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Designing for Temporal Harmony: Exploring the Well-Being Concept for Designing the Temporal Dimension of User Experience

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Abstract: User Experience (UX) is characterized by its temporal dimension, dynamic nature, and variability. Although descriptive models about the temporal dimension and related aspects exist, an understanding of the design possibilities and a design approach that ensures the design of the temporal dimension promoting a positive UX and well-being are still lacking. This paper addresses this research gap and builds on Zimbardo and Boyd's Time Perspective Theory (TPT). TPT presents five time perspectives (TPs)—Past-Negative, Past-Positive, Present-Fatalistic, Present-Hedonistic, and Future—to reveal that people have individual attitudes toward time that influence their thoughts, actions, and feelings. Studies conclude that a balance between the positive TPs (Past-Positive, Present-Hedonistic, and Future), i.e., temporal harmony, contributes to long-term well-being. We present our design framework and approach “designing for temporal harmony,” which incorporates the theory into the practice to highlight the temporal design possibilities and to offer guidance for designers. We applied the design framework and approach to a case study, developed an app concept, and evaluated it with users. The results demonstrate that it is possible to systematically develop temporal UX concepts that evoke positive anticipations, experiences, and retrospections, and that these promote a positive UX as well as contribute to users' long-term well-being.

Keywords: user experience (UX); experience design; design approach; positive psychology; well-being; time perspectives; temporal harmony

1. Introduction

We live in the present, but remember the past and imagine the future - experience has a temporal dimension. Furthermore, not only the present experience but also the temporal experience triggers emotions and influences our actions. To give some examples: The memory of a mastered challenge in the past evokes pride and motivates us to face new challenges. The imagination of a better future sparks anticipation and motivates us to strive for it, even if it requires discipline and hard work. Zimbardo and Boyd describe this phenomenon with their Time Perspective Theory (TPT) [1,2]. In this paper, we will argue and later demonstrate that the incorporation of the Time Perspective Theory into the design practice broadens the understanding of the temporal dimension and aspects of User Experience (UX) [3]. For this, we start with a summary of the current state of research regarding UX: We will begin with the definition of UX, then present different design approaches that evolved to show that a psychological perspective on the subjective temporal experience is a promising addition to the UX design practice.

The definition of UX by the International Organization for Standardization ([3] p.3), stating that “user's perceptions and responses that result from the use and/or anticipated use of a system, product

or service”, led to diverse discussions on how UX should be defined, how UX distinguishes from usability, and how it can be specifically developed, e.g., [4–7]. As a result, the core idea that UX is an experience-centered perspective on technology evolved [8,9], developing an awareness that interacting with technology creates experiences and involves us emotionally. The traditional technology design approach is considered a “problem-driven design” that treats technology as a solution or tool to solve a problem in leisure or work contexts; however, this approach does not necessarily facilitate positive experiences [10]. Researchers are therefore looking for design possibilities that can evoke positive experiences and contribute to happiness, well-being, and flourishing [4,8,10–13]. A key question, currently, asks how we can discover and explore such design possibilities (ibid.). According to Jimenez et al. ([14] p. 607), “The relevant question for designers is less whether design can create new or support existing possibilities, but rather how. How do we design for possibilities?” Jimenez, Pohlmeier, and Desmet ([15] p. 3) claimed that psychological theories can inspire designers and stated: “Design is about people, and the better we understand them, the better designers we will be.” Different UX design approaches have evolved, each taking a distinct psychological perspective, such as the emotional, motivational, or well-being perspective, to broaden the understanding of human experience and to identify UX design possibilities.

As an overview, Hassenzahl [4,8] stated that a positive UX is an evaluative feeling while interacting, and a positive feeling is evoked when psychological needs are fulfilled. His design approach involves developing UX concepts that fulfill psychological needs, such as relatedness (feeling close to persons who are important for you), meaning (feeling that you develop your best potential and your life is meaningful), stimulation (feeling that you have enjoyment, pleasure, new impressions, and experiences), competence (feeling that you achieve things and are effective), security (feeling that you are safe, have your life under control, and can follow your routines), autonomy (feeling that you are the cause of your actions), and popularity (feeling that you are respected by others and have a positive influence on them) [16].

Another design approach, which represents the emotional perspective, focuses on 25 positive emotions that can be experienced by products, such as joy, gratitude, or relaxation, that are ordered in eight categories: empathy, affection, aspiration, enjoyment, optimism, animation, assurance, interest, and gratification [17,18]. Desmet [17] identified six main sources that can evoke emotions: the product itself, the subjective meaning of the product, the interaction with the product, the activity that is facilitated, ourselves, and others involved in the interaction. The design approach involves developing UX concepts that fulfill the eliciting conditions of a selected emotion.

By contrast, Zeiner et al. [19,20] developed an empirical approach to identify design possibilities. First, they gathered positive experiences that already occur in the work context, which they analyzed for common structures, factors, fulfilled needs, and evoked emotions and then distilled these to 17 experience categories, e.g., “receiving feedback”, “rising to a challenge” and “helping others”. These experience categories belong to the following six clusters: resonance, social support, challenge, engagement, organization, communication, and new experiences. The experience categories act as a starting point from which to develop UX concepts that are based on the described structure and fulfill the factors.

Desmet and Pohlmeier developed a Positive Design framework [11] based on positive psychology to design for happiness and well-being. The framework includes three main components of subjective well-being that are addressed by the design: pleasure, personal significance, and virtue. The goal of positive design is to support human flourishing [21], which refers to the optimal functioning of people and having positive emotions, a sense of meaning, engagement, interest, and purpose in life.

Overall, the summarized approaches contribute to the understanding of positive experiences, that is, the “ingredients” of positivity, how they arise, and how we can shape them by design. However, these approaches have a deficit in common: UX focuses on the experience, and human experience is characterized by its dynamic and variability of experience, i.e., of thoughts, actions, and feelings,

which means that UX develops over time and is not a stable phenomenon [3,22–25]. However, the abovementioned design approaches pay little attention to that.

Several descriptive models present the temporal dimension and related aspects of UX, such as the model “ContinUE” [24], which describes four sequential phases: anticipated experience, use experience, reflective experience, and retrospective experience. This model contributes to the understanding of the UX lifecycle and the development of experience by emphasizing that the factors of user, system, and context underlie temporal dynamics, which result in short- and long-term effects (learnability, durability, maintenance, and variability of the context). Additionally, the judgment about the product is dynamic due to the variability of the user (e.g., capabilities), the system (e.g., adaptability, age), and the context (e.g., environment, time pressure).

A comparable but simplified model is described in the ISO 9241-210 [3]. This model characterizes the temporal dimension in three phases: anticipated use, during use, and after use, with a focus on usability.

The model “Temporality of Experience” [23,25] presents three main forces that influence the UX over time: familiarity, functional dependency, and social as well as emotional attachment. The authors also identified the phases of anticipation, orientation, incorporation, and identification. Therefore, the model describes how the quality of experience and the evaluation of the product develops over time, and it emphasizes that, depending on the phase, other product qualities are important (e.g., stimulation, learnability, usefulness, usability, personal, and social aspects).

Overall, while the models “ContinUE” [24], “Temporality of Experience” [23,25] and the model described in ISO 9241-210 [3] broaden the understanding of the temporal dimension and temporal aspects of UX, they are descriptive. Hence, they do not focus explicitly on positive UX, offer a systematic design approach, or present design possibilities [10]. We therefore asked how we could design for a UX that incorporates the temporal dimension, the dynamic nature, and the variability of experience, which led us to the conclusion that just as other psychological perspectives led to design approaches, a new psychological perspective on subjective time could broaden the understanding of the temporal experience and identify further UX design possibilities.

This paper makes the following contributions:

1. First, we broaden the understanding of the temporal experience that develops over time by building on the Time Perspective Theory (TPT) [1], and we show how time perspectives (TPs) have a powerful influence on experience, namely on thoughts, actions, and feelings.
2. Then, we present the design framework and approach “designing for temporal harmony,” which incorporates the knowledge of TPT and the concept of balanced time perspectives (BTP), also known as temporal harmony, to UX design. The presented methods and the distilled design principles uncover UX design possibilities for the temporal dimension of experience (the past, present, and future).
3. Finally, we present a case study in the context of public transport that explores and evaluates “designing for temporal harmony.”

2. Time Perspective Theory (TPT)

To gain a better understanding of subjective time, we reviewed diverse psychological theories and related constructs, e.g., TP [1], temporal focus [26], and time attitude [27,28]. After analyzing these regarding the potential for UX design, we selected TPT [1] because it unites the findings of 30 years of research and led to an international research network. However, most important for UX design is that the authors present how TPs can contribute to well-being [1,2].

2.1. Time Perspectives (TPs)

Zimbardo and Boyd [1] summarized the mostly unaware and habitual influence of time on experience under the term “time perspective”, which they defined as follows:

“The often nonconscious process whereby the continual flows of personal and social experiences are assigned to temporal categories, or time frames, that help to give order, coherence, and meaning to those events [. . .]. They are used in encoding, storing, and recalling experienced events, as well as forming expectations, goals, contingencies, and imaginative scenarios.”

Zimbardo and Boyd [1,2] observed that people unconsciously develop a habitual focus on a certain TP, which influences their general mood, individual decisions, and behavior in daily life. They claimed that the development process is shaped by factors of culture, education, religion, social class, and family. They developed a valid and reliable individual difference metric to assess one’s TP profile (ibid.), which distinguishes three time frame orientations and five dimensions. In the following paragraphs, we summarize these and complement them with research by Seligman [29] and Stolarski et al. [30], who explored the relationship between TPs and immediate emotional experience as well as emotional valence.

A past-oriented person is subconsciously influenced by past similar situations. Their behavior is characterized by conservative action and maintenance of the status quo.

- “Past-Negative” reflects a negative, aversive view of the past. The thoughts revolve around things that went wrong in the past and the feelings of pain, regret, and sadness.
- “Past-Positive” (PP) reflects a warm, sentimental attitude toward the past. The thoughts reflect the nostalgic remembrance of the good old times, feelings of nostalgia, satisfaction, pride, gratitude, and a sense of continuity and identity.

A present-oriented person focuses on the here and now rather than what could be or used to be. Their behavior is characterized by actions that bring immediate pleasure or avoid pain.

- “Present-Fatalistic” reflects a fatalistic, helpless, and hopeless attitude toward life and the future. The thoughts revolve around the pattern that nothing works out, nothing good happens, and that nothing can be changed about it. The attitude of resignation, cynicism, and pessimism dominates.
- “Present-Hedonistic” (PH) reflects a hedonistic, risk-taking attitude toward time and life. The action is characterized by the enjoyment of all things that bring immediate pleasure. Feelings of joy, serenity, pleasure, lust, and euphoria dominate.

A future-oriented person’s actions and decisions tend to be based on anticipated imaginations of a possible future rather than the immediate present or the past. Their behavior is characterized by goal-oriented actions, the investment of effort, time, and money for a better future and the acceptance of delaying immediate gratification.

- “Future” (F) reflects a general future orientation. The behavior and decisions are characterized by ambitious goal orientation, increasing efficiency, and the confidence that it will work out and be worthwhile. Feelings of anticipation, positive expectancy, hope, curiosity, and attitudes of optimism and self-confidence dominate.
- “Transcendental Future” reflects the belief of life after death. The behavior and decisions are characterized by the belief that they will be rewarded or punished for their current life behavior in the afterlife. Note: This TP is not part of the five factors that form the Zimbardo TP Inventory [1], but it is described by them.

Carelli et al. [31,32] suggested creating six dimensions by splitting Future into Future-Positive and Future-Negative. Future-Negative reflects a negative view of the future characterized by concerns or worries about not achieving the chosen goals.

2.2. Temporal Bias

“Temporal Bias” [1,2] describes when people over- or underuse one of the three temporal frames, i.e., the past, present, or future. Doing so can be harmful to well-being because each orientation has

its advantages but also disadvantages. A PP person focuses on the past positively, recalls positive memories, e.g., of their achievements, rituals, and tradition, and experiences a sense of identity, relatedness, and security, but tends to resist change and takes fewer risks or challenges. However, the PH person, who focuses on the present and lives for pleasure with no regard for tomorrow, experiences positive emotions. The problem is the phenomenon of hedonic adaptation [33], which describes the tendency to adapt to circumstances, e.g., fortune or new experiences, and then to return to a “happiness set point.” In the long run, it is difficult to find pleasure. Another problem is that this temporal bias is related to having unclear future goals and thus leads to difficulties in achieving school and/or career objectives. By contrast, the F person, who focuses on the future and works hard to strive for a professional career and to unfold his/her potential, is likely to neglect his family and friends and in the long run experience stress, burnout, or loneliness. More detailed findings can be found in *Zimbardo and Boyd’s book The Time Paradox—The New Psychology of Time That Will Change Your Life* [2] in which they present in detail how TPs influence thoughts, feelings, and actions, and therefore shape (individual) lives.

2.3. Balanced TPs and Temporal Harmony

Because of the described interdependencies, i.e., advantages and disadvantages of TPs for well-being, Zimbardo and Boyd [1,2] recommended developing an ability to switch TPs flexibly, e.g., depending on the tasks, situational considerations, and personal resources. However, based on their studies, they concluded that the Past-Negative and Present-Fatalistic TPs are not good for well-being because they correlate with risks of physical and psychological health problems [34]. Therefore, Zimbardo and Boyd ([1], p. 1285) recommended a balance between PP, PH, and F: “The future focus gives people wings to soar to new heights of achievements, the past (positive) focus establishes their roots with tradition and grounds their sense of personal identity, and the present (hedonistic) focus nourishes their daily lives with the playfulness of youth and the joys of sensuality. People need all of them harmoniously operating to realize fully their human potential.”

Stolarski et al. [35] summarize in their paper “Assessing Temporal Harmony: The Issue of a Balanced Time Perspective” the research history of “balanced TP” (BTP), also referred to as “temporal harmony” [35], and state that the Zimbardo Time Perspective Inventory (ZTPI) [1] was widely accepted as a measure of temporal orientation. Furthermore, Zimbardo and Boyd [2] provided with their above-mentioned BTP profile (high scores on PP, moderately high scores on PH and F, low scores on PN and PF) a starting point for empirical operationalization. Stolarski et al. ([35], p. 69) summarize the attempts to operationalize BTP from different researchers and conclude that each approach has strengths and weaknesses and that the “BTP construct is not yet totally explored and clarified.”

However, many studies have concluded that having a BTP is related to subjective well-being. For example, Drake et al. [27] specified that participants having a BTP were happier and more mindful than individuals with other TP profiles. Zhang, Howell, and Stolarski [36] prove that BTP is related to increased satisfaction with life, happiness, positive affect, psychological need satisfaction, self-determination, vitality, gratitude, and a decreased negative affect. Additionally, Webster, Bohlmeijer, and Westerhof [37] concluded that a BTP is related to higher well-being and wisdom across the adult age span.

3. Design for Temporal Harmony

As previously summarized in Chapter 2, Time Perspective Theory (TPT), people unconsciously develop a habitual focus on a certain TP [1,2], which can have negative effects on well-being. Zimbardo and Boyd [1,2] assumed that people’s TPs change when they are supported and instructed, and they also recommended developing the ability to switch TPs flexibly depending on the situation, as this is considered to be, psychologically and physically, the healthiest option. Various studies conclude that a BTP, also referred to as “temporal harmony” [35], is related to subjective well-being and more positive outcomes [27,36,37]. Based on the summarized assumptions and findings, we developed the

idea to promote TPs and balance them via interactive systems. We understand interactive systems [38] (3.1.5) as a “combination of hardware and/or software and/or services and/or people that users interact with in order to achieve specific goals.”

To explore the concept of temporal harmony for UX design, we developed a design framework and approach that is derived from TPT [1,2] and applied it to a case study: The “Temporal Harmony” framework (see Figure 1) presents the goal of evoking and balancing the positive TPs, i.e., PP, PH, and F, via interactive systems, to achieve the recommended BTP, or rather a temporal harmony to promote user well-being. Overall, the framework helps designers to gain a new perspective: it helps to better empathize with users, to explore temporal design possibilities, to ideate and design ideas for the temporal dimension of UX, and to evaluate the temporal user experience.

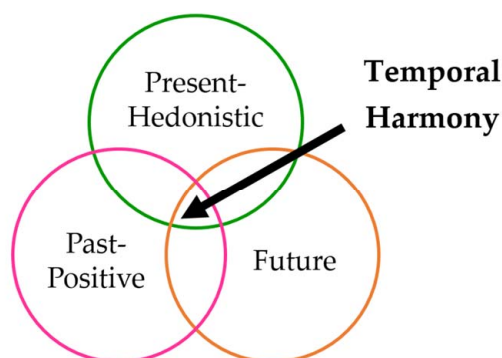


Figure 1. Temporal harmony framework. It represents the goal of evoking and balancing the positive time perspectives (TPs), i.e., Past-Positive (PP), Present-Hedonistic (PH), and Future (F), via interactive systems to promote users’ temporal harmony and well-being.

The following design approach aims to incorporate the framework to guide designers to systematically design a positive UX, temporal harmony, and thus happiness and well-being. To achieve these goals, we used and adapted the principles and activities of user-centered design [3] and possibility-driven design [10], which we explain briefly by the following list (a short overview of the design approach is also shown in Table 1, for all details, see all following subchapters):

1. Phase 1. Empathize (see Section 3.2 Empathize): The design framework presents the goal of evoking and balancing the TPs. For designers, TPs can be understood as vessels of design possibilities that are rooted in the knowledge of well-being [10]. TPT offers insights about activities that promote specific TPs. This knowledge can be used by designers to fill the vessels by promoting the activities via interactive systems. However, to develop meaningful and successful interactive systems for users in a specific project context or rather context of use, designers are required to explore relevant design possibilities. An example: an interactive system that promotes the recall of family traditions and events is likely to be experienced positively (PP) but would be unsuitable in the work context and consequently be a product failure. Therefore, to avoid product failures, exploring relevant design possibilities for the context of use is important. For this reason, we suggest the phase empathize and the following methods: We developed the “temporal experience interviews” to enhance the understanding of users in the project context and their positively experienced TPs to identify design possibilities that promote happiness and well-being. We also suggest creating a TP persona to illustrate how the user experiences the TPs in the context of use.
2. Phase 2. Design (see Section 3.3 Design for Temporal Harmony): Based on the results of the first phase, namely the temporal experience categories as well as the TP Persona, and previously derived TP design principles [39], designers develop an interactive system concept that is intended to promote all the (positive) TPs—PP, PH, and F—through different functionalities, to achieve temporal harmony.

- Phase 3. Evaluate (see Section 3.4 Evaluate): We suggest evaluating the interactive system concept at an early stage, based on rapid video-prototypes and using a mixed-methods approach to assess whether it evokes a positive UX and temporal harmony. For this, we suggest our adapted version of the valence method [40,41] and our developed temporal questionnaire.

Table 1. Overview of “Designing for Temporal Harmony”. It presents the “phases”, describes for each phase the “goal”, “how” we strive for the goal resp. what methods we use, and the results we achieve as “output”. (For all details, see all following subchapters.).

Phases of Designing for Temporal Harmony	Goal	How? (Developed Methods)	Output
1. Empathize	Enhance understanding of the user group, experienced TPs, eliciting conditions, and factors in the project context to get a source of inspiration for the following design phase.	Conduct online temporal experience interviews (based on experience interviews [19,20] with a developed extended set of questions to address TPs).	TP persona and temporal experience categories (reports of mental constructions and experiences)
2. Design	Develop one system that promotes positive TPs in harmony for the user group.	Use TP persona to empathize with the user group. Be inspired by temporal experience categories and use derived TP design principles [39] to design for temporal harmony: Develop core concept for PH and complement it with functionalities to address PP and F. Create video-prototypes.	Concept, video prototypes
3. Evaluate	Assess whether the system (video-prototypes) evokes a positive UX and whether the different functionalities address the intended TPs and evoke temporal harmony.	Use a mixed-methods approach: the adapted valence method [40,41] and developed temporal questionnaire.	Assess UX, TPs, and temporal harmony based on data analysis of valence method and temporal questionnaire

3.1. Project and Context of the Case Study

The case study focuses on the UX design of an existing mobile journey planner offered by the local public transit association. So far, the key goal has been to make passengers feel well informed. Therefore, the core functionality provides door-to-door timetable information and real-time information about commuter trains. It also offers relevant and general information, e.g., about tickets and fare zones, lines, and a city map.

3.2. Empathize

TPT [1] provides general theoretical knowledge about the influence of TPs on behavior, emotions, and decisions. For the design process, it is helpful to broaden the understanding of TPs in the context and to develop empathy with the users, i.e., to explore when and why positive TPs are experienced by users in local public transport. Questions include the following: What kind of situations in public transport does the user anticipate positively? (F); What kinds of hedonistic pleasures does the public transport offer? (PH); Which memories of experiences or events on public transport does the user recall positively? (PP) To obtain answers and to develop empathy, we conducted the following study.

3.2.1. Approach and Goal

A typical approach for developing empathy toward the user group in a specific context is to gather positive experiences by conducting experience interviews [19,20]. This interview technique has been developed to collect positive experiences in defined contexts (e.g., work, cooking). The technique is a narrative interview with an instruction to recall and describe a positive experience for a specified context. Using narratives of positive experiences is a well-accepted research paradigm in UX research [42]. The interviews can be conducted face-to-face or online. After having described the positive experience, the interviewee has to answer several questions concerning the experience: What was the activity during the experience? Where did you experience it? Who was involved in the positive experience? How did you feel? Which factors supported the positive experience? Then, the collected positive experience descriptions are analyzed and classified into experience categories to identify common

structures and facilitate factors of positive experience, e.g., the surroundings, the presence of others, activities, technology (ibid.).

Similar to the described experience interviews [19,20], we conducted online temporal experience interviews with an extended set of questions to explore and broaden the understanding of TPs in the context of local public transport. We derived initial questions for every positive TP [1,2] (translated to English, see Table 2). The goal was to explore the eliciting conditions, the when, and the why, of an experienced TP in the local public transport context. Each question addressed the temporal frame (past, present, or future), referred to the emotional essence of the TP, i.e., emotions related to a temporal frame [29] and also the eliciting activity, situation, or mental construction. In summary, the interviewees were asked to report hedonistic activities or situations as well as mental constructions about the past and future, which they experience positively.

After that, the participants had to answer the mentioned experience interview questions to get more detailed information about the situation and factors [19,20]: What was the activity during the experience? Where did you experience it? Who was involved in the positive experience? How did you feel? (The mentioned emotions of the initial question were presented as checkbox items and there was additionally an empty input field.) Which factors supported the positive experience?

3.2.2. Participants

To distribute the study and recruit participants, we used a mailing list of the Stuttgart Media University and posted the call in some Facebook groups, e.g., local groups such as “Stuttgarter help Stuttgarter.”

Before starting the study, we presented information about data protection and the collection of personal data via pseudonyms. The participants all gave their written consent.

65 persons participated. 56 persons stated female =87%, six stated male =9%, three did not state their gender =5%. The mean age is 25. The age ranges have the following sample percentages: 16% are “under 20 years”, “between 20 and 25 years” has the largest share with 39%, followed by “25 to 30 years” with 25%, “30 to 35 years” with 12%, “over 35 years” with 4%, and 4% didn’t state their age. The majority of the participants (45%) had achieved a high-school diploma (in German “Abitur”), 17% had an advanced technical certificate (in German “Fachhochschulreife”), 20% had a bachelor’s degree, 8% a master’s degree, and 8% had completed an apprenticeship. Of the participants, 37 study, 24 work, one is unemployed, and three did not answer the question.

Table 2. Temporal experience interview. It is used to explore and broaden the understanding of occurring TPs in a project context.

Past-Positive (Mental Constructions, Memories)	Present-Hedonistic (Hedonistic Activities and Situations)	Future (Mental Constructions, Anticipations, Plans, Goals)
<p>Have you experienced something related to public transport that makes you feel</p> <ul style="list-style-type: none"> • satisfied • fulfilled • proud • grateful • self-confident • nostalgic <p>Overall, does this make you think positively about the past?</p>	<p>Is there something related to public transport that generally</p> <ul style="list-style-type: none"> • you enjoy • evokes interest or fascination • you pursue to feel sensory pleasure and excitement • makes you feel relaxed <p>Overall, does this make you happy in the present?</p>	<p>Is there anything related to public transport that</p> <ul style="list-style-type: none"> • evokes a pleasant anticipation • makes you want to plan • makes you want to experience • makes you want to master • inspires you • lets you consider consequences • gives you hope <p>Overall, does this let you think about the future?</p>

3.2.3. Analysis and Results

Similar to Zeiner et al. [19], the reports were classified and compared by content analysis [43] to explore the similarities. First, we identified three sources that can evoke positive experience and mental constructions about the past, present, and future: evoked by the presence of others, evoked by activities and internal factors, and evoked by external public transport factors (see Figure 2). Similar experiences and mental constructions were then categorized by the core action and context. We found 13 temporal experience subcategories that describe the core action and context, e.g., the category “discovering something”.

The difference from experience categories [20] is that we not only illustrate the core action and context but also capture and represent the temporal frame and the TP. By comparing the hedonistic activities and mental construction reports of a category by TPs and emotions, we examine whether the positive experienced core action is also experienced positively when constructing it mentally as a memory or anticipation. The reports of mental constructions were analyzed, categorized, and represented with the specification of the TP within a subcategory.

In total, we gathered 60 positive memories (mental constructions that focus on the past and evoke positive emotions), 52 hedonistic pleasures (hedonistic activities or situations that are generally pleasant), and 40 positive anticipations (mental constructions that focus on the future and evoke positive emotions).

As an example, for the categories and reports, the category “discovering something” represents hedonistic pleasure. The context offers different opportunities for discovery, which fulfill the need for stimulation and evokes emotions like interest and fascination, e.g., through discovery journeys or through observing different people of different ages or cultures. Some excerpts of the participants’ responses include “Discovery journeys are exciting, getting to know new routes or stations” and “I love observing other people. It’s fascinating that so many people have countless stories to tell.” However, we also gathered reports of positively experienced mental constructions addressing the past and future. For PP, we gathered explicit mental constructions of experiences, for example, where the participant discovered something special while using local public transport, such as an unknown place nearby, and this memory evokes positive emotions like a feeling of fulfillment or gratitude toward the local public transport: “We just took the next train without a destination in mind. We arrived at places we had never seen before: from high-rise settlements to farmlands.” Another report shows that experiences, such as memories, can lead to a positive attitude toward the local public transport. One participant reported: “I always like to travel by bus because it enables me to explore unfamiliar places and cities to get a first impression.” A mental construction addressing the future is, for example, a pleasant anticipation of discovering something, which is evoked by imagining and planning journeys: “I feel anticipation when I know that I will arrive somewhere, where a pleasant experience awaits me. Then, I anticipate the experience and imagine it, which evokes hope.” Other mental constructions addressing the future are, for example, the anticipated technological progress of mobility. Other reports show that anticipations can also inspire people to plan new journeys: “I would like to make a long train journey through another country. I anticipate that you can enjoy the scenery and at the same time enjoy being with others. Moreover, train rides are less stressful compared to car rides because you do not have to sit behind the steering wheel.”

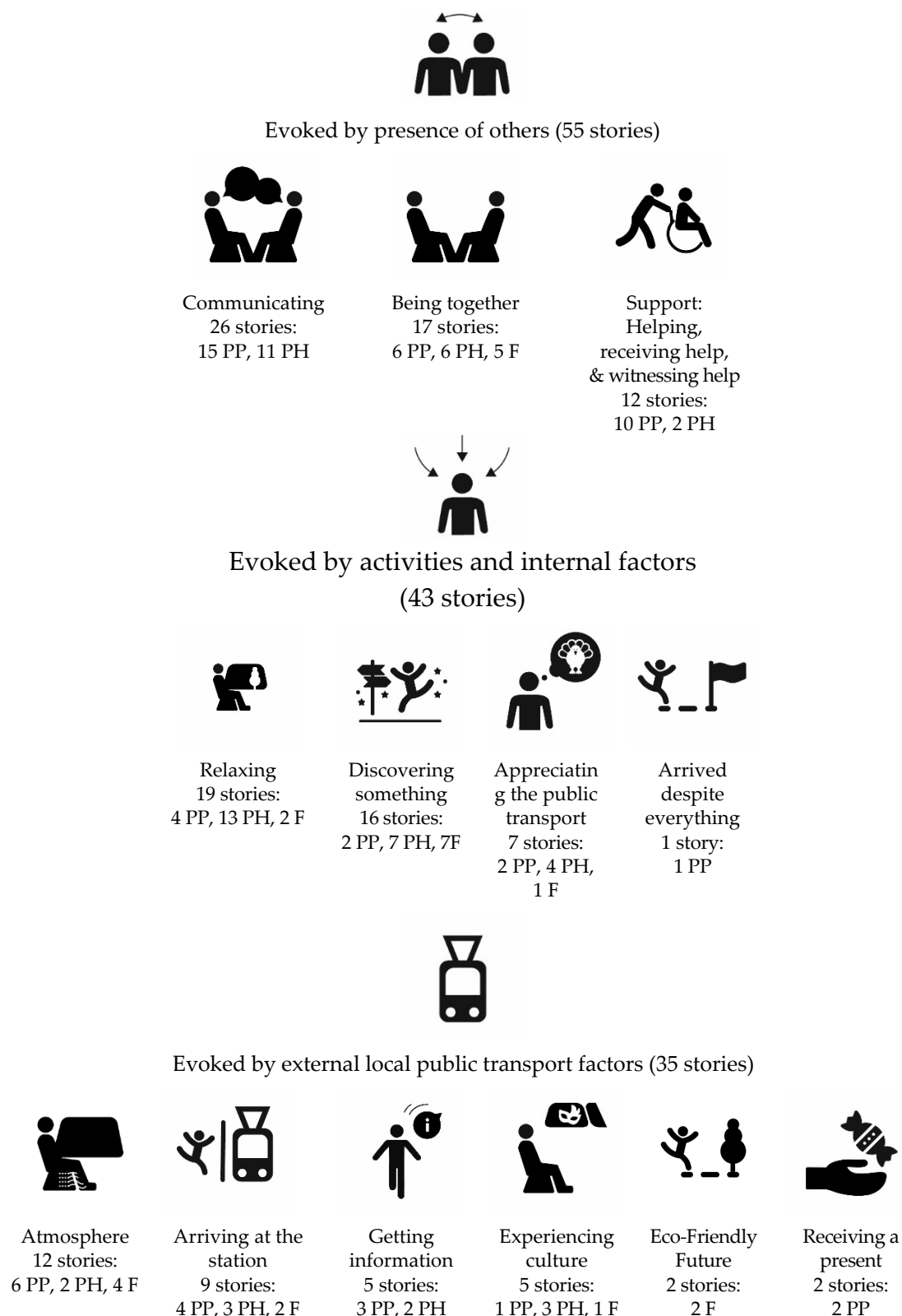


Figure 2. Temporal experience categories for public transport. They represent activities and situations that can elicit positive experiences and mental constructions about the past, present, and future. The category with the most reports is “Communicating”, followed by “Relaxing”, “Being together”, and “Discovering something”.

Another example: In the category “communicating,” the participants reported experiences that essentially include the core action of communicating spontaneously and informally with strangers and the unexpected experience of humor. The reports for PH represent a general positive attitude toward “communicating” with a frequent part of “humor.” One participant wrote: “The journey home from the Stuttgart Beer Festival in the S-Bahn is always very amusing because of the happy passengers!” and “Traveling by train in the late hour with some drunken guests who suddenly start singing makes the trip more fun.” The reports for PP resemble a concrete recalled experience, e.g., “I [...] got into a conversation with an older gentleman. We talked for a while and then he told me how nice it was to be able to chat with young people. He said that I brightened up his gray everyday life. [...] It’s nice to make other people happy, and, in the subway, you meet an incredible number of people you can talk to.” Another participant explained the following: “The train was extremely late [...]. Accordingly, the mood was anything but positive. The announcement, shortly before arriving at the destination station, said, ‘we actually somehow reach our destination.’ This announcement from the train staff was very humorous and positive. Some of us had to laugh out loud, and we even applauded. I like to remember this because one person with humor changed the mood of all the passengers.” However, for the category “communicating” we did not obtain mental constructions for F. Based on the analysis, we assume that such situations are unplanned or, if planned, they have the core action of “being-together”.

3.2.4. TP Persona

The findings of the temporal experience interviews and other gathered research findings, e.g., surveys and interviews with passengers on the topics commuting [44–46] as well as the characteristics of typical Swabian citizens, as they are the main users, were used to create a TP Persona.

A persona is a typical tool used to represent a user group [47]. The profile of the characteristics and preferences of a specific user group are transferred to a description of a hypothetical member of that group having a real name, a family situation, a concrete job, etc. Personas are useful for designers to assume the perspective of the described user as if they were a real person. Personas are psychological empathy tools for designers, which are helpful for creating meaningful concept ideas for users.

We created a TP persona template and used it as shown in the preview Figure 3 (for the full-size version see Figure A1: TP persona presented in the Appendix A). The figure illustrates the characteristics of a user group, e.g., name, age, education, and profession. However, the TP persona aims to capture the assumed TP personality. To illustrate the goal of temporal harmony and to support designers to develop ideas accordingly, the TP persona samples stories that represent TPs: hedonistic activities (for PH), memories that evoke positive emotions (for PP), and pleasantly anticipated experiences and goals (for F).

We developed the following scenario that represents the findings and our assumptions: Elena moved to Stuttgart for a job opportunity one year ago. She thinks the prejudices about Stuttgart are justified, e.g., that there are no attractive leisure activities. Since she has been living here, she lives by the Swabian motto: “Work hard, scrimp and save for a house.” This affects her daily routine: getting up, commuting to work, working late, commuting home, watching television, or surfing the web, and then her daily routine starts again. In summary, Elena feels trapped in her everyday life.

So, the persona illustrates the patterns of F but also experiences the negative sides of it, feeling the need for PH and PP, i.e., the need for BTPs.



Figure 3. TP Persona Elena. It illustrates the characteristics of a user group and aims to capture the assumed TP personality as well as TP potentials in the project context. (Full-size presentation in the Appendix A, see Figure A1.)

3.3. Design for Temporal Harmony

The next step is to conceptualize the knowledge of TPT and gained insights of the previously conducted study. For this, we developed the following approach.

3.3.1. Approach and Goal

As introduced, the “Designing for Temporal Harmony” framework is based on TPT research [1,2,29,30] and combines three positive TPs to promote well-being (see Figure 1). In short, the design approach is an analytical, empathetic, and creative approach that is used to identify design possibilities to design for temporal harmony (see Figure 4):

To identify design possibilities for the TPs, hedonistic activities, and mental constructions, it is helpful to gain an understanding of these in the project context and context of use. Therefore, we used the developed TP persona and the temporal experience categories to obtain a better understanding of experienced TPs and their “ingredients” (see Section 3.2 Empathize and Figure 4, left column). While some experiences and mental constructions involve technology, most do not. Hedonistic activities and mental constructions that do not involve technology offer an opportunity to design innovative interactive systems that promote these. With these insights, our derived design principles and questions ([39] p.4, translated to English) that address every component of the framework, i.e., for the TPs PP, PH, and F, can be used individually by designers to uncover relevant design possibilities and to develop concepts that evoke a specific TP (see Figure 4, middle column):

- PP: Recall memories of meaningful and positive experiences to evoke satisfaction, pride, gratitude, hope, and optimism. Which positive experiences, activities, or situations in the context does the persona like to recall? When and how could such memories be encouraged by clues and reminders?

- PH: Satisfy needs and stimulate sensuality to evoke pleasure, joy, amusement, euphoria, surprise, and serenity. What activities/events are there in this context that are satisfying, varied, and enjoyable for the persona? How could these be further promoted and evoked?
- F: Promote and facilitate goal pursuing to evoke anticipation, confidence, and optimism. What intentions, wishes, desires, or projects does the persona have? What goals does the persona identify with? How could the voluntary and personal goal setting and pursuit be evoked?

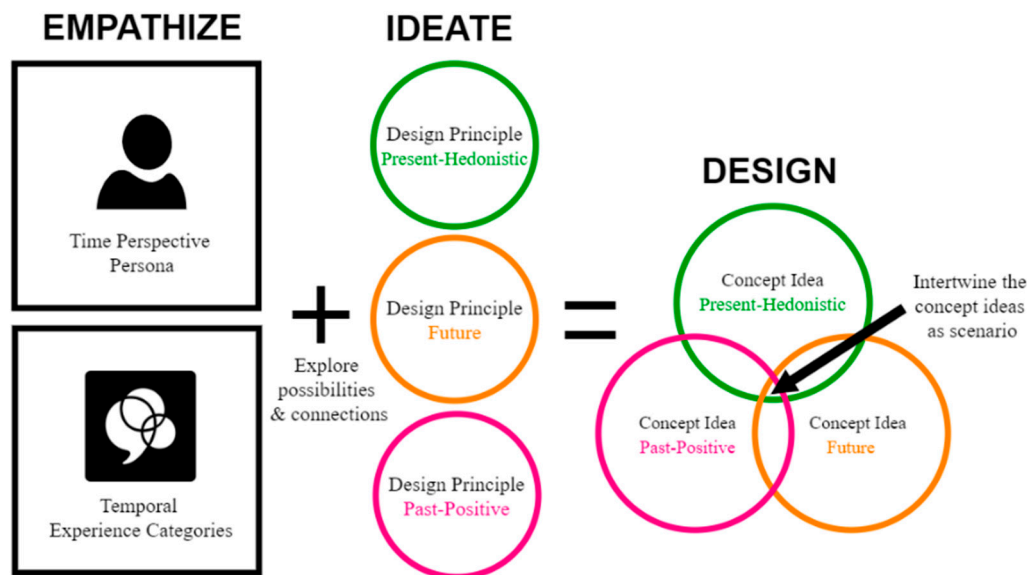


Figure 4. “Designing for Temporal Harmony” ideate and design phase approach. Designers can use the previously developed TP persona and temporal experience categories to empathize with a user group and broaden the understanding of TPs in the project context (**left** column). Then, the design principles are used to explore design possibilities and connections (**middle** column). Next, designers can develop concept ideas that intend to evoke a specific positive TP and intertwine various concept ideas as a scenario to achieve the goal of temporal harmony (**right** column).

However, designing for a temporal harmony means that the resulting interactive system should address all the positive TPs in balance (see Figure 4, right column). Thus, we needed to identify how to do that:

First, we developed a core concept that mainly is intended to evoke PH. Our reasoning was the following: When the user experiences something with the system, they can later recall these experiences with the help of reminders to evoke PP or they can make new plans to experience something similar to evoke F. So, as a second step, we complemented this concept by developing relevant functionalities and visualizations that address the other TPs, i.e., F and PP. Then, we wrote a scenario that intertwines the selected concept ideas that should facilitate the TPs in harmony. A scenario is a written story about the use of a future system [48], which describes the interaction in terms of the system functionality, i.e., what the user can do. The scenario also describes presented information, such as what the user will see, and the interaction sequences, such as how the user pursues a goal and how the user interface influences the user’s actions. In summary, the scenario describes the ‘what’ and ‘how’ of the system. Based on the scenario, a visual prototype can be developed.

3.3.2. Developed Concept and Video Prototypes

The TP persona, the temporal experience categories, and the design principles led to the development of an interactive system called “experience portal” that brings together various concept ideas to address the TPs in harmony.

We found that many commuters experience their commuting time as lost time. The design intention of the “experience explorer” is to create an enjoyable, hedonistic activity for the commuting time. For this purpose, we used the gained insights of the temporal experience category “discovering something.” The participants described that they enjoy discovering new routes and places. This activity also fulfills the psychological need for stimulation and evokes emotions such as interest and joy (PH). Based on these insights, we developed a functionality that presents users who are near a station or on their train journey with location-dependent experience possibilities that fulfill their psychological needs [16] (Figure 5a). At the same time, the design intention of this functionality is to inspire users trapped in a daily routine with new experience possibilities and to inspire them to establish a fulfilling leisure time (F). The experience possibilities are created by the community, i.e., users can publish them. As an example, for the experience possibilities: Stuttgart is in a valley basin, and, because of the days of winegrowing, there are more than 400 open staircases called *Stäffele*. We developed the experience possibility “workout with 407 steps,” which is located near the station *Feuersee* and fulfills the need for physical activity [49].

With this in mind, experience possibilities can be scheduled (Figure 5b) to promote a positive anticipation (F). We consider that this functionality can help users who are focused solely on the future and experience the negative side of this TP to reflect and change their unconscious behavior: they neglect free time and experience stress and burnout because they strive so hard for their goals and fail to grant themselves a break. By planning the experience, it is more likely that they will actually pursue it.

Additionally, we designed a travel book (Figure 6a) to evoke the positive recall of experience possibilities or explored locations and to evoke emotions such as satisfaction, pride, and gratitude (PP). The book contains positive quotes such as “experiencing makes you happier than owning” and the amount of explored experiences are counted below to visualize the progress, e.g., “you participated in four experience possibilities”.

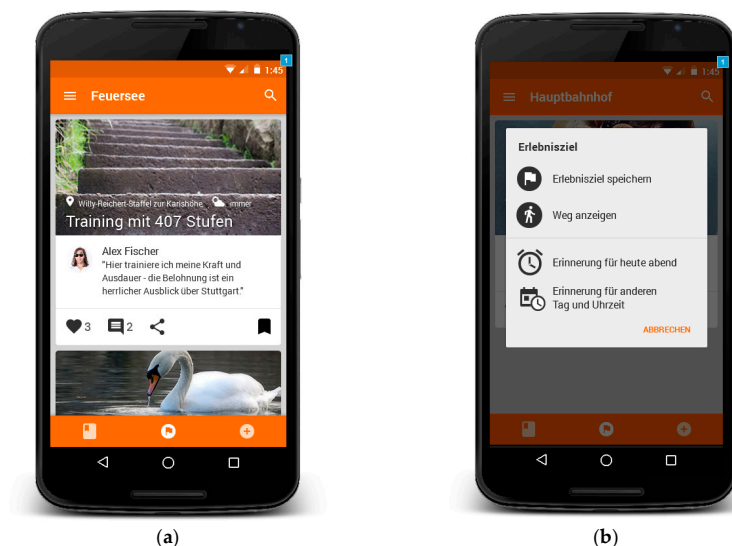


Figure 5. User Experience (UX) Concept ‘Experience Explorer’: (a) users can explore location-dependent experience possibilities; (b) users can use Bookmark functionalities, e.g., to appoint a date or showing the route.

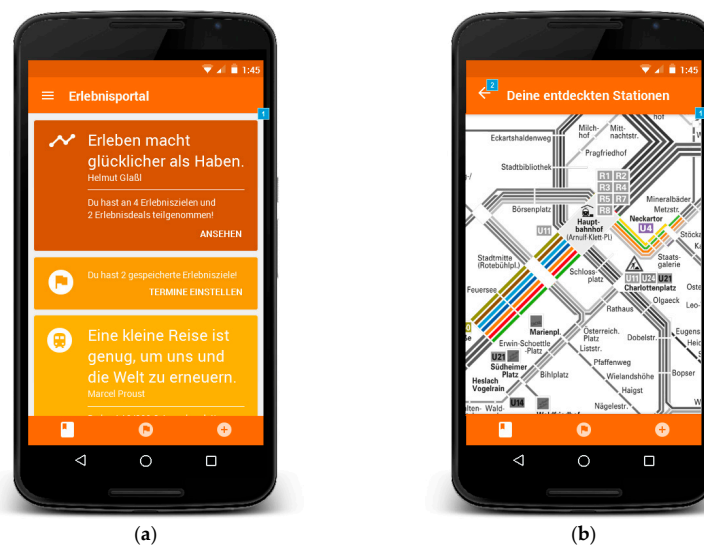


Figure 6. UX concept ‘travel book’: (a) users can read quotes and statistics about the participation on experience possibilities and the exploration of the city; (b) travel map, users see a visualization of explored locations vs. not explored locations.

The public transport map was used to visualize the routes and locations that were explored (highlighted routes and stations) and that were not explored (grey). The aim was to motivate users to explore previously unexplored routes and unknown locations and to evoke interest and anticipation (F) (Figure 6b).

3.4. Evaluate

We evaluated whether the developed UX concept evoked a positive UX and whether the different functionalities addressed the intended TPs and evoked overall temporal harmony.

Because the developed functionalities are technically demanding (the core functionality of the “experience explorer” relies on its location-dependency and many functionalities on action responses), we chose video prototypes to create the illusion of a functional system. Therefore, we were also able to illustrate the persona, their daily routine, and how they would interact with the “experience portal” over time. We were also able to demonstrate the different functionalities that we expected to evoke different TPs one after another using separate videos, so we could evaluate these individually. Evaluating UX concepts using video prototypes has proven to be a suitable method [50]. The advantage of rapid video prototyping is being able to evaluate concepts early rather than taking the risk of developing something that does not evoke the intended positive UX.

The following subchapters explain our mixed methods approach consisting of qualitative and quantitative methods.

3.4.1. Valence Method, Complemented by Discussing Emotions

We chose the dedicated UX evaluation valence method [40,41]. The theoretical background is based on the UX model of Hassenzahl [4,8], which defines UX as a momentary evaluative feeling while interacting with interactive products or services, and claims that positive UX is the consequence of the fulfillment of psychological needs. The valence method consists of two phases: the explorative phase and the retrospective phase. In the explorative phase, participants watch the video prototype and set positive or negative valence markers (e.g., using two buttons) to give feedback about their experienced positive or negative emotions. In the retrospective phase, the marked video scenes are retrieved and the participant is interviewed. For each valence marker, the interviewer clarifies which design element (e.g., a map on the screen) and design aspect (e.g., the information presented on the map) evoked the

positive or negative feeling. The interviewer applies the laddering technique [51,52] to identify the underlying subjective meaning and the fulfilled or frustrated psychological needs.

To make it easier for the participant to talk about their experience and emotions, cards with emotional terms were prepared. These are based on Fredrickson's 10 positive emotions [53]. The German emotion cards from the Design4Xperience project could also have been used, describing 25 positive emotions that can be triggered by products [17]. However, that number of terms could be overwhelming, while the 10 emotions include only the essential emotions needed to check the TPs (e.g., PP: gratitude, pride; PH: joy, cheerfulness, interest, pleasure; F: anticipation, hope, inspiration). Each card represents an emotion term. The participants were informed that this list of emotions was only a small selection of emotion terms and that they could name more if necessary.

3.4.2. Temporal Questions

To evaluate systematically whether the presented functionalities evoked temporal experience, TPs and temporal harmony, we researched existing questionnaires related to TPs or aspects and constructs of time, such as the Zimbardo TP Inventory (ZTPI) [1], Temporal Focus Scale [26], Adolescent Time Attitude Scale [54], The Adolescent Time Inventory [55], and the German version of the Temporal Satisfaction with Life Scale [56]. As these questionnaires measure personal traits or the individual's past, present, and future life satisfaction and not situational experiences that have effects on temporal experience and TPs, we could not use them and thus had to develop our own.

We used the Zimbardo and Boyd [2] described BTP profile (high scores on PP, moderately high scores on PH and F) and their definition of balance as a starting point for operationalization ([1], p. 1285): "Balance is defined as the mental ability to switch flexibly between TPs depending on task features, situational considerations, and personal resources rather than be biased toward a specific TP that is not adaptive across situations."

We assumed that participants understand what the terms "past", "present" and "future" mean. Similar to the Temporal Focus Scale [26] that measures if participants are thinking about the past or future, we wanted to measure whether the presented functionality evokes affectively toned thoughts about the "past" or "future". Additionally, for the temporal frame "present" we wanted to know whether the presented functionality evoked an enjoyable experience. Overall, the instruction of the temporal questions refers to the core functionality that was presented by the video prototype. We developed prompting questions that ask whether and at what intensity a positive experience or mental construction in relation to the temporal frames—past, present, and future—was evoked by the video prototype resp. presented functionalities. For example (translated questions, see Figure 7 for the German version), "When you use the 'experience explorer',

- Do you think positively about the past?
- Do you enjoy the present?
- Do you think positively about the future?"

Furthermore, we assumed that the participants would be able to reflect, evaluate, and speak about the effectiveness of the functionalities, and how intensely mental constructions about the past, future, and/or positive experiences in the present were evoked. To assess the effectiveness, the participants could choose a value on a five-point scale ranging from "not at all" (=1) to "completely" (=5) [57]. As the questions were used as prompting questions, the participants were finally asked which values they chose and why, allowing us to explore which aspects of the concepts or functionalities led to an experience of the temporal dimension (past, present, future) and TPs. For example, if a participant described a positive experienced memory in detail and named the related emotions like satisfaction and pride, we can conclude that they experienced PP.

Wenn Du den Erlebniskunder nutzt:	-- gar nicht	- wenig	. mittelmäßig	+ überwiegend	++ völlig
Denkst Du dabei positiv an die Vergangenheit/ Vergangenes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Genießt Du dabei die Gegenwart/ den Augenblick?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Denkst Du dabei positiv an die Zukunft/ Zukünftiges?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 7. Temporal Questions. These can be used as a starting point to investigate if and how intensely the presented functionality evoked a positive recall of the past (PP), sparked enjoyment in the present (PH), or evoked positive thoughts regarding the future (F) (see text above for translated version).

3.4.3. Participants

We recruited 11 participants aged 16 to 39 years (mean age = 25 years). Seven were female, and four were male. Eight participants were students (five studied information design, two studied mobile media, one studied media and communication management), one pupil, and two were workers (an office worker and an automotive saleswoman/service assistant). Before starting the study, we gave all the participants a sheet with information about the study, data protection, and collection of personal data via audio and video. All participants gave their written consent. Five participants used public transport daily, four participants approximately once a week, one participant approximately once a month, and one participant less frequently than once a month. Five participants said they enjoyed public transport (because they could avoid traffic jams and searching for parking spaces, and it was stress-free compared to car driving), four said that they experience it negatively (because of the price, delays, other passengers that are unpleasant, or strange odors), and two had mixed feelings.

3.4.4. Data Analysis of Valence Method






We analyzed each valence marker and coded the following attributes: participant number, marker sequence number, positive or negative valence, design element and aspect, meaning for the participant, underlying needs, and TPs. In doing so, we identified the design elements and aspects with the most influence on experience.

The valence markers were used to calculate a UX metric that indicated the experience based on the number of all positive minus all negative valence markers collected, divided by the sum of all valence markers [40]. The result is an indicator of the overall user experience caused by the system: −1 (negative experience) and +1 (positive experience).

3.4.5. Results of the Valence Method

Descriptive statistics: 188 markers were set (159 positives and 29 negatives); see Table 3. The overall UX metric mean is +0.7, which indicates that the developed system “experience portal” evoked a positive UX. On average, participants set about 17 valence markers (14 positives and three negatives). The UX metrics per participant showed that 10 of the 11 participants experienced the system positively (=0.5–1.0) and only one was neutral (=0.2).

Table 3. Quantitative data of the Valence Method: all developed design elements and aspects as well as their UX metrics. The results indicate that the system evoked a positive UX overall.

					
Video Prototype (Design Element, Aspect)	Number of Participants	Total Markers	Positive Markers	Negative Markers	UX-Metric
Experience Explorer	11	65	59	6	+0.8
(Notification, Function)	7	9	6	3	+0.3
(Experience Explorer, Function)	5	6	6	0	+1.0
(Experience possibilities, Content & Presentation)	11	24	24	0	+1.0
(Detail page, Content)	6	9	8	1	+0.8
(Bookmark Dialog, Function)	7	8	8	0	+1.0
Publish experience possibility	11	35	24	11	+0.4
(Notification, Function)	6	7	1	6	−0.7
(Publish, Function)	6	6	6	0	+1.0
(Publish, Interaction)	10	18	16	2	+0.8
(Adjust Time & Rhythm, Interaction)	7	8	5	3	+0.3
Travel Book	11	20	18	2	+0.8
(Travel Book, Content)	10	15	14	1	+0.9
Travel Map	11	58	49	9	+0.7
(Card Places, Content)	7	8	7	1	+0.8
(Dialog about an explored station, Design)	8	8	8	0	+1.0
(Travel Book Main Station, Design)	5	6	6	0	+1.0
(Reminder Board, Design)	5	5	5	0	+1.0
(Travel Information, Interaction)	7	9	9	0	+1.0
Your contribution to the environment	10	10	9	1	+0.8
(Card, Content)	10	10	9	1	+0.8
Total		188	159	29	+0.7

Qualitative analysis: We obtained rich qualitative data from the retrospective interviews for 16 design elements and aspects. For example, the results show that the participants set six positive valence markers for the design element “experience explorer” and the aspect “function,” see Figure 5a. The function made it possible to explore nearby experience possibilities. As expected for PH, the participants described being able to explore the city as positive, and they explained that it raised their interest and curiosity: “You are fed with information, you become curious that you can explore something” (P02); “When you’re on the train, you don’t really notice the beautiful places in the city. I think it’s pretty cool. Arouses curiosity, you may have the feeling that you have experienced something new that you would otherwise have missed” (P07).

Participants set 24 positive valence markers for the design element “experience possibilities” and the aspect of “content and presentation” (part of the functionality “experience explorer,” see Figure 5a). So, this refers to the content and presentation of an experience possibility. As expected for PH, the participants described exploring the content of experience possibilities as positive because scrolling through these fulfilled the need for stimulation (getting to know new things, being up to date), which addressed their diverse needs (e.g., physical thriving, relaxation, food): “You live in the city, but you know little about it. This is a way of getting to know the city better” (P03); “I like that I am getting an overview of the experience possibilities near the station and even complete basic and free activities like ‘workout with 407 steps’; that is sweet” (P02); “If you don’t visit the city center regularly, you will miss the constant changes. Stores are opening and closing quite quickly. The content informs me that a new store has opened, which is informative” (P11). It was also reported that the experience possibilities enhance the user’s mood because they are leisure time activities: “I like the experience possibility of watching swans and relaxing. You are generally stressed out in Stuttgart because you are often stuck in traffic jams or waiting for the train. The words of the experience possibility have a positive meaning; they make you feel better.” (P11) The experience possibilities also evoked positive memories (PP) and emotions such as gratitude and satisfaction: “I live there. [...] Sometimes I relax there. So I am directly inspired, interested, satisfied, and grateful that I live there and I am proud of my neighborhood. I think it’s nice there, [...] it’s idyllic” (P08). Another participant reported his experience when looking at a historic experience possibility (an artificial hill built from the ruins and rubble from World War II):

“I’ve been there before, and it reminded me how I walked the path, climbed the ruins, but also how I felt. I felt free, but I was also affected because I had been imagining what the people have lived through (in the World War). It evoked the complete sensorial and emotional experience. However, it was a positive experience to recall that.” (P04) Overall, the content evoked a pleasant anticipation (Future): “Now, I feel amused and a bit happier because I have plans for the weekend. Moreover, when I bookmark an experience possibility and set a date, I feel a pleasant anticipation” (P09).

Participants set eight positive valence markers for the bookmark functionalities, e.g., appointing a date or showing the route, see Figure 5b. As intended, it evoked the F regarding goal-setting and the psychological need for safety:

- “In the daily grind, you can forget about an experience possibility. It is nice to have a reminder: Hey, you wanted to go there. It is also a way to remind someone who is in a daily routine: Hey go out there” (P05).
- “For example, now I am too busy, but I can schedule it for the next two to three weeks—otherwise I’ll forget about it, but if I have the calendar and it reminds me . . . I think that’s a great thing. [. . .] This is my assistant who works for me” (P03).
- “I was really pleased because I love planning. I had to think about how I always note everything when I get a good tip. I thought it was great that I was able to make a fixed appointment [. . .]. It made me happy. I like to be in control, and I never want to lose control of my week. I’m also always afraid that I’ll forget something” (P06).

Participants set 14 positive and one negative valence marker for the content of the travel book, see Figure 6a. As intended, the quote and statistics evoked PP emotions, such as pride and satisfaction, and F emotions, such as inspiration:

- “It was a good quote that gave me reassurance that I should experience more. I feel happy when I read it. [. . .] Yes, today you don’t go to work, but take a trip. That there is more in life than work and university” (P09).
- “The quote—I find that it intensifies the feeling of pride that I have achieved something, that it was worth it to invest something and that it is rewarded with the quote. Maybe reward is too strong, but in the direction—confirmation? Yeah, right. Confirmation for your own actions? Exactly” (P07).

The participants set three positive and three negative valence markers for the design element “travel map” and the aspect “design”, the visualization of explored locations vs. not explored locations, Figure 6b. As expected, the design element and the aspect, evoked F: “I take the same route. There are certainly places that I have never seen, even though I was born here. I think that motivates me because you realize that the city is not only made up of Königsstrasse (a famous road), but that there are other corners too” (TN11). The travel map was experienced as negative due to usability aspects such as the overwhelming size and amount of stations. (Notably, this map is the same map as that used on the public transport.)

In summary, design elements that violated interaction principles [58] or frustrated needs sparked negative feedback. For example, diverse “notifications” (see Table 3) evoked negative experience because the users felt frustrated that the notifications appeared without their consent, e.g., “Why is that popping up now? Did I set that up?” (P04).

3.4.6. Data Analysis of Temporal Questionnaire/Temporal Harmony

We defined that a score between 3 = “average” and 5 = “completely” showed that the participant experienced the TP. Results regarding temporal harmony were determined by calculating the median of the five ratings for each TP. We defined that a balanced score for each TP between 3 and 5 indicates temporal harmony.

3.4.7. Results Regarding Temporal Harmony

Based on the ratings of one participant (i.e., all ratings of all questionnaires), we determined the median for each TP to investigate whether the participants experienced temporal harmony. The results (Table 4) show that nine of the 11 participants had medians for their intensity scores ranging from ‘moderately’ to ‘very’ for the TPs. Five of the 11 participants had balanced intensity scores, namely ‘very’. Therefore, we consider that the design intention of temporal harmony was achieved.

Table 4. Quantitative data of the temporal questions: the median per TP and per participant. The results indicate that the system evoked temporal experience and harmony.

Participants	Intensity Not at All = 1 to very = 5;										
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11
Past-Positive	4	2	1	4	4	4	4	4	3	4	3
Present-Hedonistic	4	3	5	4	3	4	4	3	3	4	3
Future	4	3	5	4	4	4	4	4	5	4	5

3.4.8. Final Feedback from the Participants

At the end of the study, the participants were asked: “What is your impression of the presented system?” All the participants gave strongly positive feedback, claimed that the system was meaningful for them and evoked positive emotions:

- “The experience possibilities provide a new perspective on stations—it’s not just a station, it’s a possibility to spend my leisure time. It’s making you curious because you can explore something” (P02).
- “Very good functionalities to become conscious in life. The quotes, in particular, make you more conscious” (TN05).
- “I can identify with Elena (persona) because I haven’t been living that long in Stuttgart. I like that I can explore experience possibilities while I normally have nothing to do on the train. Normally, I would play Candy Crush on my smartphone, but I think the app offers me a more meaningful activity. That’s nice” (P08).

The participants also found the app motivational because of the anticipated new experience possibilities (F), but also through the retrospection and the feeling of achievement (PP): “I like that it encourages you to use the app again and again because new experience possibilities could be added, and you also get a sort of reward through the travel book: Yes, I explored 10 of 200 stations” (P09).

We also received some negative feedback because some participants were concerned about being tracked by the app or other persons using the app; thus, the need for privacy frustrated five of the participants. Some visualizations and usability issues also resulted in negative feedback from five participants.

4. Summary and Contributions

We introduced “Designing for Temporal Harmony” that incorporates Time Perspective Theory [1,2] into the experience design practice. It consists of a design framework, approach, and adapted methods that guide designers to explore temporal experience design possibilities that promote a positive UX and contribute to users’ well-being. Furthermore, we applied “Designing for Temporal Harmony” in a public transport project to investigate if the approach and methods work. The results demonstrate that it works overall, and we achieved good results according to participant feedback and analysis results. Therefore, we would like to encourage others to try it out. The following contributions were made and we discuss some limitations:

For the “empathize phase”, we adapted two proven methods. We adapted the classic experience interview [59] and derived a set of three initial questions to develop empathy toward the users and their experienced TPs in the project context. The applied temporal experience interview study uncovered 13 temporal experience categories for public transport, which contribute to the understanding of the temporal dimension of UX since they reveal not only positive experiences but also positively experienced mental constructions. In summary, we obtained reports for positive memories (PP), joyful experiences (PH), anticipations, and plans (F), including associated emotions, regarding the project context. We think that the results that can be gained by this method are valuable and inspiring for designers because these broaden the perspective from experience to temporal experience. It helps to get a better understanding of what users experience positively in general as repetitive action in the present, but also what kind of experiences from the past they enjoy remembering and what anticipations and plans towards the future spark joy. In the future, this research method should be investigated according to measurement theory criteria.

Furthermore, we adapted the method persona [47], a typical tool used to represent a user group. The TP persona illustrates the assumed TP personality and helps to get an understanding of related typical behavior, thoughts, and feelings. Furthermore, an overuse of a TP and the resulting negative effects on well-being can be illustrated by a representative scenario. Representative stories for all of the TPs, the ingredients of temporal harmony, can be used to illustrate potentials for the positive temporal experience. This helps to spark meaningful ideas that help users to achieve temporal harmony and well-being. The TP persona worked well for us to systemically develop relevant ideas.

Then, we presented an approach for the “ideate and design phase”. It uses the previously gained temporal experience categories as well as the TP persona, and our derived design principles [39]. Designers can use the three “sources” to develop and identify meaningful concept ideas. This approach worked well for us and we want to encourage others to try it.

For the “evaluation phase”, we adopted the valence method [40]. This method is used to investigate positive and negative experiences evoked by a system. We concluded that it is too broad to investigate temporal experience. Therefore, we supplemented it with a developed set of temporal questions and an in-depth interview to evaluate whether the design intentions and temporal harmony are achieved. We see the following potential for further research: First, we only used one prompting question per TP. For PP and F, we addressed positive affectively toned thinking. For PH, we addressed the enjoyment of the present. This worked fine for us to draw conclusions, especially because we used them as prompting questions to start an in-depth interview. We see them as a starting point, but a questionnaire should be developed and tested according to measurement theory criteria. Second, for long-term studies, the question arises on how to investigate effects on well-being.

Overall, the case study demonstrated that it is possible to systematically develop a system that addresses the temporal dimension. The resulting interactive system evoked positive anticipations and goal setting (F), experiences (PH) as well as retrospections (PP), which reference ingredients of temporal harmony. Furthermore, the study shows that the system evoked a positive UX. Based on the research of TPT, resp. temporal harmony, the data analysis, and user feedback, we conclude that the resulting system contributes to users’ short-term positive experience as well as long-term well-being. We hope to lay the ground for further research and recommend UX designers to try it out. That way, we would gather more examples to explore and understand the full potential of an experience design approach that incorporates the TPT.

5. General Limitations and Future Work

This work had only so far undergone a preliminary empirical evaluation. We see several research fields, for example, the further investigation of long-term effects on temporal experience and the well-being of interactive systems that address temporal harmony. Although the evaluation of UX concepts using video prototypes has proven to be a suitable method [50], the next step would be to develop an interactive system and conduct long-term studies to evaluate whether the system generates

a positive experience, supports users to achieve temporal harmony, and contributes to subjective well-being in the long term. Moreover, the design approach should be applied to other projects and contexts. The company “points Internet Agentur (GmbH)” (www.points.de) is currently applying “designing for temporal harmony”. The goal is to develop an interactive app that promotes museum visits (F), the exploration of museums (PH), and the recall of those visits (PP). The app is expected to be released soon and could be a starting point for further research.

Another point is the investigation of temporal experience differences in user groups. Evaluations involving more participants of heterogeneous user groups, e.g., children, adults, seniors, would be worth pursuing to investigate possible differences in experience and to investigate how participants with different TP profiles react to a system that addresses a BTP. Furthermore, based on the newest research, a BTP offers an opportunity to positively influence the attitude toward technology among older adults: Zambianchi, Rönnlund, and Carelli [36] showed that BTP of older adults correlates with a positive attitude toward technology. This insight could be worth investigating further in the aging demographic.

Moreover, we need more feedback from UX Designers: We started investigating how other designers experience “Designing for Temporal Harmony”. We want to draw conclusions about several questions, such as: Does TPT and “Designing for Temporal Harmony” broaden their perspective on temporal experience? Do they find it useful and inspirational? Is the approach manageable and fun to work with? Do they want to use it in the future? Furthermore, we want to investigate if it empowers them as well to design for temporal harmony and evaluate the developed results. One first positive feedback from a UX Professional working in the field of public transport was (translated):

What represents a genuine value here, and what I miss in other methods, is the Time Perspective Theory. We think often about individual screens, e.g., we finalize two screens and think that the work is done. This timeline (a visualization of the time horizons and TPs) gets me to think more about the interaction sequences, the process, so where I have to offer the user what and why. So I’m not thinking in individual screens anymore that have to be connected somehow, but now I know why and how and in what order the interaction should be. (P1)

6. Discussion and Final Reflection

Experience design research tends to define experiences as chunks that have a start and an end [60]. However, such an approach does not address the long-term temporal dimension and dynamics of experience. Moreover, the question arises if it is the right approach to design for long-term well-being. We see the knowledge of TPT as a meta-perspective for understanding experience, experience patterns, and well-being, as it illustrates the unconscious influence of TPs on thoughts, feelings, and actions. As different UX researchers stated [8,15], the better we understand people and experience, the better we can design for positive user experience. We think this design approach can contribute to this mindset. TPT highlights that people live in the moment, but they can reconstruct the past and anticipate the future using cognitive processes that, in turn, can evoke positive emotions at the moment. This means that remembering, anticipating, or planning an experience mediated by technology can also become an experience and arouse positive emotions. From a semantic viewpoint, the experience mediated by technology can address not only the time frame of the present that is taking place at the moment but also that of the past and future. The evaluation of the video prototypes showed that, for example, looking at semantic content addressing past and anticipated experiences evoked a joyful and meaningful experience. Therefore, using the framework and approach expands the design space of the UX—from designing a single or repeated use interaction to designing for the whole temporal dimension of life.

Another strength of TPT is that it describes and shows patterns of cognition, affect, and behavior that are valuable for developing meaningful interactive systems that contribute to users’ well-being. It supports designers in not only creating concepts that evoke short-term positive experiences, but it also highlights where users could need support in the long-term to really benefit from the interactive system. For example, when evaluating the video prototypes, some participants confirmed our assumption

(illustrated by the TP persona, see Figure A1) that they are in the daily grind, they work hard, and they take little time for themselves, which refers to the negative effects of the TP F. The participants argued that the UX concept of the experience portal, particularly the function to schedule experience possibilities, would help them to plan some free time, to look forward to their free time, to actually take it, which refers to PH and that looking back at the leisure activities they experienced would make them proud which refers to PP. Therefore, the developed interactive system helped the users to reflect on their mostly unconscious habits and evoked the desire to change. “Designing for Temporal Harmony” seems to tackle the phenomenon described by Desmet ([61] p. 17): “For some reason, the positive emotions we experience in relation to our products are fleeting rather than sustainable. [. . .] The paradox is puzzling: we surround ourselves with products that make us feel good, but the very same products do not make us happy.” Furthermore, he argues that conscious active behavior is essential for happiness: “If you want to increase your happiness, don’t buy new products . . . change your behavior” (ibid., p. 18). Positive psychology presents activities that contribute to happiness [62]. However, people have to make a conscious decision to pursue these activities. TPT offers a well-founded explanation as to why such activities are not pursued, namely the habitual attitude toward time, which unconsciously determines behavior patterns and influences decisions in life. The statements made by the participants of this study show that users can be supported in aligning their behavior to their well-being in the long term and without manipulating them. The developed experience portal does not force users to do something, i.e., the option of scheduling experience goals is voluntary. The participants thus recognized the value of the functionality and chose it to have a positive impact on their lives. Based on the statements of the participants, the assumption can also be made that such support is important to change the unbalanced TPs. We see interactive systems as one way to provide this support.

Overall, we see “Designing for Temporal Harmony” as a source to spark innovation, since this new positive psychological perspective reveals new design possibilities that address the temporal dimension of UX. Some traditional problem-driven designers may argue, that this design approach and the resulting interactive system are idealistically motivated and that it is not realistic to apply a design approach like this in economic projects. We want to argue that these do not only contribute to users and their well-being, but also to companies, because people, especially in an affluent society, always want to go the extra mile to further increase their happiness, well-being, and life satisfaction. As Desmet [17] stated, for example, products that evoke positive emotions are bought and used more often. Moreover, well-being contributes to health, longevity, work performance, and relationships [63]. So, applying a design approach that strives for positive experiences and long-term well-being can be an advantage in a competitive market, have economic effects, and be beneficial for our society.

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Appendix A



Figure A1. TP persona.

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