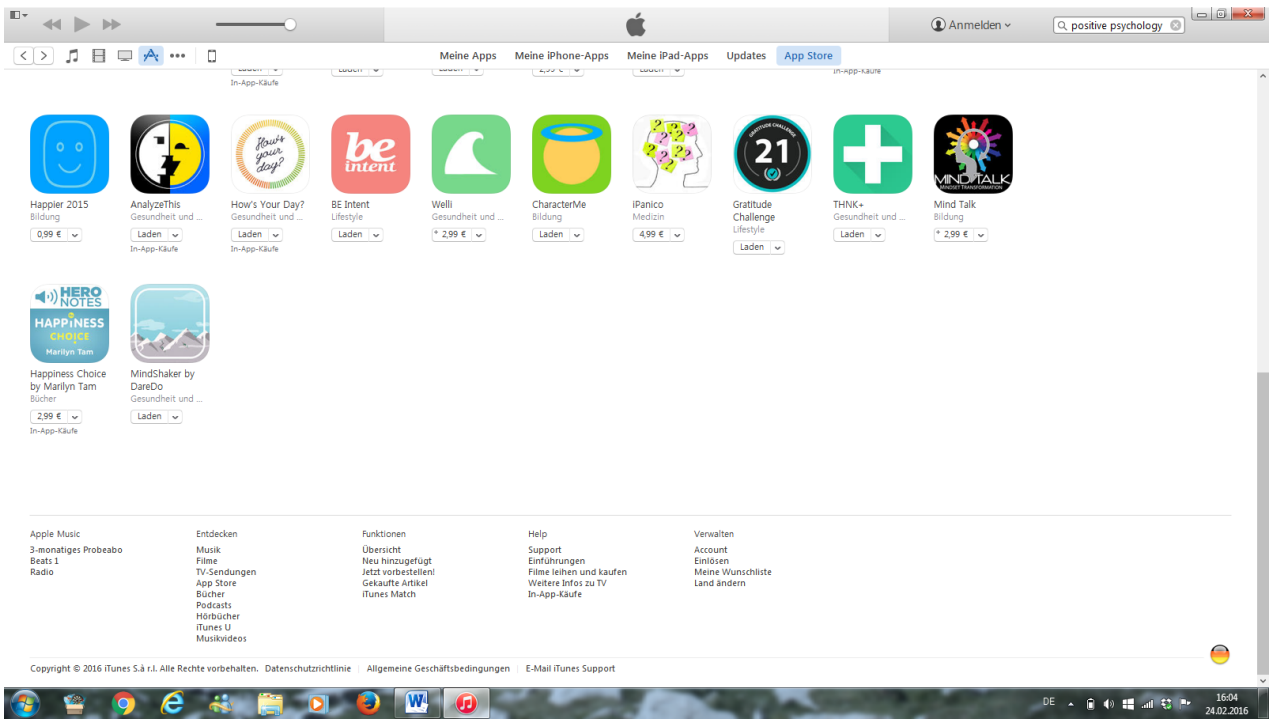
Appendix A

Screenshots of results in the German App Store for the different search terms

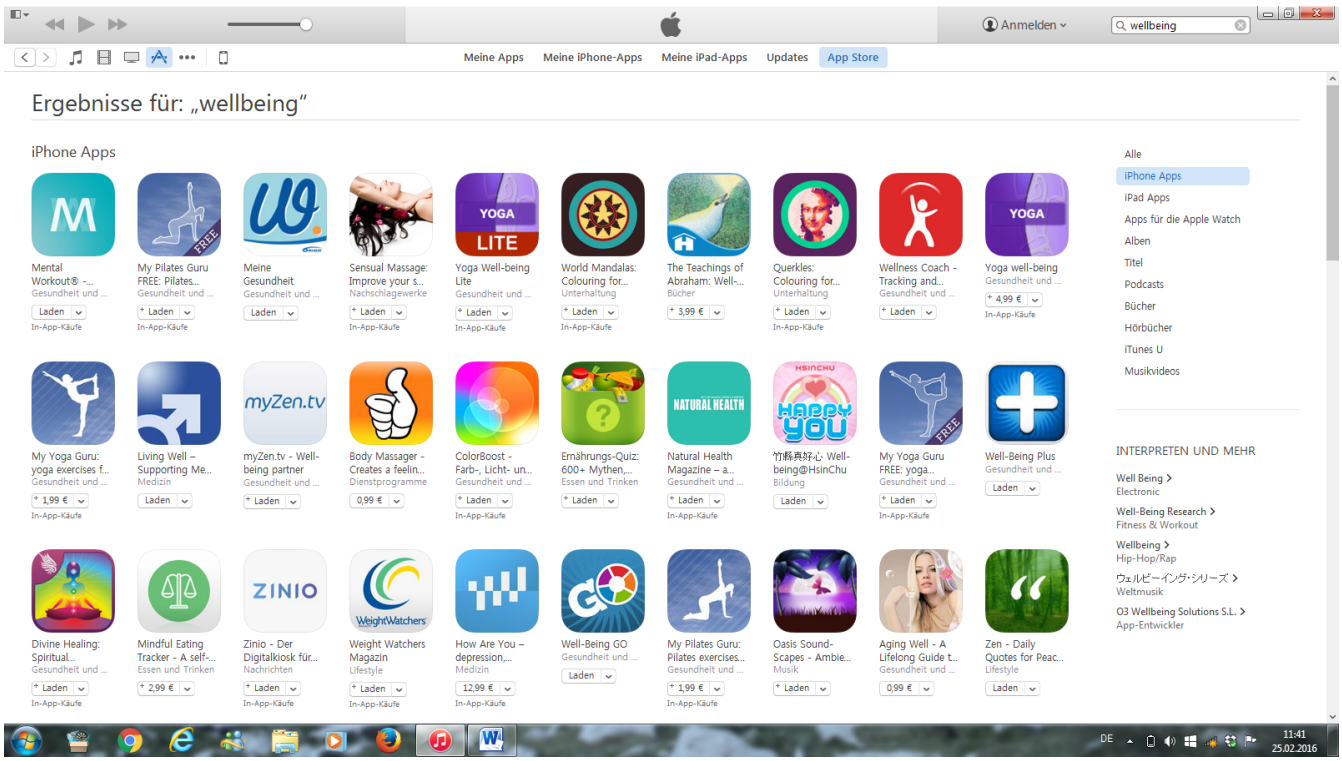
24.02.2016

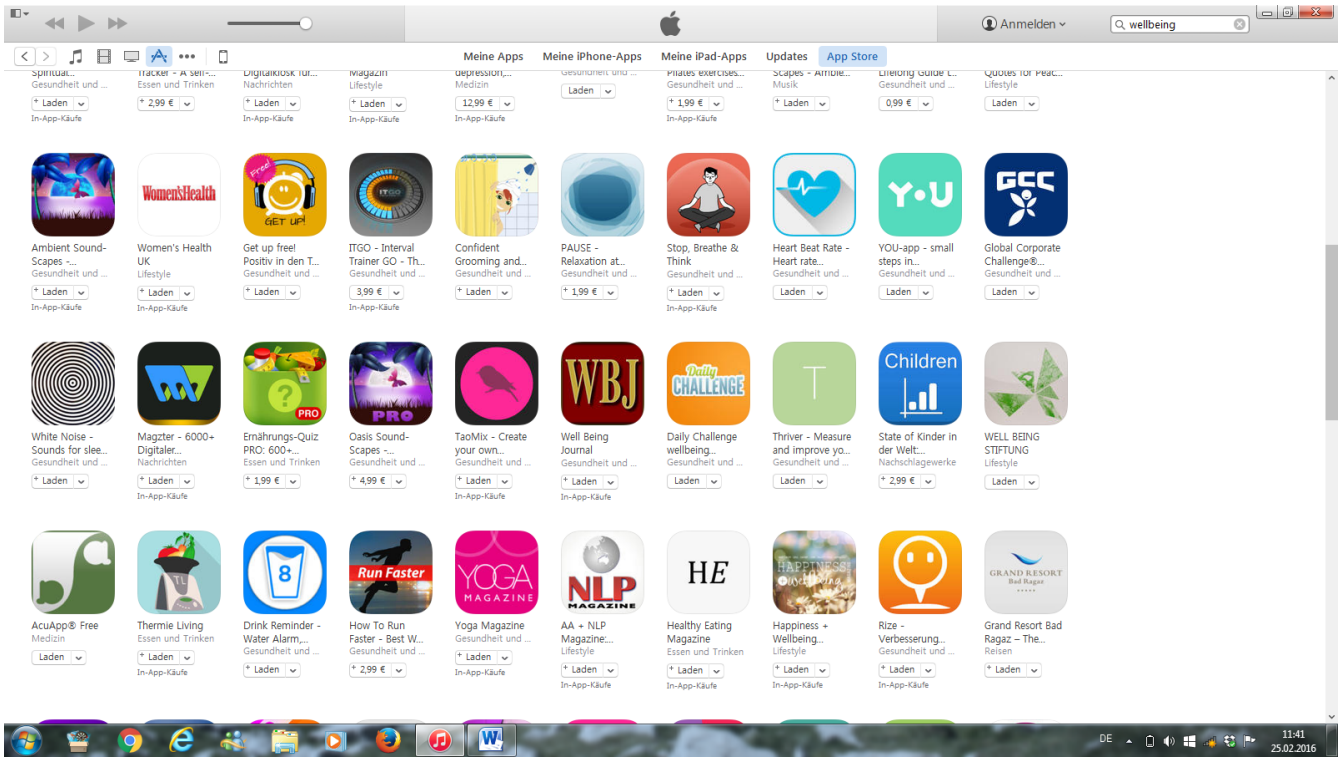
Positive psychology (42)

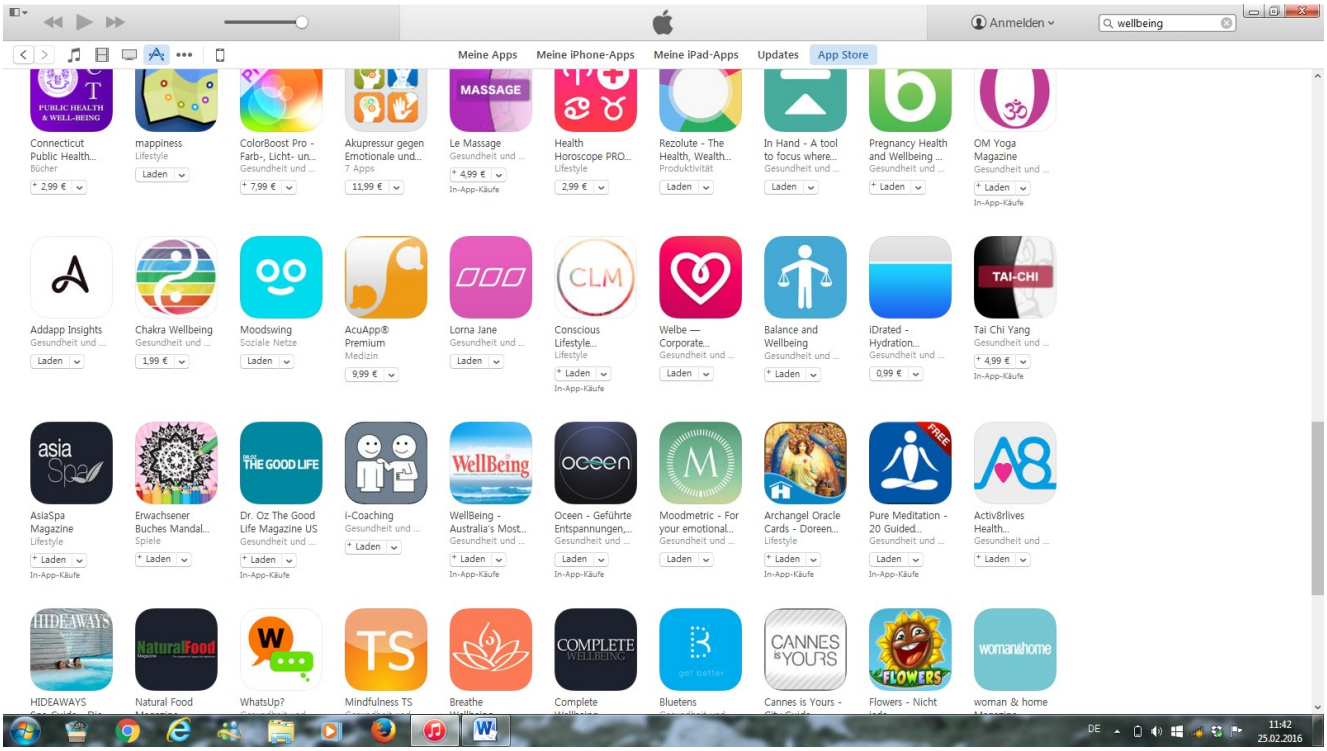




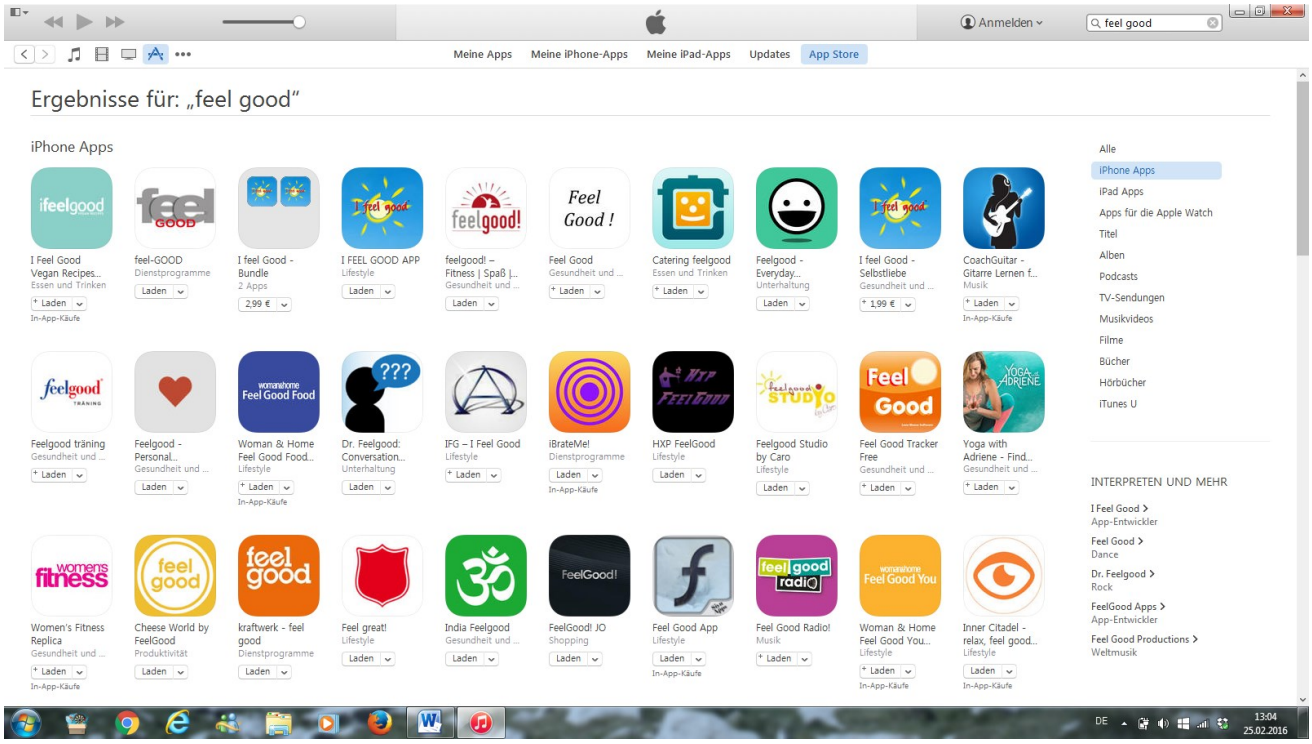
Wellbeing (100)



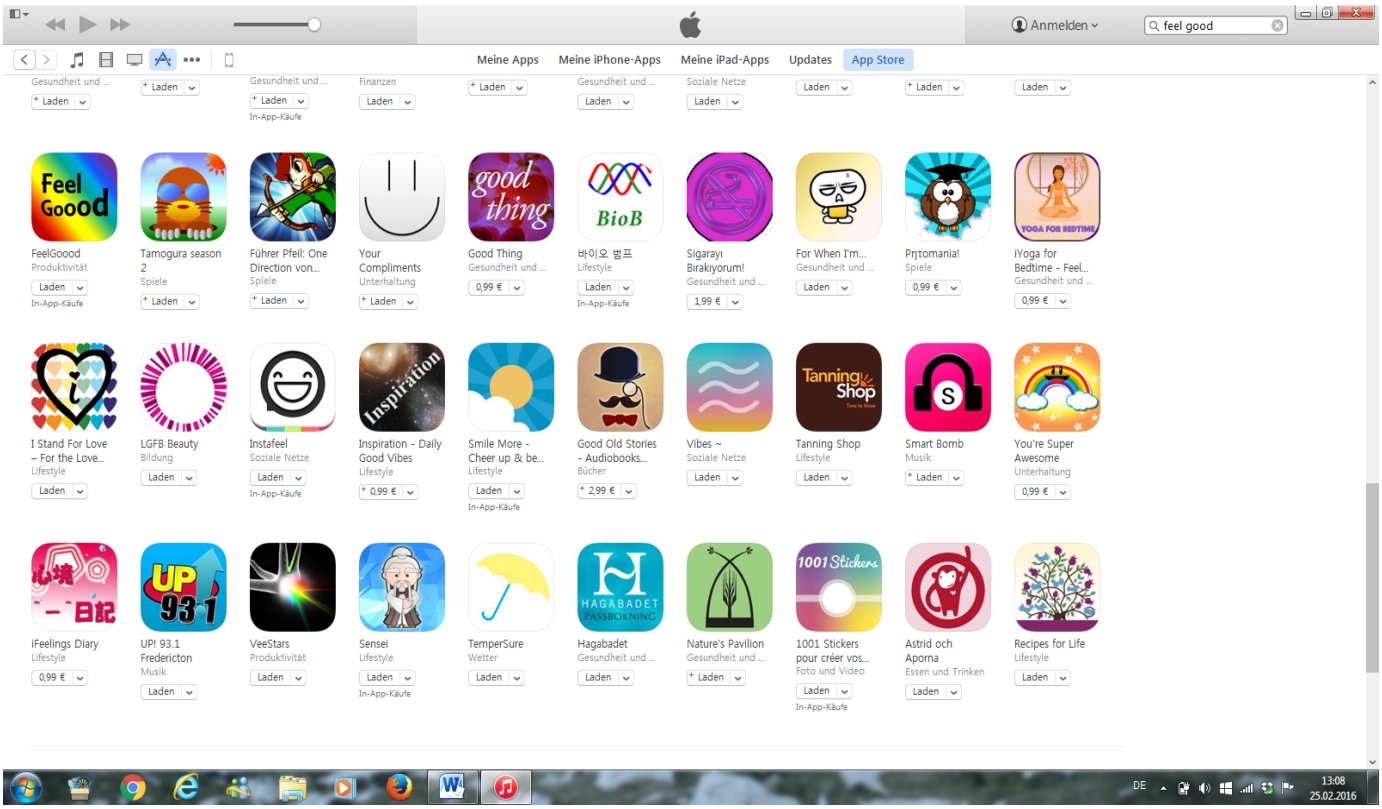




Feel good (100)




feel good
Meine Apps
Meine iPhone-Apps
Meine iPad-Apps
Updates
App Store
Fasting 5:2 Diet - Fastest way to...
Party Radio USA
Good News: Feel Good Stories an...
LISA - Look & Feel Good On...
Happily - Small Daily Habits Th...
Feel - GOOD
Look Good Feel Great
鬼たき
iStream Feel Good
Wage-o-meter
Gives Me Hope
LandIDEE Dutch Version - epape...
Happy Track - feel good music
Cute Cats - cheer you up!
Dr. Feel Good
App of AWESOME -...
Punkt & Kreis Super Süchtig...
Feel Good Tracker
Feel Good - Cuidate
Momentum - The Journey
Dragon Seekers
Mr. Steam Feel Good Rewards
Tamogura beating.
Feel Good Radio
Ocean 100
Healthy Body Cards - Louise...
Its4U - Feel good messages for...
Feel Good Gym
The Happy App
GMH 2.0
Feel Good
Feel Good Coffee
Positive Body
Feel Good Bank
Bet Predictor
Sportingclub Feel
Totem - The Feel
KWXX FM
K-98.3
Energy Boost


feel good
Meine Apps
Meine iPhone-Apps
Meine iPad-Apps
Updates
App Store
FeelGoood
Tamogura season 2
Führer Pfeil: One Direction von...
Your Compliments
Good Thing
바이오 밤프
Sigarayı Bırakıyorum!
For When I'm...
Pyromania!
iYoga for Bedtime - Feel...
I Stand For Love – For the Love...
LGFB Beauty
Instafeel
Inspiration - Daily Good Vibes
Smile More - Cheer up & be...
Good Old Stories - Audiobooks...
Vibes ~
Tanning Shop
Smart Bomb
You're Super Awesome
iFeelings Diary
UP! 93.1 Fredericton
VeeStars
Sensei
TemperSure
Hagabadet
Nature's Pavilion
1001 Stickers pour créer vos...
Astrid och Aporna
Recipes for Life

Appendix B

Table Results theoretical background

Name app, creator, version	**description, parts**	**based on theory (x): explicitly, seemingly; not**	**type of exercises** (hedonic vs. eudaimonic; reflective-cognitive vs. social-behavioral. Self-vs. other-oriented)
1. Happiness Wizzard (Success Wizzard, version 1.7)	**5 parts**: **(1) Today** (my daily mantra, my goals, today's focus), **(2)To do** (summary of your schedule: active, on-hold and completed tasks that contribute to your well-being), **(3)Reflect** (develop your self-awareness by considering the following questions throughout your day), **(4)Notepad** (My blessings, boosters and priorities, Ideas, Do More, Avoid), **(5)Journal** (place to express your thoughts, feelings, experiences and realizations); **themes covered**: life priorities, my time, relationships, influences, gratitude, love, my day, daily reflections **Test in beginning**: My happiness score, my top happiness contributors, areas to focus on **start page:** words of wisdom **settings**: email reminder, coaching, reminders (set time for morning routine reminder, daily check-in and reflection reminder)	not explicitly referring to a theory but **seemingly based on**: "you can become happier by consciously adjusting your perspective, focus and daily routines, "spend more time doing things you enjoy" → **positive emotions and engagement well-being theory Seligman** (2012), "devote more time to family and friends" → **relationships and engagement, well-being theory Seligman** (2012), "get rid of negative influencers" → **coping with** setbacks and **distress**, **competences that contribute to well-being Bohlmeijer and Hulsbergen** (2013), "express gratitude, appreciate all that you have" → **expressing gratitude, Positive Psychology interventions**, Bolier et al. (2013), "express love towards those you care about" → **Relationships, well-being theory, Seligman** (2012), "focus your attention on the positive" → **three positive things, PPI**, Bolier et al (2013) and **positive emotions, well-being theory Seligman**	**eudaimonic** (are you spending enough time on things that are meaningful to you) , **hedonic** (..things that are joyful), **reflective-cognitive** (Reflect part), **social-behavioral** (To do part) **self-oriented** (how can I enjoy the present?, reflect on your blessings) **other-oriented** ("how can I be more helpful to others today?, tell someone you care about deeply how you appreciate him/her) **no psychoeducation part** (exercises are described in detail, but effects or benefits of them are not explained)

	themes covered after paying 7,99€: attitude, goals, health, contribution, here and now	(2012), "pursue meaningful goals and dreams" → **meaning and accomplishment, well-being theory Seligman** (2012), "help others, contribute, give, gift" → **Acts of kindness, PPI**, Bolier (2013) **relationships, meaning, well-being theory Seligman** (2012), "live in the moment, experience life to its fullest" →**enjoying activities, PPI**, Bolier (2013), **engagement, well-being theory Seligman** (2012)	
2. The emotion diary (Linda Burke, version 2.3)	**parts: (1) Emotion tracking, free** (emotion diary of happiness), **(2) Emotional Dimensions, 0,99€** (you can select the following dimensions for detailed tracking: Alertness, Anger, Anxiousness, Comfort, Confidence, Confusion, Control, Disappointment, Distress, Energy, Enthusiasm, Excitement, Fear, Guilt, Hostility, Insomnia, Inspiration, Jealousy, Nervousness, Recklessness, Social Connectedness) **(3)Positive features**, 0,99€ (track your positives for today and write in box: what went well, I was grateful for, my acts of kindness, strengths) **"About"** (**psychoeducation** about positive effects of greater well-being and effects of the exercises) **"Setup Options"**	**explicitly named: positive psychology** ("a stream of psychology that shifts focus from illness and what is wrong to the promotion of well-being; life that is filled with pleasure, meaning, accomplishment, engagement and positive relationships"), **seemingly based on PERMA, well-being theory of Seligman** (2012) and "greater well-being enhances learning. A positive mood provides a broader attention, more creative thinking, more holistic thinking and the ability to learn new things" → **Broaden-and-build -theory**, **Fredrickson** (1998) **seemingly:** "write down what went well today and why" → **positive emotions, well-being theory Seligman** (2012), **three positive things exercise, PPI,** Bolier (2013) "I was grateful for" → **gratitude exercise, PPI,** Bolier (2013), **positive**	**hedonic** (what went well), **eudaimonic** (strengths, acts of kindness), **reflective-cognitive** (diary for what went well, strengths etc) **mostly self-oriented** (strengths, what went well, emotion tracking) **other-oriented** (diary about my acts of kindness) **psychoeducation part in App** (More in Setup Options: Why the emotion diary? "It's difficult to accurately recall how you felt over a period of time when discussing with a health professional, how you feel at the time can falsely adjust your perception of how you have felt, the emotion diary is also

	(features you can buy, dimensions of emotions, strengths and positives other features that are not bought: Group feature (2,99€), Therapy Feature (2,99€)	**emotions, well-being theory Seligman** (2012), "my acts of kindness" → **acts of kindness, PPI**, Bolier (2013), relationships, well-being theory Seligman (2012), "my strengths" → **examining personal virtues, Bohlmeijer and Hulsbergen** (2013), **engagement, well-being theory Seligman** (2013), "emotion diary, how happy are you today ranging from very sad to very happy; "Do you feel a lack of energy or are you feeling energetic?" → **tracking of emotions (what you track improves) →Seligman** (2012)	useful for self-analysis; positive psychology is a stream of psychology that shifts focus from illness and what is wrong to the promotion of well-being; the focus is on life that is filled with pleasure, meaning, accomplishment, engagement and positive relationships; greater well-being enhances learning, broader attention, holistic thinking etc"
3. Smiley alarm clock: smile and wake up (Maxim Ivanov,Arty Apps, version 1.0.1)	**parts:** **Alarms** (choose time at which alarm clock rings) → you can only turn off alarm by looking in the camera and smiling and select sound of alarm) **psychoeducation part** only available in description of app store, but not directly in app	**explicitly**→ "build on **emotion detection technology**" "Smiling makes you healthy. Scientists proved that smile does good for your entire body: stress hormones lower and happiness hormones raise. Smile in the morning will make your day." → **seemingly** based on **Facial Feedback Hypothesis, Strack, Martin & Stepper** (1998), **positive emotions, well-being theory Seligman** (2012)	**hedonic** (only directed at pleasure), **self-oriented** (smiling in camera) **short psychoeducation part in App store description** ("Smiling makes you healthy. Scientists proved that smile does good for your entire body: stress hormones lower and happiness hormones raise. Smile in the morning will make your day"
4. Instar Affirmation writer (Blink Interactive, Inc.; version 1.0.0)	-write down your affirmations, repeat them each morning, evening and in between **parts: (1) my affirmations** (write them down) **(2) Reminders (3)**	"writing powerful, impactful affirmations that positively influence your life; cognitive psychology tells us that affirmations we make with our self-talk are accepted as literally true	**reflective-cognitive** ("by altering the ways you think, you can…", "write down your daily affirmations"), **eudaimonic** ("begin

	Tips & Tutorials (Guidelines for powerful affirmations) **(4) Affirmation Library (5) About Instar** **suggested categories in which you can write your affirmations:** Core, Exercise, Family, Financial, Friendship, Growth, Career	by our subconscious mind ;begin experiencing **insight and growth** today; write your affirmation in 1st person, present tense, positive/emotive; say your affirmations to yourself while looking in a mirror, "find pictures that represent your affirmations and put them in visible places"→ " → **explicitly: Cognitive Psychology; seemingly: positive emotions, well-being theory Seligman** (2012), **dealing realistically with goals, Bohlmeijer and Hulsbergen** (2013) "Affirmation categories: Family and Friendship" → **relationships, well-being theory Seligman** (2012), "Category Core"→ **engagement, well-being theory Seligman** (2012), "Category Career, Financial" → **achievement, well-being theory Seligman** (2012), "Category growth" → **engagement, meaning, well-being theory Seligman** (2012)	experiencing insight and growth today, improve on different domains as relationships and career") **hedonic** (positive emotions through self-talk) **self-oriented** ("write affirmation in 1st person, say your affirmatios to yourself") **short psychoeducation part in App** (in: About Instar "by altering the ways you think, you can change your habits and behaviors; powerful affirmation process is a cornerstone for establishing new thought patterns toward the realization of positive change)
5. Feed your Happy (nCourage,LLC; version 1.3)	receiving activities that have to be fulfilled during a specific period **parts:** **(1)Feed your happy** (current activities are displayed with points that you receive for them) **(2) Knowledge Center** (overview and explanation of the scientific relevance of the	**explicitly in description:** "each activity is backed up by science…positive psychology have identified core skills of unusually happy people, now these skills are available to you as a systemized tool" → positive psychology "be grateful, savor the now, lift someone else,	**social-behavioral** ("call a friend, give a compliment…) **reflective-cognitive** ("take 5 minutes to write about…") **eudaimonic** (foster relationships, making use of your strengths…)

	topics and related activities: be grateful, savor the now, lift someone else, Don't worry, Foster Relationships, Improve Daily, Begin Again) **(3) My journal (4) Rewards** (videos that can be unlocked with specific earned points) **(5) My dashboard** (Points over time, Activity Completion, Satisfaction with life, Subjective Hapiness Score, how are you feeling right now? **(6) daily reminders**	don't worry, foster relationships, improve daily, begin again" → positive emotions, engagement, relationships, meaning, accomplishment"→ **complete PERMA, well-being theory Seligman** (2012) **explicitly: gratitude** ("give a genuine compliment; be grateful; gratitude is the foundation skill") → **seemingly: positive emotions**, **well-being theory Seligman** (2012), **PPI, expressing gratitude**, Bolier et al (2013) **explicitly: foster relationships** ("call an old high school friend") → **seemingly: relationships, well-being theory, Seligman** (2012) **explicitly: "be grateful"** ("Take your first step and buy a box of thank you cards") → **seemingly: positive emotions, well-being theory** Seligman (2012) **"explicitly: find your motivation"** ("look at your calendar; what feels like an obligation now and how can you turn that activity into something you actually want to do? Find a challenge, opportunity, or curiosity you can get out of the activity" → seemingly: **making use of your strengths, PPI**, Bolier et al (2013), **engagement, well-being theory Seligman** (2012),	**hedonic** (place a pen between your mouth → positive emotions) **other-oriented** (give somebody a compliment,…) **self-oriented** (find your motivation,…) **detailed psychoeducation part in app** (in Knowledge Center : "gratitude is known as the universal happiness skill;…;studies show that strong social support can positively impact health,…)

		explicitly: boost your **appreciation levels** ("plan to watch tonight's sunset, have the best view of the colours and light that changes in the evening sky; it's enjoying the sun on your face") → seemingly: **well-being theory Seligman** (2012), **positive emotions**, **enjoying one activity, PPI**, Bolier et al (2013), **explicitly**: "place a pen sideways in your mouth for two minutes;pen/chopstick technique produces a Duchenne smile, researchers found that this leads to lower heart rates during stress recovery" →**seemingly: facial-feedback-hypothesis**, **Strack et al** (1988), positive emotions, **well-being theory Seligman** (2012) **explicitly**: **being grateful** ("Recognize the good in others, take five minutes to write about someone who made a difference for you")→ **seemingly: positive emotions, well-being theory**, Seligman (2012), **practicing gratitude, PPI**, Bolier et al (2013)	
6. DayMinder (Geoff Kent, version 1.0.1)	recording things that happened, how you felt over day and what you are grateful for **parts: (1) Add it all (2) Record stuff that happened** (when, what, how did you feel) **(3) Count my blessings** (3 each day) **(4) Rate my day** (0-5 stars) **(5) List**	"Count my blessings; 3 each day" → **three positive things, PPI**, Bolier et al (2013), **positive emotions, well-being theory Seligman** (2012),"what does it all mean?; overview of common activities that you did on days that you rated highly" → insight into activities that are	**reflective-cognitive** (recording of daily actions and feelings), **hedonic** (counting blessings and doing more of activities that were rated highly increases positive emotions) **self-oriented** (how

	stuff that happened (overview of all your entries) **(6) What does it all mean?** (overview of common activities that you did on days that you rated highly; of month, 3 month, lifetime)	pleasant and encouragement to do them more often → **positive emotions and engagement, well-being theory Seligman** (2012)	did you feel, what did you do), **psychoeducation part only shortly in app store description** ("after you've entered your details for a while, see in *what does it all mean?* Section the common activities that you did on days you have rated highly so you can do them more often")
7. UniThrive wellbeing (The University of Adelaide, version 1.3)	tracking your mood, inspiration for relaxation, planning activities and gratitude journal parts: **(1) daily mood enhancer** (select your mood, save quotations, overview of month, receive a tip **(2) study timer** (choose your study length, choose your recovery length) **(3) Helpful tools** (set reminders to help take care of yourself; plan daily, weekly, monthly activities; reflect what you are grateful for and what went well; check in reminder) **(4)relaxation center** (breathing, meditation, yoga) **(5) Blog** (sharing ideas to thrive) (6) Unithrive (info and contact details) **(7) Tutorial** (how to get started with the app)	**explicitly**: aim of helping 'thrive' using the principles and ideas offered by **positive psychology**, **seemingly:** "monitor your mood and receive tips of the day" → **positive emotions, well-being theory Seligman** (2012), "what are you grateful for, what went well today?" → **three positive things, PPI,** Bolier et al (2013), **practicing gratitude, positive emotions, well-being theory Seligman** (2012), "get organized and plan your activities" →**dealing realistically with goals, Bohlmeijer and Hulsbergen** (2013), **accomplishment, well-being theory Seligman** (2012), "unwind and relax" → **positive emotions, well-being theory Seligman** (2012), "take care of yourself: add items as controlled breathing, filling in your gratitude list, me time…" → **positive emotions, well-being theory Seligman** (2012),	**mostly reflective-cognitive** (writing down what you are grateful for and what went well, tracking your mood), **social-behavioral** (plan your activities), **self-oriented** (track your mood, studytimer, relaxation) **hedonic** (helpful tools for self-care and relaxation center), **eudaimonic** ("get organized and plan your activities →realizing goals) **psychoeducation part shortly in app** (in Tutorial part: "mediation is an ancient skill used to…;and to generally improve well-being", but no explanations about gratitude and what went well)

		Broaden-and-Build-theory by Fredrickson (1998)	
8. Daily Doses of Positivity (Lindsey Collins, version 1.0.0)	you receive a new inspiring message daily regarding positivity and a new exercise **parts: (1) Home** (daily exercise that can be saved to journal) **(2) Free Gift** (get your free copy of Creative Recognitions: Flourish or Languish **(3) Journal** (diary of your experiences with exercises) **(4) Connect** (information about developers of app and email contact) **(5) More** (History and latest journal entry)	**explicitly:** "synthesize strategies from inspirational thought leaders, **positive psychology**, cognitive/rational emotive behavior; nurtured heart approach; using intrapersonal communication, interpersonal relations with others, everyone **flourishes together**" **seemingly:** "Define your undaunting purpose. Why is it you are choosing happiness, positivity and rational thinking? Write down your responses and reactions. → **examining personal virtues**, Bohlmeijer and Hulsbergen (2013), "think about ways you can use peaceful power in all your relationships…this can be particularly useful when there are differences of opinion, how will you channel your inner Mandela?" → **relationships, well-being theory, Seligman** (2012), "Create relationships that flourish and nurture them; who supports you? reach out the people you want to have in your team, do it now" → **relationships, well-being theory Seligman** (2012), "the power to believe in yourself and increase well-being is a precious gem, take time to honor yourself, reflect back to your strengths, what are your talents?, write down some of your gifts now,	**mostly reflective-cognitive** ("write your thoughts in your journal"), **eudaimonic** (reflecting on personal virtues, focus on relationships…), **social-behavioral** (reach out the people…,do it now") **self-oriented** ("what strengths and talents do you have?") **other-oriented** (create relationships and nurture them) **psychoeducation part in app** (daily new description of exercise including explanation of importance:"seek out others who have positive energy, when making change in your life it works best when you have a team wrapped around you…")

		what strengths and positive qualities do you have?" → **examining personal talents,** Bohlmeijer and Hulsbergen (2013), "you can promote healthy growth within you by increasing psychological, social and emotional capital-human capital; this can be done by simply noticing, notice the beauty of humanity first by seeing it in you and then reflecting it back to others, share the miracle of growth and prosperity in the garden of humanity, what do you see right now? write it down"→ **seemingly**: **meaning, well-being theory Seligman** (2012), recognize what is going strong rather than what is going wrong, start the practice of rational, peaceful and positive thinking"→ **optimism, positive emotions,well-being theory Seligman** (2012), "your success is not something that is going to be handed to you; get in touch with every thought, feeling and action that you choose to take in your daily life, give yourself credit for the day to day things you do"→ **seemingly**: **accomplishment, well-being theory Seligman** (2012)	
9. Thankful (Quantumbit Works Interactive Studios, version 2.4)	journal with remind-option, where you can daily write down what you are thankful for parts: **(1) journal of thankful messages (2) reminder**	**explicitly:** "aims at transforming the **'Losada ratio'**,the ratio between good and bad thoughts; good practice based on positive psychology"→ **Broaden-and-Build theory** (Fredrickson, 1998)	**hedonic** (being grateful leads to positive emotions), **reflective-cognitive** (writing down things you are thankful for) **self-oriented**

		seemingly: **practicing gratitude, PPI,** Bolier et al (2013), **positive emotions, well-being theory Seligman** (2012)	(writing what you are thankful for) **short psychoeducation part only in app store description** (by being thankful you are focusing on positive things, making bad thoughts disappear; aims at transforming the 'Losada ratio',the ratio between good and bad thoughts; good practice based on positive psychology")
10. Happier2015 (Xiaofei Tang, version 1.1)	track your emotions, happiness and gratefulness in journal, tool for setting and tracking your goals, receiving tips for more happiness **parts: (1) Tips** (description of principles and how to) **(2) Quotes** (get inspiring quotes) **(3)videos** (understand emotions, videos about emotions)→ but no videos are displayed **(4) Logs** (write a journal of happiness, gratitude or emotions) **(5)Goals** (set short-term and long-term goals)	**explicitly:** "this app implements some of the most effective principles, science proven and based on positive psychology". **principles described in tips**: understand how to manage your emotions, write down three new things each day that you are grateful for, set and remember your goals and dreams, being part of something big and help others in need and practice random acts of kindness → **seemingly: positive emotions, meaning, accomplishment, engagement, well-being theory Seligman** (2012), **acts of kindness, three positive things, practicing gratitude, PPI**, Bolier et al (2013), **dealing realistically with goals**, Bohlmeijer and Hulsbergen (2013)	**reflective-cognitive** (journal of happiness, gratitude and emotions and overview of goals) **social-behavioral** (practice random acts of kindness) **hedonic** (positive emotions through being grateful) **eudaimonic** (tips: set and remember your goals, being part of something big, help others in need) **self-oriented** (set and remember your goals) **other-oriented** (help others in need) **no psychoeducation part about why principles work**
11. Gratitude Challenge 21 (Justin	over 21 days, each day a new 5 minute gratitude	**-explicitly based on:** "built with proven	**mostly reflective-cognitive** (recall and

Sebastian, version 1.0)	challenge **parts: (1) Daily Challenge (2) History** (overview of your completed challenges **(3) Walkthrough** (Research facts about the positive effects of gratitude; overview of challenges) -before you receive your daily challenge, the importance/effects of the exercise is explained	principles of **positive psychology;** based on research of **Robert Emmons:** gratitude makes you happier, healthier, improves job performance, relationships, shifts focus to appreciation " **-seemingly based on:** "recalling and writing down three good things that happened today for which you could give other people some credit. It is important to write down why that good thing happened. Write down as many reasons as you can." → **three positive things, PPI,** Bolier et al. (2013), **positive emotions, well-being theory Seligman** (2012), "gratitude journal; shift your focus on those things in your life that you might be grateful or thankful for by answering the following questions" → **practicing gratitude, PPI,** Bolier et al (2013), **positive emotions, well-being theory Seligman** (2012),"focus for a moment on benefits or gifts that you have received; things as everyday pleasures, people in your life, personal strengths or gestures of kindness from others; slowly say a phrase such as I am gifted and be aware of your feelings and how you savor this gift in your imagination; be especially aware of the depth of your gratitude" →**practicing gratitude, PPI,** Bolier et al (2013); **positive emotions, well-**	write down…,gratitude journal…) **social-behavioral** (practice acts of kindness) **hedonic** (increased positive emotions by being grateful) **eudaimonic** (acts of kindness and dealing with distress, examining personal strengths) **mostly self-oriented** (gratitude journal) **other-oriented** (perform a non-random act of kindness) **short psychoeducation part in app** (research facts about gratitude in walkthrough)

		being theory Seligman (2012), "Is there a way to pass along this gift to others? Can you perform a non-random act of kindness?" → **acts of kindness, PPI**, Bolier, **positive emotions and relationships well-being theory Seligman** (2012), "choose an activitiy, exercise, relationship that may be ending soon, keep in mind that you only have a short amount of time left to spend doing it or being with it;given how many time you have left, write about, why you are grateful for it"→ **savoring, PPI,** Bolier et al (2013**), positive emotions, well-being theory Seligman** (2012), "negative visualization: by identifying how much worse your life could be, you gain a renewed sense of gratitude for just how lucky you are; think about an aspect of your life for which you feel grateful and then write about the ways in which this might never have happened"→ **explicitly: negative visualization for being grateful; seemingly: gratitude, positive emotions, well-being theory** Seligman (2012), **explicitly:** "transforming problems, remember the bad; choose an event of your life that was unpleasant and unwanted; try now to focus on the positive consequences of this difficult experience; were there personal strengths that grew out of your experience…?In sum, how can you be grateful for the beneficial consequences that have	

		resulted?" → seemingly: **coping with setbacks; examining personal strengths, Bohlmeijer and Hulsbergen** (2013),gratitude, **positive emotions well-being theory Seligman** (2012), exercises related to 7 topics were repeated 3 times (after 7 days, three-list exercise had to be done again ,etc.)	
12. Daily Challenge wellbeing (MeYou Health, LLC; version 1.7.2)	everyday new challenges that increase "everyday well-being" **parts: (1) Activity Feed** (receive a new challenge everyday, how to do it, **why it matters**, connect with other people using the app or see what other users wrote about their challenges) **(2) Connections** (see what your friends wrote) **(3) Find a member** (invite your friends) **(4) Challenge History** (overview of your completed challenges) **(5)Tracks** (select special track as challenges focusing on living mindfully, finding fulfillment, exploring emotions, everyday well-being, stress relief etc) **(6) Settings** (set time for your reminders via phone or email, update password, terms and conditions, privacy policies)	**explicitly:** "builds on recent advances in scientific literature about behavior change, public health, and social networks. Scientific principles are imperceptively woven into each product to lessen users' burden in managing their well-being. Small Steps approach by Dr. James Hill, shaped the content and overall design" **seemingly based on:** "pledge to introduce yourself to a neighbor or check in with one you haven't seen in a while" → **relationships, well-being theory Seligman** (2012), "take out your calendar and plan at least a 30-minute block when you can do whatever you want"→ **enjoying one activity, PPI**, Bolier et al (2013); **positive emotions, well-being theory Seligman** (2012), "strengthen your arms, shoulders and core muscles 12 times; a strong core helps with good posture and gives your body enough power to carry out everyday activities"→ **physical**	**mostly social-behavioral** (introduce yourself to a neighbor), **reflective-cognitive** (take 5 minutes to write down something that is stressing you..) **hedonic** (positive emotions by taking time for yourself) **eudaimonic** (relationships, meaning) **self-oriented** (enjoying one activity) **other-oriented** (check in with one you haven't seen for a while) **psychoeducation part in app** (*why it matters part* describes importance/effect of each task)

		exercises, not related to positive psy, "how do you keep your coupons organized? why it matters: coupons can save you cash on groceries.., but only if you have them on hand"→ **not related to positive psy!,** "get up to date for the recycling guidelines of your city"→ **not related to positive psychology→ track "everyday well-being"was changed to "finding fulfillment":** "share a favorite memory from the last month; it could be a milestone, an event, or something smaller like a relaxing walk you took or a phone call to a friend; when we recall fond memories, we experience positive feelings and a greater sense of belonging and meaning in our lives"→ **positive emotions, meaning, well-being theory Seligman** (2012), "Look into your closets or storage room and find something that you haven't used in months or years, clust it if needed and donate it; why:helps you focus on what is important to you in the present" → enhances positive emotions, but not related to positive psychology	
13. YOU (Fifth Corner, Inc. Oy; version 3.1.1)	positive community in which you receive small challenges daily and share pictures of your activities if you like **parts: (1) Me** (overview of your completed challenges including	**explicitly:** "working with advisors including Dr. Tara Swart to embed knowledge from neuroscience, change and learning into YOU-app; we believe in **micro-change**"	**social-behavioral** (call somebody) **reflective-cognitve** (write down one thing you are grateful for, expressive writing)

	pictures of them) **(2) We** (overview of shared challenges and pictures of community members, possibility to like and comment on them) **(3) Do** (overview of new challenges, including the relevance of the challenge) **(4) Hey** (follow explanations of the you_team) **(5) More** (find people, invite people, feedback and faq, settings, science of micro actions, letter from the you_team)	**seemingly:** "starting action: your own goal; what's one small change you can make and commit to?" → **dealing realistically with goals, Bohlmeijer and Hulsbergen** (2013), **accomplishment, well-being theory Seligman** (2012), "remember a woman in your life; who is a woman who was important in your life…,call, send her a message or give a small proof of love and appreciation" → **expressing gratitude, PPI,** Bolier et al (2013), **relationships, well-being theory** Seligman (2012), "2-minute breathing; take 2 minutes and simply concentrate on your breath; this is a great action to calm down"→ **using mindfulness→ positive emotions, well-being theory Seligman** (2012), "what have you done today for you? try to get into the everyday habit of consciously doing at least one thing just for you"→**enjoying one activity, PPI,** Bolier et al (2013); **positive emotions, well-being theory Seligman** (2012), "Add some movement to your day with a few push-ups" → **physical fitness, not related to positive psy;** "get emotional and try to find meaning,what can I learn, how was this useful?"→ **explicitly:**"expressive writing→ helping to deal with changes in life, gratitude"→ **seemingly**: personal growth; **dealing with setbacks, Bohlmeijer and**	**hedonic** (positive emotions by enjoying activities, gratitude) **eudaimonic** (improve relationships, growth through dealing with setbacks) **self-oriented** (take a mindful moment for yourself) **other-oriented** (reach out to someone) **detailed psychoeducation part in app** (every action is described including importance/effect of it: "social connection is proven to be one of the strongest determinants of happiness..")

		Hulsbergen (2013) and gratitude, **positive emotions and meaning, well-being theory Seligman** (2012), "be grateful, write down one thing you are grateful for" → **practicing gratitude, positive emotions, well-being theory, Seligman** (2012), "reach out to someone; grab the phone, write a message,etc" → **relationships, well-being theory Seligman** (2012)	
14. Rezolute (THINK OF A NAME LATER, LTD., version 1.1)	setting and recording your goals in different domains parts: **(1) Rezolutes** (overview and examples of goals, adding own goals) **(2)Settings** (reminders,sound effects, help, credits/founders,facebook and twitter,homepage,call team) **(3) status**	**seemingly:** example Rezolutes: achieve at work, have romantic moments, do a good deed, give someone a compliment → **accomplishment and relationships, well-being theory Seligman** (2012); **acts of kindness, PPI,** Bolier et al (2013) "setting and tracking realization of goals" → **dealing realistically with goals, Bohlmeijer and Hulsbergen** (2013)	**social-behavioral** (set goals in different domains and put belonging icon in cycle after you achieved them such as do a good deed, give someone a compliment), **reflective-cognitive** (track your goals) **mostly eudaimonic** (domains relate not only to positive emotions but to accomplishment, relationships, etc.) **hedonic** ("have a romantic moment") **self-oriented** (achieve at work, tracking own goals) **other-oriented** (give someone a compliment, do a good deed), **no psychoeducation part** (only short description of how to do it but no explanation of

			importance/effect)
15. FeelGood tracker (David Crane, version 3.4)	record and rate your activities and remember them via pictures and highlight your favorite places parts: **(1) By date** (record and rate your activities by date) **(2) By title (3) by FeelgoodFactor (4) Summary (5) Refer** (review at app store, recommend via email)	**explicitly:** "everyone knows that doing activities you love can contribute to a happy and healthy lifestyle; focus on positive activities in your daily life; take a photo to capture the most memorable moments; e-mail and tweet your entries to share what you love with family and friends" → **seemingly: positive emotions, well-being theory Seligman** (2012), **savoring, PPI,** Bolier et al (2013) **seemingly:** "use it to motivate yourself to reach a goal; use the calendar feature to schedule an activity"→**dealing realistically with goals, Bohlmeijer and Hulsbergen** (2013), **accomplishment, well-being theory Seligman** (2012)	**reflective-cognitive** ("record and rate activities"), **hedonic** (focusing on positive activities increases positive emotions), **eudaimonic** (planning activities to reach goals) **self-oriented** (record the activities that make you feel good) **short psychoeducation part only in app store description** ("everyone knows that doing activities you love can contribute to a happy and healthy lifestyle; instead of allowing the stresses of daily life to overshadow your well-being record the activities that make you feel good, take control of your own happiness, focus on positive activities in your daily life, helps you realizing the importance of positive activities in your daily life)
16. TheHappyApp (Kevin Brown, version 2.2)	reminds you to write down one thing that went well during your day, describe those things or upload a picture parts: **(1) diary of what went well today (2) settings** (daily reminder,	**explicitly**: "I tried a handful of gratitude journals and diary apps, but I'm not religious and didn't want…,I needed something simple and easy so I built this app, so I can stay happy" → seemingly: **practicing**	**hedonic** (positive emotions through tracking what went well), **reflective-cognitive** (thinking and writing down what went well),

	hide empty days,select pdf photo quality, about the app, privacy,instructions,email us,find us on facebook) **(3) Keep the memories** (create pdfs to print, save or share)	**gratitude, PPI,** Bolier et al (2013),**positive emotions, well-being theory Seligman (2012)**	**self-oriented** (gratitude journal) **very short psychoeducation part in app** (About part: "the app reminds you about the good stuff, so you feel better")

Appendix C

Coding scheme elements of PSD model

Table 1. PSD framework elements coding scheme.

Principle and definition according to PSD framework [31]		Coded as element included when the web-based intervention:	Example
Primary Task Support			
Reduction	A system that reduces complex behavior into simple tasks helps users perform the target behavior, and it may increase the benefit/cost ratio of a behavior.	Specifically divides the target behavior into small, simple steps	A web-based intervention for weight management includes a diary for recording daily calorie intake, thereby dividing the target behavior (reducing calorie intake) into small, simple steps of which one is recording calorie intake
Tunneling	Using the system to guide users through a process or experience provides opportunities to persuade along the way.	Delivers content in a step-by-step format with a predefined order	A web-based intervention for the prevention of depression that delivers the content in sequential lessons that can only be accessed when the previous lesson is completed
Tailoring	Information provided by the system will be more persuasive if it is tailored to the potential needs, interests, personality, usage context, or other factors relevant to a user group.	Provides content that is adapted to factors relevant to a user group, or when a counselor provides feedback based on information filled out by a participant	A web-based intervention for supporting self-management among patients with diabetes provides information adapted to patients based on whether they have diabetes mellitus type I or II
Personalization	A system that offers personalized content or services has a greater capability for persuasion.	Provides content that is adapted to one user (ie, the name of the user is mentioned and/or the user can adapt a part of the intervention)	A web-based intervention for increasing physical activity allows users to choose whether they want to see their weekly activity score on the home page or not
Self-monitoring	A system that keeps track of one's own performance or status supports the user in achieving goals.	Provides the ability to track and view the user's behavior, performance or status	A web-based intervention for the treatment of alcohol dependence provides a diary to track and view daily alcohol use
Simulation	Systems that provide simulations can persuade by enabling users to observe immediately the link between cause and effect.	Provides the ability to observe the cause-and-effect relationship of relevant behavior	A web-based intervention for smoking cessation includes a calculator that shows how much users will save when they quit smoking
Rehearsal	A system providing means with which to rehearse a behavior can enable people to change their attitudes or behavior in the real world.	Provides the ability and stimulation to rehearse a behavior or to rehearse the content of the intervention	A web-based intervention for supporting self-management in patients with epilepsy starts each lesson with the same important exercise for stress-management
Dialogue Support			
Praise	By offering praise, a system can make users more open to persuasion.	Offers praise to the participant on any occasion	A web-based intervention that aims to promote healthy nutritional habits compliments participants when they have eaten 2 pieces of fruit for 5 days
Rewards	Systems that reward target behaviors may have great persuasive powers.	Offers some kind of reward when the participant performs a target behavior relating to the use or goal of the intervention	A web-based intervention for the treatment of social phobia gives points to participants when they engage in exposure exercises
Reminders	If a system reminds users of their target behavior, the users will more likely achieve their goals.	Provides reminders about the use of the intervention or the performance of target behavior	A web-based intervention to support self-management among patients with rheumatic arthritis sends an automatic email message to remind the participant that the new lesson may begin
Suggestion	Systems offering fitting suggestions will have greater persuasive powers.	Provides a suggestion to help the participants reach the target behavior	A web-based intervention for weight management provides low-calorie recipes

Principle and definition according to PSD framework [31]		Coded as element included when the web-based intervention:	Example
Similarity	People are more readily persuaded through systems that remind them of themselves in some meaningful way.	Is designed to look familiar and designed especially for the participant	A web-based intervention for the treatment of panic disorder in teenage girls explains the exercises through a teenage girl with panic problems
Liking	A system that is visually attractive for its users is likely to be more persuasive.	Is visually designed to be attractive to the participants	During the design of a web-based intervention to increase physical activity in middle-aged women, a representative group is asked for feedback on the design and their feedback is subsequently incorporated in the new design
Social role	If a system adopts a social role, users will more likely use it for persuasive purposes.	Acts as if it has a social role (eg, a coach, instructor, or buddy)	A web-based intervention to support self-management among patients with migraine incorporated an avatar to guide the participant through the intervention
Social Support			
Social learning	A person will be more motivated to perform a target behavior if (s)he can use a system to observe others performing the behavior.	Provides the opportunity and stimulates participants to see others using the intervention or performing the target behavior	A web-based intervention for weight management provides the option, and stresses the importance, of posting physical activity self-monitoring data on the discussion board and commenting on the performance of others
Social comparison	System users will have a greater motivation to perform the target behavior if they can compare their performance with the performance of others.	Provides the opportunity for participants to compare their behavior to the target behavior of other participants and stimulates them to do this	A web-based intervention for drug abuse prevention for teenagers automatically compares the response of the participant to other users of the intervention
Normative influence	A system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behavior.	Provides normative information on the target behavior or the usage of the intervention	A web-based intervention to promote self-management among patients with COPD provides feedback on the level of physical activity of the participant by comparing it to the physical activity of well-managed COPD patients
Social facilitation	System users are more likely to perform target behavior if they discern via the system that others are performing the behavior along with them.	Provides the opportunity to see whether there are other participants using the intervention	A web-based intervention for smoking cessation includes a discussion board for users of the intervention
Cooperation	A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to cooperate.	Stimulates participants to cooperate to achieve a target behavior	A web-based intervention for the promotion of physical activity stimulates participants to form groups and to achieve the group goal of a certain number of steps each week
Competition	A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to compete.	Stimulates participants to compete with each other to achieve a target behavior	A web-based intervention for diabetes management among children includes a leaderboard in which the children who enter blood glucose levels at the right times receive the highest place
Recognition	By offering public recognition for an individual or group, a system can increase the likelihood that a person/group will adopt a target behavior.	Prominently shows (former) participants who adopted the target behavior	A web-based intervention treatment of anxiety includes a testimonial page where successful users of the intervention tell their story

Table 4. System Credibility Support

Principle	Example requirement	Example implementation
Trustworthiness A system that is viewed as trustworthy will have increased powers of persuasion.	System should provide information that is truthful, fair and unbiased.	Company Web site provides information related to its products rather than simply providing biased advertising or marketing information.
Expertise A system that is viewed as incorporating expertise will have increased powers of persuasion.	System should provide information showing knowledge, experience, and competence.	Company Web site provides information about their core knowledge base. Mobile application is updated regularly and there are no dangling links or out-of-date information.
Surface credibility People make initial assessments of the system credibility based on a firsthand inspection.	System should have competent look and feel.	There are only a limited number of, and a logical reason for, ads on a Web site or mobile application.
Real-world feel A system that highlights people or organization behind its content or services will have more credibility.	System should provide information of the organization and/or actual people behind its content and services.	Company Web site provides possibilities to contact specific people through sending feedback or asking questions.
Authority A system that leverages roles of authority will have enhanced powers of persuasion.	System should refer to people in the role of authority.	Web site quotes an authority, such as a statement by government health office.
Third-party endorsements Third-party endorsements, especially from well-known and respected sources, boost perceptions on system credibility.	System should provide endorsements from respected sources.	E-shop shows a logo of a certificate that assures that they use secure connections. Web site refers to its reward for high usability.
Verifiability Credibility perceptions will be enhanced if a system makes it easy to verify the accuracy of site content via outside sources.	System should provide means to verify the accuracy of site content via outside sources.	Claims on a Web site are supported by offering links to other web sites.

Sources:

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Appendix D

Scores PSD model including reasoning or example why code was given

Table 1. Primary Task support

App	Reduction	Tunneling	Tailoring	Personalization	Self-monitoring	Simulation	Rehearsal	Score of included features
1.Happiness Wizzard (Success Wizzard, version 1.7)	included → divides target behavior into small, simple steps: "to-do list with activities for today that increase well-being; my goals for today; today's focus"			included→ content that is adapted to one user: "what new activities will contribute to your overall well-being? Select 2-3 enjoyable activities and add them to your schedule"	included → track and view the user's behavior or status: "My journal including complete happinessplan; To do list including diary to see current activities, on hold and completed activities"		included →ability and stimulation to rehearse a behavior or content of intervention: "Daily Check-in questions" about acts of kindness, gratitude, optimism, etc.	4
2. The emotion diary (Linda Burke, version 2.3)	included →divides tracking of emotions in different dimensions of emotions			included→ in the setup options the user can choose which dimensions of emotions he/she wants to track	included→ user can track his emotions, what went well today, his acts of kindness, his strengths and what he is is grateful for in a diary		included→ each of the topics is rehearsed daily	4
3. Smiley alarm clock: smile and wake up (Maxim Ivanov,Arty Apps, version 1.0.1)	included → small steps: "set alarm and smile to turn it off"			included→ "personalized service": user can choose the time of the alarm clock			included→ every morning you have to smile to turn the alarm off	3
4. Instar Affirmation writer (Blink Interactive, version 1.0.0)	included → small, manageable actions "write your affirmatio			included→ user can assign his affirmations to suggested categories such as core,	included→ you can retire affirmations that you completed		included→ app encourages to repeat affirmations daily	4

	ns, assimilating your affirmations"			exercise, family, friendship				
5. Feed your Happy (nCourage,LLC; version 1.3)	included →daily activities as small steps	included → new activities only appear if you completed the other ones		included→ "personalized service": user can choose the time of reminder to do the activities and can choose whether he wants to pass or do a suggested acitivity	included→ user can track his activities in "knowledge center"		included→ rehearses topics of activities such as "be grateful", "foster relationships ,etc	5
6 DayMinder (Geoff Kent, version 1.0.1)	included → divides tracking of day in different dimensions: "stuff that happened, when, what, which feeling, counting blessings, rating day in total"				included→ track and view "daily stuff, blessings"		included→ rate the same things everyday	3
7. Unithrive wellbeing (The University of Adelaide, version 1.3)	included → diary for recording daily mood, option to select different activities in order to relax, many simple suggestions for activities		included → provides timer for study time and relaxation time especially for students, daily tips are related to selected mood	included→ user can select activities to his/her list and individually plan time to remind him to do this activity	included→ overview of daily, weekly and monthly mood and activities		included→ always starts with monitoring the mood	5
8. Daily	included			included→	included→		included→	4

Doses of Positivity (Lindsey Collins, version 1.0.0)	→ you receive small exercises daily and can reflect on them in journal			personalized service: user can choose when app shall remind him/her of using the app	user can view all his journal entries in journal section and all tasks in the "history" part		daily new positive exercises	
9. Thankful (Quantumbit Works Interactive Studios, version 2.3)	included → small, simple step: write down what you are thankful for"			included→ personalized service: user can choose whether he wants to be reminded or not	included→ user can review every thankful message		included→ daily writing your thankful message	4
10. Happier2015 (Xiaofei Tang, version 1.1)	included → small,simple steps of recording emotions, happiness and goals				included→ user can review his journal entries and monitor progress of his goal attainment		included→ user is encouraged to do the same exercises daily	3
11. Gratitude Challenge 21 (Justin Sebastian, version 1.0)	included → "member receives daily one small, manageable task to improve well-being by being grateful"				included→ overview of all challenges in "history"		included→ 7 main topics as gratitude journal or three list are rehearsed during the 21 days	3
12. Daily Challenge wellbeing (MeYou Health, LLC; version 1.7.2)	included → "member receives daily one small, manageable action to improve well-being"		included → user can choose track with new activities related to his interests and needs as "active	included→ own profile page with picture and name	included→challenge history offers possibility to track activities and performance			4

			life" or "daily well-being"					
13. YOU (Fifth Corner, Inc. Oy; version 3.1.1)	included → user receives daily one small, manageable action to improve well-being	included → new challenges only appear if you have completed the other actions of the other days	included → user can choose playlist with new activities related to his interests and needs	included→ user has got own profile with name and picture, user can choose playlists including activities related to topics such as happiness or you & others	included→"Me" page includes overview of pictures of fulfilled actions		included→ you can choose to "keep up" actions in order to form a habit	6
14. Rezolute (THINK OF A NAME LATER, LTD., version 1.1)	included → activities are divided into different domains and can be chosen and tracked daily			included→ personal goals can be created as items and user can choose which activities shall be listed in today's cycle	included→ user can see status of chosen goals of the last days		included→ user is encouraged to set and track his goals daily	4
15. FeelGood tracker (David Crane, version 3.4)	included → small,simple steps of recording, rating and memorizing positive activities			included→ activities can be scheduled in own calendar and personal pictures can be uploaded to memorize good moments	included→ track the users activities and raitings		included→ by tracking highly rated activities, system encourage to repeat those activities	4
16. TheHappyApp (Kevin Brown, version 2.2)	included → small, simple step: write down what went well today; add a photo, share if you like"			included→ user can choose whether empty days shall be displayed or not, personal entries are shown on front page	included→ diary is provided to track what went well		included→ daily writing what went well	4
total score principle	16	2	3	13	15	0	15	

Table 2. Dialogue Support								
App	Praise	Rewards	Reminders	Suggestion	Similarity	Liking	Social role	Score
1.Happiness Wizzard (Success Wizzard, version 1.7)			included → "Daily email reminder, Morning routine reminder, Daily Check-in reminder and reflection reminder"	included → suggestions for daily affirmations that you should repeat everyday:"example: I am a good person who deserves to be happy", suggestion: "devote more time to family and friends; "who are the people that contribute most to your happiness?; suggestion for happiness booster: my brother/sister, my boyfriend, etc"		included →visually attractive design		3
2. The emotion diary (Linda Burke, version 2.3)				included→ in the "About" section, suggestions are made for the different positive activities: "dropping in on a sick friend or elderly neighbor" as suggestion for acts of kindness in order to increase well-being		included →visually attractive design, other colours would still improve design		2
3. Smiley alarm clock: smile and wake up (Maxim Ivanov,Arty Apps, version 1.0.1)			included→ alarm rings					1
4. Instar Affirmation writer (Blink Interactive, version 1.0.0)			included→ choose time for reminders to write affirmations	included→ how affirmations should be written is described in detail: 1st person, present tense, positive emotion; tips are given such as: stick a paper with your affirmation in a place		included → attractive design		3

				where you read it often"				
5. Feed your Happy (nCourage,LLC; version 1.3)	included→ "Congratulations!You did a good job!"	included → "you've earned 15 points", unlock videos with points	included→ user can set time for reminder	included→ daily activities are described in detail and include suggestions such as "foster relationships by calling an old high school friend"		included → attractive design		5
6. DayMinder (Geoff Kent, version 1.0.1)						included → design is okay		1
7. Unithrive wellbeing (The University of Adelaide, version 1.3)			included→ reminder to check-in and planned activities	included→ provides videos for relaxation methods and suggestions for self-are activities		included → design is very attractive	including→ social role of "sheep" that acts as a coach or buddy by representing status of mood and giving daily tips	4
8. Daily Doses of Positivity (Lindsey Collins, version 1.0.0)			included→ reminder on smartphone	included→ daily exercises are described in detail				2
9. Thankful (Quantumbit Works Interactive Studios, version 2.3)			included→ reminder on smartphone					1
10. Happier2015 (Xiaofei Tang,				attention: videos (including suggestions) were not visible to user				0

version 1.1)								
11. Gratitude Challenge 21 (Justin Sebastian, version 1.0)	included → compliments user after finishing challenge("Congratulations! You've completed …Let's keep this streak going!		included→ email reminders	included→ daily tasks are described in detail("how has the event made you better able to meet challenges in the future, how has the event helped you to appreciate…?"		included → attractive design		4
12. Daily Challenge wellbeing (MeYou Health, LLC; version 1.7.2)	included→ compliments user: "Congratulations!"	included → "250 points earned"	included→ user can set on/off daily reminders via push notifications on smartphone or email	included→ video is provided to show how exercise could be done		included → design is attractive		5
13. YOU (Fifth Corner, Inc. Oy; version 3.1.1)	included→ compliments user after finishing action of the day		included→ setting push notifications on/off	included→ provides suggestions for doing daily actions,e.g. "read a book, take a bath…in order to do something for yourself"		included → attractive design		4
14. Rezolute (THINK OF A NAME LATER, LTD., version 1.1)	included→ compliments user ("perfect day!") when he achieved all of his daily goals		included→ reminders for check-in or tracking of achievement during the day can be scheduled			included → attractive design		3
15. FeelGood tracker (David Crane, version 3.4)						included → design is okay		1
16. TheHappy App (Kevin Brown, version 2.2)			included→ app reminds you if you haven't done diary entry by a chosen time			include → design is attractive		2
total score	5	2	12	9	0	12	1	

Table 3. Social Support								
App	Social learning	Social comparison	Normative influence	Social facilitation	Cooperation	Competition	Recognition	Score
1.Happiness Wizzard (Success Wizzard, version 1.7)								0
2. The emotion diary (Linda Burke, version 2.3)								0
3. Smiley alarm clock: smile and wake up (Maxim Ivanov,Arty Apps, version 1.0.1)								0
4. Instar Affirmation writer (Blink Interactive, version 1.0.0)								0
5. Feed your Happy (nCourage,LLC; version 1.3)								0
6. DayMinder (Geoff Kent, version 1.0.1)								0
7. Unithrive wellbeing (The University of Adelaide, version 1.3)								0
8. Daily Doses of Positivity (Lindsey Collins, version 1.0.0)								0
9. Thankful (Quantumbit Works Interactive Studios, version 2.3)								0
10. Happier2015 (Xiaofei Tang, version 1.1)								0
11. Gratitude Challenge 21 (Justin Sebastian, version 1.0)								0
12. Daily	included→	included→users		included→ see		included→		4

Challenge wellbeing (MeYou Health, LLC; version 1.7.2)	user can see how others users completed the activities and comment on it	can compare their performances with other users via the "activity feed"		other users in the "activity feed"		recommended to make at least 3 connections with friends or other users and see how many points they achieved		
13. YOU (Fith Corner, Inc. Oy; version 3.1.1)	included→ in "We" part you can see how others performed the daily actions and comment on it	included→users can compare their performances with others in the part "Inspiration from community"		included→ in the "We" part you can see other users and chat with them via comments				3
14. Rezolute (THINK OF A NAME LATER, LTD., version 1.1)								0
15. FeelGood tracker (David Crane, version 3.4)								0
16. TheHappyApp (Kevin Brown, version 2.2)				included→ via the hashtag #100happydays you share your entries and you can see posted entries of other people				1
total score	2	1	0	3	0	1	0	

Table 4. System Credibility Support

App	Trustworthiness	Expertise	Surface credibility	Real-world feel	Authority	Third-party endorsements	Verifiability	Score
1.Happiness Wizzard (Success Wizzard, version 1.7)	included→ provides information related to topic and no biased advertising or marketing information	included→ there are no outdated information and company website provides knowledge about their core knowledge base	included→ system looks and feels competent, no advertisements	included→ company website provides email address to contact specific people and ask questions; however: only				4

				available after googeling, the app no link available within app				
2. The emotion diary (Linda Burke, version 2.3)	included→ provides information related to topic and no biased advertising or marketing information	included→ information showing knowledge: "studies have shown that 5 acts of kindness per week over 6 weeks resulted in an increase in well-being"	included→ system looks and feels competent, no advertisements					3
3. Smiley alarm clock: smile and wake up (Maxim Ivanov,Arty Apps, version 1.0.1)				included→ you can contact creator via email				1
4. Instar Affirmation writer (Blink Interactive, version 1.0.0)	included→ provides information related to topic and no biased advertising or marketing information	included→ app description refers to Cognitive Psychology and describes how affirmations work	included→ competent look and feel					3
5. Feed your Happy (nCourage,LLC; version 1.3)	included→provides truthful, fair and unbiased information; related to activities	included→ showing knowledge and competence: after each activity completion, you have to fill in the satisfaction with life scale by Ed Diener and in knowledge center studies are described that explain importance of activities ("studies show that")	included→ competent look and feel, no advertisements		included→ refers to Ed Diener and social scientists of positive psychology			4

6. DayMinder (Geoff Kent, version 1.0.1)	included→ provides information related to topic and no biased advertising or marketing information							1
7. Unithrive wellbeing (The University of Adelaide, version 1.3)	included→ system provides information that is truthful, fair and unbiased	included→ information about creators of app (Counselling and disability services team, University of Adelaide) and there is updated content on the Blog	included→ competent look and feel, no advertisements	included→ information about university and contact details	included→ posts about "healthy weight week by the Dietitians Association of Australia and videos are made by counselors of the University of Adelaide			5
8. Daily Doses of Positivity (Lindsey Collins, version 1.0.0)		included→ in "connect" part, information about experience and knowledge of creators		included→ you can contact creators via emai				2
9. Thankful (Quantumbit Works Interactive Studios, version 2.3)	included→ provides information related to topic and no biased advertising or marketing information		included→ system looks and feels competent, no advertisements					2
10. Happier2015 (Xiaofei Tang, version 1.1)	included→ provides information related to topic and no biased advertising or marketing information			included→ email address of creators is available				2
11. Gratitude Challenge 21 (Justin Sebastian, version 1.0)	included→ provides information related to topic and no biased advertising or marketing information	included→based on research of Robert Emmons who demonstrated positive effects of gratitude	included→ competent look and feel, no advertisements		included→ based on studies of Robert Emmons, a professor at University of			4

					California Davis			
12. Daily Challenge wellbeing (MeYou Health, LLC; version 1.7.2)	included→ provides information related to topic and no biased advertising or marketing information	included→ information about professional creator company is provided, no out of date information	included→ competent look and feel	included→ you can contact creators via email		included→ webpage of creator company shows a logo of a certificate of the Boston Globe newspaper that complimen ts the company		5
13. YOU (Fith Corner, Inc. Oy; version 3.1.1)	included→ provides information related to topic and no biased advertising or marketing information	included→ "work together with Dr. Tara Swart, to embed knowledge from neuroscience, change and learning"	included→ system looks and feels competent, no advertiseme nts	included→ you can contact creators via app	included→ refers to Dr. Tara Swart		included→ references of research articles are provided	6
14. Rezolute (THINK OF A NAME LATER, LTD., version 1.1)	included→ provides information related to the app, no advertisements		included→ system has got competent look and feel, no advertiseme nts	included→ you can call creator of the app				3
15. FeelGood tracker (David Crane, version 3.4)								0
16. TheHappyA pp (Kevin Brown, version 2.2)	included→ provides only information related to functions of app	included→ developer describes own experience of importance of writing down what went well	included→ system has got competent look and feel, no advertiseme nts	included→ email of creator is provided				4
total score	13	10	11	9	4	1	1	