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# Activities as a Gateway to Sustained Subjective Well-Being Mediated by Products

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## ABSTRACT

Research in positive psychology indicates that sustained well-being is more determined by our actions than by our possessions. Products' contribution to well-being may thus be grounded in their potential to support well-being-enhancing activities rather than in their material value. In a laddering study, we investigated how products shape a range of well-being determinants, including activities, and well-being outcomes. Following a hierarchical structure, seven product experience qualities, six motivations, and seven activities were empirically found to be linked to long-term well-being. We describe these ingredients for sustained well-being in further detail and provide actionable guidance on how to address them by means of design. As the majority of product-supported long-term well-being outcomes were mediated by activities, we propose activities as most promising starting point in design for sustained well-being.

## Author Keywords

HCI; design; user experience; well-being; positive design; experience design

## CSS Concepts

• HCI theory, concepts, models

## INTRODUCTION

Due to technological advancements in recent decades, more and more aspects of our everyday lives are nowadays supported or accompanied by products and services, which creates the opportunity for designers to impact peoples' quality of life and well-being on a broad scale. In fact, some of the most widely used interactive products like social networks and communication technologies explicitly aim to improve core elements of psychological well-being such as having strong and intimate relationships with others [57]. Despite this great potential for positive impact, there is evidence linking specific ways of using interactive technology to impoverished social lives, e.g. reduced quality of face-to-face interactions, decreased measures of mental health, e.g. higher

stress levels, and lower psychological functioning, e.g. increased loneliness (see [8] for an overview). This shows that the effects of technology use can reach far beyond mere product interactions, and create lasting effects on individuals and society. Consequently, design efforts should not stop at shaping human-product interactions in the present but also consider long-term consequences on well-being. Growing awareness of potential risks has lead influential IT corporations to address *Digital Wellbeing* (Google, e.g. [38]) and *Digital Wellness* (Apple, e.g. [20]) in their product development efforts.

In parallel to these developments in industry, academic research on well-being design gained momentum within Human-Computer-Interaction (HCI) in recent years. Publications in this field contributed theoretically informed frameworks [[6],[13],[27],[42],[51]] grounded in psychology, and outlined possibilities to deliberately design for sustained well-being [[44],[47]]. These approaches cover a wider range of psychological or eudaimonic well-being outcomes and emphasize the potential of products to mediate well-being-enhancing activities in the longer term. Some authors also explicitly point to potential negative side-effects that need to be taken into account when designing for well-being [13]. In their line of thinking, design that fosters engagement or triggers positive emotions in a given moment, but, for instance, makes individuals addicted in the long run cannot be considered design for well-being.

However, in order to shape the design of everyday products and technologies, these academic contributions have yet to be translated into actionable design practices and measurement tools that can be applied in industry contexts [[28],[42]]. What is missing is a clear understanding of (causal) relations between product experience qualities, well-being determinants and well-being outcomes in order to address these relations in the design process. In this paper, we will contribute to this understanding by enriching prevailing theoretical models in the field of well-being design with empirical insights. We do so by means of laddering interviews, which illustrate how specific product experiences are linked to (sustained) well-being. Furthermore, we visualize pathways from product experience qualities to well-being determinants and well-being outcomes. To show how product experience qualities are supported by concrete product attributes, we also refer to various ways in which products seem to support these experience qualities.



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## RELATED WORK

Momentary, hedonic aspects of well-being such as pleasure and positive emotions have been studied intensely in the context of human-product interactions (see [14] for an overview). Other more enduring aspects of eudaimonic or psychological well-being (i.e., optimal psychological functioning) [[53],[56]–[58]] such as having a sense of purpose in life, being fully engaged in one's daily activities, and growing as a person, have not explicitly been addressed by design research until the beginning of this decade [[12],[24],[45]] (see [30] for a more systematic definition of hedonia and eudaimonia). Related theoretical frameworks comprise work on Positive Technologies [51], Experience Design [27], Positive Design [13] and Positive Computing [6]. They draw from existing theories in (positive) psychology and specify determinants of psychological well-being that can be tackled by design, e.g. fulfillment of psychological needs [[27],[42]], realization of self-concordant goals [13], personal values [40] and assignment of rewards [6]. Empirical studies on eudaimonic product experiences [[35],[37],[40]] support the involvement of these theoretically suggested determinants in human-product-relationships. However, empirical research in this field is scarce and the exact nature of those relationships is poorly understood, e.g. what are distinct qualities of eudaimonic and hedonic product experiences. Even though these conceptualizations provide a broad theoretical basis for designers to draw from, they remain rather unspecific. In the current study, we will therefore take an exploratory, bottom-up-top-down approach to investigate well-being determinants and well-being outcomes empirically found to be supported in human-product-relationships and map these empirical insights with established theories and frameworks in psychology and HCI (*gap 1*). As requested by Peters et al. [42], our objective is to take first steps towards establishing a library of empirically validated determinants shaping long-term well-being outcomes from human-product-relationships (*goal 1*).

Well-being design frameworks emphasize nuanced ways in which products contribute to individuals' well-being: (1) directly during human-product interactions and (2) indirectly by mediating, i.e. supporting or enabling positive and meaningful activities [[16],[42],[45]]. On the indirect pathway, the product itself may no longer be in the focus of attention [16] while performing the activity. Referring to research in positive psychology [[34],[62]], activities have been proposed as a particularly promising starting point when designing for sustained well-being [[44],[47]]. This line of research demonstrated that a significant proportion of inter-individual differences in well-being cannot be explained by genetics or life circumstances but by deliberate engagement in well-being-enhancing activities [[34],[62]]. Consequently, numerous cognitive (e.g. expressing gratitude, savoring life's joys), volitional (e.g. committing to one's goals) and behavioral (e.g. learning a new skill, practicing random acts of kindness) activities were empirically studied and found to be linked to lasting increases in well-being [[5],[32],[49],[60]]. Literature

points to a number of reasons why activities have these favorable effects on individuals' well-being. One reason is connected to the phenomenon of hedonic adaptation [18] describing how people react to positive changes in their life, e.g. winning the lottery [4], getting married [31] or starting a new job [2] by reverting to their individual happiness baseline level. This mechanism can be compared to running on a 'hedonic treadmill' [3] and was found to arise particularly fast following material acquisitions compared to changes of one's experiential patterns. In addition, material purchases were found to lead to smaller increases in well-being compared to experiential purchases (see [41] for an overview), e.g. because they are more likely to trigger social comparisons. Experiences on the other hand are phenomenologically unique to a person and may serve as means to identity construction and personal storytelling, e.g. describing oneself to other people by referring to personally relevant experiences. Compared to changes in material possessions or one's life circumstances, activities are per se more transient and varied and thus less prone to adaptation [34]. Moreover, engaging in specific activities such as practicing gratitude or savoring life's joys can counterbalance hedonic adaptation [62]. Another promising way to achieve enduring changes in well-being, is to establish habits around well-being-boosting activities [34]. Research has further identified specific person characteristics (e.g. motivation, self-efficacy beliefs) and activity characteristics (e.g. dosage, variety) moderating the success of positive activities in terms of well-being enhancements [[33],[34]]. Even though theory and research suggests the importance of activities for sustainable well-being, few empirical studies have been devoted so far to the question if and how products support well-being-increasing activities beyond (the obvious) affordances, e.g. a ball is for kicking and throwing (*gap 2*). One explicit aim of the current work is therefore to derive a clearer understanding of the contribution of product-mediated activities to long-term well-being (*goal 2*).

Previous empirical studies [[26],[35],[37],[39],[65]] used online accounts of qualitative, personal narratives to investigate positive and meaningful experiences mediated by products. However, these studies rarely analyzed the content of the qualitative narratives themselves in greater detail or reported difficulties in doing so due to the heterogeneous nature of user-generated narratives gathered in online studies [26]. Consequently, major empirical insights derived from this line of research were primarily based on correlation analysis using quantitative ratings of product-mediated experiences rather than on a qualitative analysis of the personal narratives [65]. Hence, several HCI researchers call for more systematic qualitative analysis techniques to further investigate the essence of positive and meaningful product experiences [[26],[37],[39],[65]].

## METHODS & MATERIALS

To investigate (causal) relations between product experience qualities, well-being determinants and well-being outcomes

more systematically, we conducted one-on-one, in-depth laddering interviews following the guidelines by Reynolds & Gutman [50]. Participants were probed about personal items and a meditation app. Interview data were analyzed based on means-end analysis [[22],[50]]. In order to help participants reflect on their well-being and products' potential contribution, a sensitizing booklet containing daily assignments was sent to participants prior to the interviews.

### Participants

Due to the complexity of laddering interviews and the associated qualitative data analysis, we started with a small participant sample. 14 participants were recruited from the internal database of a German market research company. Two participants were excluded because they did not return the sensitizing booklet in time or did not show up at the interview. The data of the remaining 12 participants (median age: 31 years; range: 18-36 years; 8 female; higher education) was analyzed. Participants were video-recorded during the interviews. Written informed consent was obtained prior to the study and participants were compensated for their efforts (230 Euros).

### Materials

The relationship between product experience qualities, well-being determinants and well-being outcomes was examined using two types of products: a) *personal items* that participants selected based on a sensitizing booklet, and b) a *well-being product* used by all participants (meditation app). Personal items were expected to inform about product categories subjectively associated with well-being and to facilitate participants' reflection about linkages between product experience qualities and well-being outcomes. The meditation app was chosen to assure that the sample included at least one product used by every participant to support pattern extraction from the laddering interviews.

#### *Personal Items (self-selected)*

Participants were asked to bring three products to the interview that they believed contribute to their well-being. They were further instructed to think of products as any kind of object, tool, service, or interactive experience that is created or designed by a human being (not a rock or other natural object, but websites and apps count). This instruction was used in a conference workshop [48] before and found to generate a diverse range of products. In order to assist participants in reflecting on their well-being and select appropriate products, a sensitizing booklet was sent to participants via mail one week prior to the interviews (see [59]), containing 5-10 minutes long assignments (e.g., “Describe your recipe for a happy life”, “What was the nicest gift you ever received for your birthday?”, “What products would you bring along if you were going to spend a long period of time on a faraway island?”) over the course of seven days (presented in German). At the end of the sensitizing period, participants were instructed to select three personal products that they believe contribute to their well-being and bring these items to the interviews.

#### *Well-Being Product (assigned)*

In order to extract patterns across participants based on just a small sample, we further integrated one product all participants were familiar with. The meditation app *Headspace* ([headspace.com](http://headspace.com)) was chosen since it has been linked to improved well-being measures in smartphone-based mindfulness intervention studies [[1],[15]]. All participants were regular users of the app (i.e., have used the app for at least six months; mean: 12.15; SD: 7.45 months). Ten participants reported to also use other mental health or well-being apps (e.g. yoga, running, nutrition) regularly.

### Procedure

In order to link product experience qualities to well-being determinants and well-being outcomes, laddering interviews were conducted. Laddering is based on the assumption that consumers choose a product because they suspect specific attributes (‘means’) lead to beneficial consequences with regard to their personal values (‘ends’) [22]. Laddering combines specific interviewing techniques with a data analysis format to extract *means-end chains* (MEC) or *ladders* from the interview data [50]. MECs represent hierarchical sequences of product attributes (A), perceived consequences (C) and underlying personal values and goals (V), which increase in their abstractness from tangible product features to more general intrapersonal concepts such as motivational consequences and overarching personal values (Figure 1). The laddering interviews (90 minutes) were conducted at a user research facility in Berlin (Germany) and based on a semi-structured interview guide. To minimize order and familiarization effects, participants were first interviewed either about (a) their personal items or (b) the meditation app (randomly assigned). In order to extract MECs, the interviews started with eliciting key product *attributes*, i.e. concrete and/or experienced product qualities by asking participants (a) what is special about the product, (b) what they like about the product, and (c) which features they would not want to miss about the product. Since products' contribution to well-being was not expected to be easily accessible by participants, we encouraged them to further think about typical positive experiences associated with the product. This usually resulted in nominating motivational and behavioral *consequences* of product usage and facilitated generating insights about product-mediated activities. The link to personal *values* was derived by asking participants what these positive experiences meant to them.

### Data Analysis

Video recordings from the interviews were transcribed and analyzed following a four steps approach: (a) content analysis to generate an empirically derived category system, (b) extraction of MECs by linking attributes, consequences and values from individually reported experiences, (c) aggregation of individual MECs into an Implication Matrix (IM) to extract prominent MECs across participants, and (d) visualization of the most prominent MECs as Hierarchical Value Map (HVM).

Content Analysis

Interviews were transcribed and analyzed using qualitative open and axial coding [9]. During content analysis, a category system was generated based on participant responses that reflect recurrent key elements related to attributes (A), consequences (C) and values (V) and iteratively refined. Overall, 40 key elements were identified (Table 1). When possible, categorization and terminology were derived from existing theoretical frameworks in (positive) psychology and well-being design to incorporate prevalent knowledge in these respective fields (see Discussion). The aim was to establish a category structure that is neither too narrow (i.e., does not allow abstraction from individual responses) nor too broad (i.e., discards meaningful categories). The resulting category system is based on empirical input from the interviews (bottom-up) and theoretical considerations stemming from established frameworks (top-down); see Table 1 and Discussion.

<b>Experience Qualities</b>	(14) External Pushes	(27) Relaxation
(1) Context-Sensitivity	(15) Rewards	(28) Security, Health
(2) Ease of Use	<b>Activities</b>	(29) Self-Actualization
(3) Identification	(16) Contributing to the Greater Good	(30) Self-Direction
(4) Joy of Use	(17) Managing Stress, Hardship, Trauma	(31) Self-Esteem
(5) Moral Value	(18) Committing to One's Goals	(32) Stimulation
(6) Optimal Challenge	(19) Taking Care of Body & Mind	<b>Well-Being Outcomes</b>
(7) Personal Relevance	(20) Investing in Social Connection	(33) Comfort
(8) Protection	(21) Learning	(34) Engagement
(9) Symbolic Value	(22) Living in the Present	(35) Mastery
<b>Motivations</b>	<b>Intrapersonal Orientations</b>	(36) Meaning
(10) Autonomy	(23) Affiliation	(37) Personal Growth
(11) Broaden Attention	(24) Benevolence/Universalism	(38) Positive Emotions
(12) Competence	(25) Hedonism	(39) Positive Relationships
(13) Concentration	(26) Power	(40) Virtue

Table 1. Key elements resulting from content analysis

The generated categories were additionally clustered into different hierarchical levels following the A-C-V sequence proposed by Means-End Theory [[22],[50]]. We further derived more than the three basic levels (i.e., attributes, consequences, and values) as advised for the application of Means-End Theory in HCI contexts [66] (see Figure 1). More specifically, we differentiated the Attributes (A) level into concrete attributes (CA) and more abstract, experienced product qualities (EQ) to be able to extract patterns across product categories (via EQ) while keeping tangible information (via CA) to help designers deduce actionable insights for product design. Experience qualities indicate how a product (and its attributes) is perceived by an individual [23]. The Consequences level was distinguished into immediate motivational consequences (MO) of product usage and product-mediated activities (AV) promoted by these motivations. We added product-mediated activities as separate level because specific types of activities were hypothesized to play a crucial role in mediating durable well-being outcomes supported by products (goal 2, see above). Referring to the well-being literature (see [29] for a conceptual overview), the Values level was further differentiated into intrapersonal orientations (IO) and well-being outcomes (WB). Intrapersonal orientations re-

flect psychological variables within the individual that ultimately drive their behavior (i.e., universal needs, personal goals, personal values). Well-being outcomes comprise (subjective) experiences and aspects of psychological functioning, i.e. how well a person is doing in life. For each product experience we further captured whether reported increases in well-being were momentary (short-term) or persisted over longer periods of time (long-term).

Means-End Chains

Based on the generated category system (Table 1) and the category structure outlined above (see also Figure 1), MECs were composed for each participant individually by scanning transcripts for coherent experiential episodes containing one or multiple MECs: 115 individual product experiences were analyzed overall; 51 of them were linked to personal items and 64 of them to the meditation app. The basic structure of MECs (left, middle), as well as an example MEC from an individual product experience can be found in Figure 1 (right).

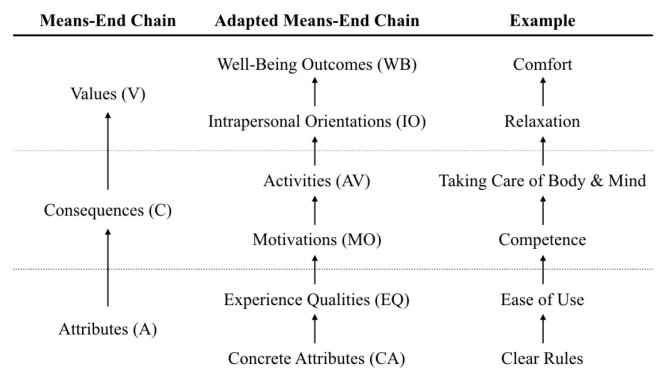


Figure 1. Means-End Chain, MEC (left), adapted MEC in the current study (middle) and example MEC (right)

Implication Matrix

Individual MECs were then aggregated across participants into an Implication Matrix (IM). This matrix reflects the number of direct and indirect links between two corresponding elements within the combined MECs. Due to the large number of categories, this step was performed using a self-programmed analysis software based on [50]. Separate Implication Matrices were derived for (a) all products, (b) meditation app only, and (c) personal items only. Within the scope of this paper, we focus on the overall product sample only. Aggregating data into the IM marks the transition from a qualitative (i.e., category-based) to a quantitative, pattern generating analysis technique.

Hierarchical Value Map (HVM)

In a final step, the most dominant linkages were visualized in the form of a Hierarchical Value Map (HVM), which provides a graphical representation of prominent links between attribute, consequence and value categories. To create this map, only those relations that occurred at least a minimum number of times (cutoff-level) are included. For the current

study, a cutoff-level of three links delivered the most conclusive results with an appropriate level of granularity (i.e. neither too broad nor too narrow).

## RESULTS

The primary objective of this study was to empirically explore theory-based determinants for sustained well-being from human-product-relationships (*goal 1*) and to investigate the role of product-mediated activities (*goal 2*) in this context.

### Goal 1: Determinants of Sustained Well-Being

Participants were each probed about three personal products; the product sample included 36 different products: 7 wellness products (e.g. shower gel), 7 digital services (e.g. social networks), 5 gifts (e.g. necklace), 5 household items (e.g. coffee machine), 4 sport items (e.g. running shoes), 2 tech gadgets (e.g. headphones), 2 lifestyle items (e.g. Waterman pen), 2 portable devices (e.g. smartphone) and 2 other items (organizer, book).

*Outcomes* (i.e., values) related to short-term and sustained aspects of well-being, *determinants* (i.e., consequences) enabling these outcomes, and *product qualities* (i.e., attributes) shaping these determinants were identified based on means-end analysis, that is: statements derived from product experiences were classified as attributes (concrete attributes and experienced qualities), consequences (activities and motivations), and outcomes (intrapersonal orientations and well-being outcomes) via content analysis and linked to determinants-outcomes pathways via means-end chains and visualized in a HVM (Figure 2). As described above, connections between individual items within this map are depicted via links, with the line thickness representing the strength of the connection between two variables. Outcome items are further distinguished with regard to short-term (*white*) and long-term (*gray*) impact. Well-being outcomes, supporting activities and motivations, as well as product experience qualities that foster them are described in the following paragraphs. We further refer to ways in which concrete product attributes shape product experience qualities. Variables are defined in Figure 2 and are marked in italics in the following. Elements below the cutoff-level, i.e. mentioned less than three times, are shown with dotted outlines in the HVM. To indicate pathways including these elements, corresponding links are shown as dotted lines. All other links below the cutoff-level are not shown in Figure 2.

### Values: Hedonic and Eudaimonic

Means-end analysis revealed that both hedonic and eudaimonic aspects of well-being manifest in self-reported product experiences: Of 115 product experiences, 77 (67%) were related to hedonic and 38 (33%) to eudaimonic outcomes. Hedonic outcomes were associated with *feelings of comfort* (56 statements; 49%), *positive emotions* (17 statements; 15%), and experiences of *engagement* (4 statements; 3%). Eudaimonic outcomes were associated with aspects of psychological functioning, i.e. a sense of *meaning* (12 state-

ments; 10%), *personal growth* (11 statements; 10%), *mastery* (9 statements; 8%), strong *personal relationships* (4 statements; 3%), and *virtuous behavior* (2 statements; 2%). Eudaimonic outcomes were linked to intrapersonal orientations towards *self-actualization* (23 statements; 20%), *self-direction* (9 statements, 8%), *affiliation* (4 statements, 3%), and *benevolence/universalism* (2 statements, 2%). Hedonic outcomes were associated with orientations towards *relaxation* (51 statements, 44%), *stimulation* (8 statements, 7%), *hedonism* (6 statements, 5%), *security/health* (5 statements, 4%), and *power* (4 statements, 3%).

### Consequences: Activities and Motivations

Consequences mediate the relationship between well-being outcomes and experience qualities that are malleable through design, and can be subdivided in activities and motivations. Activities and motivations identified via content analysis are summarized below and their hierarchical relationship to low-level product experience qualities and high-level outcomes derived from means-end analysis is shown in Figure 2.

#### Activities

The *Activities* level comprises groups of activities empirically found to be supported by products and services. The following section describes these activities and highlights links to (a) determining factors, i.e. motivations and to (b) outcomes, i.e. intrapersonal orientations and well-being aspects.

#### Taking Care of Body and Mind

Establishing healthy habits, routines and rituals such as exercising regularly, keeping a nutritious diet, cultivating self-care (e.g. beauty rituals), and meditating was related to sustained well-being outcomes such as *comfort* and intrapersonal orientations towards *relaxation* and *security/health* (46 statements). Four pathways were particularly relevant with regard to habit-supportive design: (1) offering an opportunity for individuals to flexibly (*autonomy*) integrate the activity into their daily lives (*context-sensitivity*), (2) allowing products to facilitate continuous engagement in the activity (*ease of use*) and offer *optimal challenges* in line with people's current level of expertise (*competence*), (3) designing products that assign *rewards* in form of pleasurable (*joy of use*) and safe (*protection*) interactions as well as external *feedback*, and (4) fostering focused attention (*concentration*) on the activity.

Example: “I decided to use the [meditation] app because it is quite practical as it allows me to [meditate] when I really need it (...) and I can use it here and there (...) when I am feeling acutely overwhelmed.” (participant #3)

#### Committing to One's Goals

About one out of seven activities (17 statements) linked to sustained well-being were concerned with goal setting (e.g. identifying areas of personal development) and goal execution (e.g. taking concrete next steps to advance one's professional career). Well-documented in the literature [63], pursuing personal goals provides individuals with a general sense

of purpose and meaning, helps them orient their daily lives towards these goals and ultimately fosters personal development. Goal-oriented activities were linked to well-being outcomes such as *self-actualization* (i.e., related to personal goals like expressing creativity, building self-confidence) and *self-direction* (i.e., self-directed exploration of new opportunities like taking steps to advance a professional career), which resulted in elevated feelings of *meaning* and *mastery*. In order to support the pursuit of personal goals, means-end analysis showed that products need to (1) provide *feedback* on goal progress (*rewards* → *competence*), (2) reduce distractions (*concentration*) and (3) provide activities in line with individuals' goals (*autonomy*) by offering relevant content (*personal relevance*).

Example: “*Every app [on my phone] is relevant to me. I have deleted all the pre-installed apps. [They are just] a distraction (...) and our time is too precious to spend it on useless things. I have been trying for months to focus only on things that are good for me and that help me making progress in my life.*” (participant #1)

#### Managing Stress, Hardship, Trauma

Another group of activities comprised establishing effective coping strategies (e.g. practice mindfulness, seek social support) to be able to deal with emotionally stressful situations such as mental health problems or adapting to new life circumstances (11 statements). Implementing and applying these strategies regularly resulted in more enduring feelings of *comfort* and inner peace. Products supported coping activities by (1) encouraging (*rewards*) individuals through eliciting positive emotions (*joy of use*, e.g. playful Headspace characters), by providing *feedback* on previous accomplishments (e.g. reflecting the total amount of time spent meditating) and by directly reducing tension and negative emotions (*protection*, e.g. headphones preventing sensory overstimulation). These rewards functioned as positive reinforcement and fostered feelings of *competence*. Individuals' perceived level of competence (2) was also promoted by making product interactions easy and efficient (*ease of use*, e.g. through clear instructions) and by suggesting *optimal challenges*, e.g. short duration of meditation sessions.

Example: “*When I am feeling acutely tense, I also use the [short] SOS meditation sessions. It helps me to distance myself from the immediate, stressful situation.*” (participant #5)

#### Learning

An enduring sense of *personal growth* was promoted by activities related to *learning* (e.g. tracking one's activity level and energy consumption), *skill building* (e.g. specific meditation techniques) and *adopting new perspectives* (e.g. when ruminating over a relationship problem). The most significant way products supported learning activities was by (1) making individuals feel *competent* through easy-to-use interfaces (*ease of use*) and by enabling them to adapt the difficulty of the activity (*optimal challenge*). In addition, products supported individuals in (2) focussing on the learning

activity (*concentration*) by providing relevant content (*personal relevance*).

Example: “*I started meditating for only five minutes using the 'Basics' module because meditating can be daunting at the beginning. At some point, I increased the duration to 10 minutes depending on how competent I felt. When I took a meditation class [in the past], they started with 25 minutes sessions right away which was overwhelming for me.*” (participant #2)

#### Living in the Present

Products also supported individuals to live in the present by savoring positive and meaningful experiences (3 statements) through intensifying (e.g. adding sensory pleasures such as candles or chocolate), prolonging (e.g. functioning as a tangible symbol of a personally meaningful goal) or anticipating (e.g. pleasant voice of the meditation teacher facilitating relaxation) these experiences (see also [46]) which functioned as *rewards*. Savoring was linked to both hedonic and eudaimonic well-being outcomes, i.e. *positive emotions*, feelings of *comfort* and a sense of *personal growth*.

Example: “*I put a lot of effort into making myself comfortable in my new apartment. Now I am able to relax on my couch and I regularly perform a little ceremony. I light lots of candles which gives me the feeling that I finally have a home.*” (participant #7)

#### Contributing to the Greater Good

Virtuous behavior (*virtue*) concerned with the welfare of others such as sustainable and ethical consumption was linked to durable well-being (2 statements). This group of activities was associated with products that resonate with a person's *moral values*, e.g. are manufactured following decent labor standards. Acting in accordance with one's personal values promotes feelings of *autonomy* and increases intrinsic motivation to engage in the activity.

Example: “*It's important to me that [the thermos] is made from BPA free plastic (...) and that I can always bring the thermos with me (...) and reuse it. That way I am not contributing to a throwaway society.*” (participant #10)

#### Investing in Social Connection

Lastly, products supported individuals in strengthening social relationships with others (1 statement) by providing opportunities for social affirmation (*rewards*).

Example: “*I upload my own photos to a photography interest group on Facebook (...). This way I am sharing my happiness with others (...) and it makes me happy to see that others enjoyed my photos.*” (participant #4)

As the research focus is primarily on well-being-enhancing activities, only those motivations included in prominent MECs (cutoff value: N=3) are described in more detail below, i.e., competence, rewards, autonomy, and concentration; all empirically derived motivations are listed in Figure 2 (with a short description).

Motivations

*Motivations* describe psychological effects of product usage including support of well-being-enhancing activities. Product experience qualities shaping these motivations are described below and depicted in Figure 2. Links to supported types of activities are visualized in Figure 2.

Competence

The most common way for a product to support well-being activities (30 statements) was to make individuals feel capable and effective when performing an activity. Products supporting competence motivations (1) offer *optimal challenges*, (2) are *easy to use*, and (3) encourage participants to keep performing an activity through *rewards* (e.g. feedback on goal progress).

Rewards

Products also fostered well-being-related activities via external rewards (28 statements) and increased the likelihood that desired behaviors occur again in the future. Experience qualities linked to reward motivation include (1) *joy of use* (i.e., positive emotions generated through direct interaction with the product), (2) *protection* (i.e., reduced negative emotions), and (3) *feedback* (e.g. “likes” on social networks).

Autonomy

Another way products supported activities was by enabling people to act independently (26 statements) and in accordance with deeply-held personal goals and values. Experience qualities that support autonomy motivations include (1) *context-sensitivity* (i.e., allowing adaptation of the activity to fit into a person’s daily life) and (2) *personal relevance* (i.e., choosing activities matching one’s personal goals and values, offering relevant content and functionalities).

Concentration

In addition, products supported individuals to focus on the activity (11 statements) by reducing distractions and maintaining states of flow through providing *personally-relevant* content (i.e., in accordance with personal values and goals).

Experience Qualities

Experience qualities that were mentioned at least three times (cutoff-level) are described in more detail below. We further illustrate various ways in which concrete product attributes may support these experience qualities. That relationship, however, has been subject to many studies on product experience and is beyond the scope of this study. All mentioned experienced and concrete product attributes are shown in Figure 2.

Personal Relevance

One major contribution of products (19 statements) to well-being was to enable individuals to choose activities that match their personal goals and interests. Concrete product attributes that were found to support personally-relevant activities include (1) a *variety* of functions (e.g. diverse meditation packages, multiple settings), (2) relevant *content* and (3) opportunities for *customization* (e.g. deciding which apps to install on one’s phone).

Ease of Use

Products further facilitated activities by making the product interaction easier and more efficient (16 statements). Ways to do so were by (1) providing *structure* (e.g. modular meditation packages), (2) using clear *content* (e.g. metaphors, instructions), and (3) defining *clear rules* (e.g. step-by-step introduction, takeaway messages).

Joy of Use

Products also fostered sustained well-being through *joy of use* including sensual delight, intellectual stimulation, and aesthetic pleasure (15 statements). Concrete product attributes increasing joy of use include (1) *sensory qualities* (e.g., smell, texture), (2) instilling a sense of *social connectedness* (e.g. friendly cartoon characters in Headspace), (3) *typicality* (e.g. familiar voice of the meditation teacher), (4) *novelty* (e.g. surprising interactions, new editions), and (5) offering a broad *variety* of contents and functions.

Context-Sensitivity

In order for individuals to integrate activities into their daily lives and engage in them regularly, products need to be adaptive to people’s lifestyle (15 statements) by (1) offering flexible time-settings (*dosage*) and (2) allowing them to perform the activity when needed, such as portable items or digital services available as app (*ubiquity*).

Optimal Challenge

Products further supported well-being by enabling people to choose activities that match their current level of expertise thereby supporting states of flow and continued engagement in the activity (8 statements). One way for products to do so is by (1) offering helpful communication and an appropriate level of guidance (*content*; e.g. metaphors) and by (2) allowing individuals to adjust frequency and duration of the activity (*dosage*) according to their skill level.

Protection

Products further encouraged individuals to engage in well-being-increasing activities by reducing negative emotions and dispelling concerns (5 statements), e.g. ecological materials, noise-canceling headphones.

**Goal 2: Activities as Pathway to Sustained Well-Being**

The second goal of this research was to visualize pathways that link product experience qualities to well-being determinants and well-being outcomes, and to understand which role activities play along these pathways. 24 product experiences (21%) were focused on direct product interactions and 19 of these experiences were limited to short-term increases of hedonic well-being (17%), i.e. positive emotions, engagement (see Figure 2). An astonishingly large number of 96 self-reported product experiences (83%), however, were associated with lasting increases in well-being, and 91 of these experiences (79%) were linked to activities that extended beyond the mere product interaction. Most importantly, these activities were offered (e.g. various themes), initiated (e.g. through reminders) and/or maintained (e.g. through rewards, optimal challenges) by elements of design. The favorable long-term



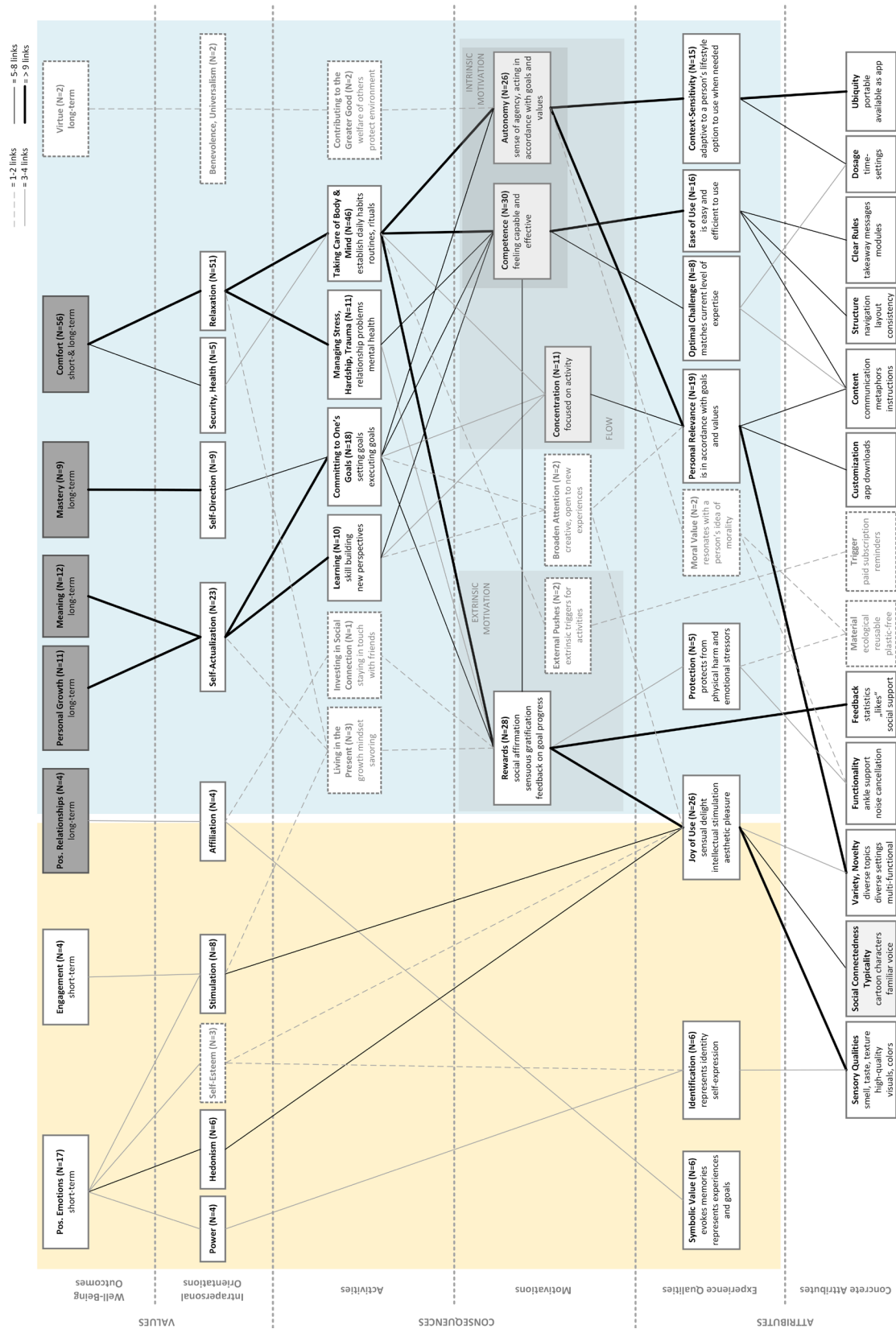


Figure 2. Hierarchical Value Map (HVM) depicting Attributes (A), Consequences (C), and Values (V). The graphic visualizes products' direct (left, yellow) and indirect contributions (right, blue) to well-being mediated via activities. Products supported short-term (white) and long-term (gray) well-being outcomes.

impact of these activities was related to performing them regularly (e.g. habits, hobbies), their association with longer-term, meaningful pursuits (e.g. working towards personal goals, learning a new skill, shaping one's personality) and/or resulting persistent changes of one's character (e.g. self-development). A considerable number (30%, N=34) of activity-based, lasting increases in well-being mediated by products were eudaimonic in nature, i.e. related to well-being outcomes such as personal growth, meaning, and mastery. Note that, in our sample, the majority of activities (47%, N=54) contributing to enduring well-being were associated with *daily habits* (esp. regular meditation practice) leading to an increased sense of inner peace and serenity (*comfort*). A small number of long-term well-being outcomes were not linked to activities (3%, N=4) but rather to symbolic representations of connectedness and personal growth conveyed by souvenirs and gifts (see also [7]).

## DISCUSSION

The goal of this research was to take first steps towards a library of empirically validated determinants of sustained well-being in human-product-relationships (*goal 1*). We also explored the specific contribution of product-mediated activities by inspecting (causal) pathways from experience qualities to well-being outcomes derived from means-end analysis (*goal 2*).

### Goal 1: Determinants of Sustained Well-Being

Supporting theoretical claims in well-being design [[6],[13],[27],[42],[51]], the current study provides empirical evidence that products are capable of shaping a diverse range of sustained well-being outcomes beyond temporary pleasures. Long-term outcomes comprised both hedonic and eudaimonic aspects, e.g. positive emotions, personal growth and meaning. Derived from a bottom-up-top-down-approach, determinants delineated in this paper stem from a theoretical and empirical basis. The current work thereby refines purely theory-driven recommendations (e.g. [[6],[13]]) how to design for sustained well-being. It further adds two layers of determinants not explicitly considered in previous theoretical work, i.e. experience qualities and activities. In our view, these determinants provide a particularly promising starting-point for well-being design as they are comparatively tangible and thus effectively malleable through design. In contrast, well-being design frameworks focus primarily on rather abstract motivational determinants, e.g. psychological needs [[27],[42]], personal goals [13] or rewards [6]. This being said, following (causal) pathways from experience qualities to motivations, the current study also shows how abstract determinants may be linked to specific realizations of product attributes.

The reported findings are in line with previous research in psychology and well-being design: The detected list of *Activities* coincides with taxonomies of Positive Psychology Interventions (PPIs) [[17],[32]] which have empirically been linked to lasting increases in well-being (e.g., [62]). The

broadest overlaps were identified with Lyubomirsky's classification of PPIs [32], i.e. '*taking care of body and mind*', '*committing to one's goals*', '*managing stress, trauma, hardship*', '*living in the present*', and '*investing in social connection*' (see Figure 2). We discovered two additional types of product-mediated activities, i.e. '*learning*' and '*contributing to the greater good*' linked to long-term well-being outcomes. Virtuous activity, i.e. contributing to the greater good has also been linked to lasting increases in well-being in positive psychology before [[43],[60]]. Previous research found similar types of activities to be associated with hedonic and eudaimonic well-being outcomes [[27],[35]] in human-product-relationships. However, the current study illustrates specific ways how to shape these distinct activity types through design.

Motivations that were empirically derived in the current work overlap with four prevalent motivation theories: (a) intrinsic motivation [54], (b) extrinsic motivation [11], (c) flow [10], and (d) Broaden-and-Build-Theory [19]. These theoretical overlaps are indicated in Figure 2. Consistent with Self-Determination Theory [[52],[55]] and theoretical claims in well-being design [[27],[42]], products fostered intrinsic motivation by supporting well-being-enhancing activities in a way that satisfies basic psychological needs for *autonomy*, *competence*, and relatedness (herein referred to as *affiliation*) [61]. Relatedness was further linked to symbolic product interactions, e.g. gifts reflecting meaningful personal relationships (see also [7]). In line with Organismic Integration Theory [11], specific types of extrinsic rewards such as feedback on goal progress and social support further promoted intrinsic motivation by increasing feelings of competence. Our findings suggest that extrinsic rewards allocated by products are particularly effective when individuals lack initial skills or deliberation (*committing to one's goals*), are confronted with challenging life situations (*managing stress, hardship, trauma*), or face difficulties integrating an activity into their daily routines and habits (*taking care of body and mind*). Besides intrinsic motivation, products shaped further characteristics of flow experiences [10] such as deep *concentration* on the task, *clear rules* and immediate *feedback*. Lastly, in line with Frederickson's [19] Broaden-and-Build-Theory, pleasure-evoking design stimulated motivation in beneficial ways by expanding users' thought-action-repertoires.

Besides well-known constituents of hedonic and pragmatic qualities [23], i.e. *joy of use*, *identification*, *symbolic value*, and *ease of use*, the list of product experience qualities includes additional variables proven to increase the efficiency of PPIs [33] and characteristics of flow experiences [10]. This indicates that existing user experience frameworks (e.g. [23]) and measurement tools (e.g. [25]) might need to be extended to incorporate all relevant categories of experienced product qualities promoting sustained well-being. Consistent with previous empirical research [35] and theoretical claims [47], our data support the involvement of pleasure-evoking design in mediating long-term hedonic and eudaimonic well-being outcomes. Previous studies did not find substantial

correlations between pragmatic qualities and hedonic and eudaimonic well-being outcomes [[26],[35],[37]]. In contrast, well-being-increasing activities were substantially facilitated by pragmatic product qualities in our study. The laddering approach taken in the current study might have been particularly well-suited to capture this facilitation effect as it differentiates multiple levels of product impact and explored self-reported product experiences in more detail.

### Goal 2: Activities as Pathway to Sustained Well-Being

As outlined above, participants' self-reported product experiences were linked to short-term (19 statements, 17%) and long-term (96 statements, 83%) well-being outcomes. Most intriguingly, sustained well-being was to a large extent mediated via activities (91 statements, 79%). Considering the strong empirical evidence linking activities and sustained well-being in previous research (e.g. [62]) and findings from the current study, we propose to regard activities as the most essential determinant in design for sustained well-being and to focus design efforts on activities accordingly. In our view, the taxonomy of activities discussed in this paper provides a good starting point. This collection may function as an inspiration to design for the 'right' activities, i.e. those most robustly linked to lasting increases in well-being. In order to prevent detrimental effects on individual or societal well-being, this list could further be complemented with activities empirically shown to detract from well-being, e.g. unfavorable social comparisons [32].

### Implications for Positive Design

The current study provides straightforward guidance for practitioners to design for lasting increases in well-being. Besides streamlining the list of theoretically derived determinants, we visualized (causal) pathways from experienced product qualities to well-being determinants and well-being outcomes in a HVM. Design for long-term impact may tackle any component along these pathways. Low-level elements linked to a dedicated component constitute opportunities to shape this component through design. The strength of association between connected elements further indicates the most promising starting points for design efforts. As outlined above, we particularly like to encourage practitioners to start the design process with thinking about product-mediated activities first. Ingredients on the *Motivations* and the *Experience Qualities* level can then be derived from the HVM. For example, if a product aims to support individuals in establishing effective coping strategies (i.e., *managing stress, hardship, trauma*), designers may preferably focus on addressing users' perceived level of competence by keeping the product interaction as simple as possible (*ease of use*) and by providing *optimal challenges* matching the person's current skills. Extrinsic rewards such as social affirmation may further increase feelings of competence. Other types of rewards, e.g. sensuous gratification represent promising levers as well but due to their weaker association with coping activities (indicated by line strength of the direct link between *rewards* and *managing stress, hardship, trauma* in Figure 2) may be targeted with a lower priority. Another example deductible

from the HVM is that products should not interfere with individuals' intrinsic drive to perform well-being-enhancing activities but rather promote feelings of *autonomy* and *competence*. Effective ways to address these needs by means of design are focusing on pragmatic product qualities, (esp. *ease of use, context-sensitivity*) and to synchronize the product with users' personal goals and values (*personal relevance*).

### LIMITATIONS AND FUTURE WORK

A major limiting factor of the current work is the small product and participant sample the study is based on. The deduced HVM might further overemphasize pathways related to meditation apps. Selection bias is another potential concern as participants were selected based on their previous usage of a specific meditation app. This selection might be associated with specific socio-demographic characteristics and motivational orientations within the tested sample, e.g. towards relaxation and self-actualization. Therefore, the current findings must be interpreted with caution and future research is needed to extrapolate results to a broader range of product categories and participants. It is important to note that laddering represents an established method in marketing to study consumer decision making. In HCI, laddering has been applied less frequently and with different purposes, i.e. to understand user motivation and to derive design recommendations [66] which limits the current state of knowledge regarding its validity in this context. Lastly, laddering and means-end analysis pose diverse methodological challenges including subjectivity associated with content analysis and data reduction [[21],[36],[64]]. As with any exploratory research, insights derived from this study thus need to be validated in future research.

### CONCLUSION

Research in Positive Psychology has confirmed intentional engagement in specific activities to be a crucial determinant of sustained well-being. So far, design research has theoretically acknowledged the opportunity to shape well-being-enhancing activities through products and services but has not yet provided actionable guidance how to do so. The current research establishes product-mediated activities as the most crucial determinant when designing for long-term impact. It further proposes a taxonomy of activity types malleable through design and illustrates opportunities to shape these activities through specific realizations of product attributes and a range of determining factors. This research supports decision-making for practitioners in industry contexts and will thus facilitate the transfer of academic contributions in well-being design into real-world applications.

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