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Beyond productivity and efficiency: design tools, methods and frameworks for psychological well-being, and (un)exploited potentials to assist employees at work

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Research has repeatedly demonstrated that fostering employees' psychological well-being is linked to several positive outcomes, both for the employee and the organization, and yet, it has rarely been considered as a design goal, especially when it comes to developing digital solutions to assist employees in their everyday tasks. In this paper, we take the first steps toward using well-being concepts to (re)design assistants. We motivate the problem by providing an overview of assistance technologies in the industrial context and their current state of development. Next, we elucidate and map the facets of psychological well-being at work, and highlight the importance of workplace eudaimonic well-being. To help designers and researchers adopt it as a design objective, we carried out a literature review to synthesize the state-of-the-art frameworks and methods that have been proposed to incorporate psychological well-being into design. Our investigation reveals that no one framework targets eudaimonic well-being, and more work may be necessary to develop a comprehensive approach that targets the various facets of workplace eudaimonic well-being. Consequently, we discuss challenges and opportunities for developing digital assistance that could foster employees' psychological well-being.

KEYWORDS

assistants, assistance systems, psychological well-being, eudaimonia, design frameworks, design methods, design tools, literature review

1. Introduction

The world of work is expected to undergo a major transformation in the future. On the one hand, work environments are being increasingly technologized, spurred by technical developments such as artificial intelligence, increasing computational power, efficient algorithms, new sensors, and ubiquitous connectivity. On the other hand, in several countries, sociodemographic challenges are mounting.

For one, an aging workforce will have to be motivated and retained, and also possibly tasked with non-routine, higher-productivity tasks that require a high degree of flexibility, creativity, and problem-solving skills (Holford, 2019; Smit et al., 2020). For instance, in

the next ten years, a quarter of the Japanese workforce will be over 60 (Van Katwyk, 2012), and, confronted with an aging workforce, Germany also faces a shortage of skilled labor in the foreseeable future (Thun et al., 2007). Two, triggered by sociodemographic changes, the preferences of prospective jobseekers are also changing. When it comes to the field of work, several sectors may no longer be attractive (Cedefop, 2015), and to compensate for a decline in apprenticeships in these sectors, industries will have to substitute a skilled, retiring workforce with young, unskilled workers. There is also evidence that the psychological expectations of younger generation of workers (e.g. millennials or gen. Z) from the employers differ from those of other generations (Schroth, 2019), for instance, they are more likely to prioritize having an interesting job than older workers (Drabe et al., 2015), or place a higher importance on the societal and organizational impact of their work (Gabrielova and Buchko, 2021). Further, it seems that the notion of work itself is undergoing a major transformation, evidenced by "the Great Resignation or Reshuffle" (Sull et al., 2022). The effects of the COVID-19 pandemic have triggered many employees to reassess whether their work fulfills their needs, which has led to a renewed academic interest in employee *mental* or *psychological well-being* (hereafter referred to as PWB), and has pressured employers to prioritize the same. Taken together, employers face an uphill struggle on several fronts. If technology is to play a role here, future efforts will have to aim at creating a man-machine symbiosis that best serves the needs of the employees and helps fulfill the updated psychological contract. This entails developing interactive solutions that meet these requirements:

R1: improve employability of older workers: help them keep up with technological change, compensate for their loss in physical/cognitive abilities, and/or

R2: facilitate intergenerational knowledge transfer: so that younger, low-skilled workers can upgrade their skills and knowledge, both from formal and informal sources, and,

R3: foster workers' mental well-being.

In recent years, one of the ways in which requirements R1 and R2 have been tackled technologically is by developing *assistance systems*, *digital assistants*, or *digital assistance applications* that combine conventional interaction techniques with augmented and mixed reality (AR/MR) technologies to guide and train workers at various levels of expertise. However, research shows that it is R3, or worker PWB, which moderates productivity (Isham et al., 2021) and engagement (Aiello and Tesi, 2017) and may drive the success of R1 and R2. At its core, PWB is understood as both "feeling good (hedonic) and functioning well (eudaimonic)" (Ryan and Deci, 2001), and workplace PWB is conceptualized as both enjoyment of the job and how it contributes to building a coherent sense of the self (e.g. in terms of growth, meaning, purpose, etc.) (Rothausen et al., 2012). Scholars also note that mental well-being is to be distinguished from a mere absence of negative symptoms (such as stress, anxiety and depression), or ill-being (Chen, 2014), and ignoring it can have significant economic consequences (Pinheiro et al., 2017).

People spend a significant proportion of their lives at their workplace, and it is not surprising that workplace well-being has also garnered significant research attention in the last decades. While both physical and mental well-being are connected and important (Kropman et al., 2022), the approaches that are necessary to foster employee physical well-being may be different from those that support PWB. The former has been studied under various rubrics, more traditionally under physical ergonomics, and more recently, as reviews indicate, in conjunction with digital applications incorporating persuasive techniques to encourage users to maintain physical fitness and physical health at work (Orji and Moffatt, 2018; Huang et al., 2019; Damen et al., 2020). However, PWB has largely been neglected as a potential outcome of technological assistance in workplace contexts. We argue that the reason for these developments is simply that industrial technology, and, in particular, assistance applications are primarily seen as a method to solve issues of productivity and efficiency in industrial tasks by re-representing (and, in turn, redesigning) them with the help of interactive technology to reduce cognitive load. While this may be an important prerequisite, the current approach falls short in that it may not facilitate PWB and motivation to tackle these problems (Klippert et al., 2018).

For this reason, in this article is we focus specifically on the foundations and components of PWB. As recent movements such as positive computing (Calvo and Peters, 2014) illustrate, researchers already recognize the importance of incorporating PWB in design, and over the years, there have been several efforts rooted in diverse theoretical backgrounds to create tools, methods and frameworks intended to help designers to comprehend and integrate the various manifestations and facets of PWB into the design of interactive tools and products. However, when it comes to designing workplace assistance, we find ourselves in the initial stages of mapping the problem domain and identifying solutions that could be used to support workers' PWB in the future.

The aim of this article is to advance the state of design of technological assistance at work by (1) summarizing and assembling the various facets of PWB at work and how they can be seen as potential design outcomes of human-technology interaction, and (2) reviewing and organizing existing design frameworks, methods and tools for PWB according to its various facets to provide a repertoire of strategies and guiding questions for prospective designers. To this end, we first provide an overview of assistance in industrial environments and their technological capabilities. Second, we extract the core mechanisms behind workplace PWB from extant literature in the form of a morphology and determine the research gap with respect to existing efforts to support worker PWB in industrial contexts. Third, we conduct a literature review where we identify 21 articles that propose possible design strategies, methods, tools and frameworks and explicate their varied origins. We categorize these different candidates using the morphology and integrate them by assigning their role as a possible design approach to explore and support the relationship between the core categories of PWB (orientation, behavior and experiences) and the core actors involved (self and others). Finally, we propose some guiding questions that could be used to initiate design efforts in creating technological assistance for work and discuss additional avenues for exploration.

2. Related work

2.1. Assistance in industrial work

According to the dictionary definition, the word *assistance* comes from the Latin word *assistere* which means to stand by or take a stand near, and can mean both the act of assisting someone and that which is supplied during this act. Assistance is driven by a *need*, consists of *aid* that is provided by a *provider* to the *recipient*, with the aim of achieving a *goal*, and can be viewed as assistance generally when it brings about a positive change. Digital assistance is modeled after the work of human assistants, who are subordinate to their principals or experts and work closely with them, with a capacity for situational awareness and readiness that is necessary to preempt and support the needs of the principal. This is achieved via communication (i.e., delegation), observation (self-initiative) and action (executing tasks) in a joint work environment with formalized processes and conventions. In working together, assistants and principals use tools and resources that are jointly accessible and contribute to a shared understanding of a situation (Dhiman et al., 2022).

Following this model, in the computing domain an assistant typically consists of an application or an agent which provides interactive support to the user in a given activity context, either based on user delegation or agent initiative. The support can be cognitive or physical in nature, the former is the classic case for Human-Computer Interaction (HCI) [e.g., conversational agents or productivity assistants (Tur et al., 2010)], whereas the latter comprises cases of human-robot interaction (Guerin et al., 2015). The application is accessible to the user via an interface, observes the user and the state of the activity (in terms of the tools and the state of the object of the activity), and supports the user by (a) acting on the tool or the object, and/or (b) by furnishing information in particular modalities at the interface (via speech or visual modality), on the tool (haptic feedback or augmented tools), on the object (in case of augmented reality), or anchored to the work environment (in case of mixed reality). Prototypical use cases include supporting workers in manufacturing and assembly (Mark et al., 2021), logistics (Schwerdtfeger and Klinker, 2008) and maintenance (Dhiman and Rocker, 2019). Figure 1 showcases some of these use cases. As such, the design space of assistance is large, and applications are increasingly incorporating machine intelligence to enhance their abilities to observe the work environment, make decisions and communicate with the user, rooted in fields of research such as context recognition, image processing, natural language interaction, mixed initiative, planning and support (Dhiman et al., 2022). While the word "assistance system" is widely used to describe such applications that assist workers in the industrial domain, in this article we use the terms "assistant" or "assistance application" synonymously to aim for parity with the terms 'virtual assistant' or 'intelligent assistant' that are becoming increasingly ubiquitous.

But what constitutes *good assistance*? The question has conventionally been answered by focusing on three main aspects: the user's attitude (and acceptance), usability and efficiency, and characteristics of the assistant (such as its anthropomorphic nature, its look and feel, personalization, predictability, maintainability, sociability etc.) (Dhiman et al., 2022). Following this line of research, in the industrial domain, the primary goal of assistant development has been the enhancement of employee productivity and efficiency. Hence, measures such as completion time, error rate, and instruction recall are most commonly evaluated, compared against different mediums of instruction (e.g. paper-based instruction) or interaction (e.g. with gamification vs. without) (Mark et al., 2021).

However, in recent years, the research focus of HCI has shifted from usability to user experience, and even further onto user PWB, as advanced by recent movements in human computer interaction such as *positive technology* (Riva et al., 2012) and *positive computing* (Calvo and Peters, 2014). According to these movements, although concepts such as usability remain important, a sole focus on productivity and efficiency may be too narrow to comprehend how user experience influences users' PWB. In the industrial context, studies from the field show that, although assistance applications exhibit potential in increasing productivity, especially by reducing error rates, their "human-centricity" is questionable, especially as these systems in their current form have brought about no change in the assignment, organization, diversity or creativity of work, or engendered any opportunities for employee growth and exchange of knowledge (Klippert et al., 2018). Similarly, the authors in Aringer-Walch et al. (2018) report on an "immanent loss of competence and autonomy", and Warnhoff and De Paiva Lareiro (2019) provide an account of how interacting with such systems can result in a devaluation of experiential and process knowledge by prompting operators to follow concrete work instructions. Further, Apt et al. (2018) warns that assistants which control the execution of tasks create work situations in which they transform human workers into function executing agents, and the resulting cognitive under use negatively impacts motivation, mental health, and long-term workability. Technological advancement has brought about positive changes, but at the same time, put employees in a precarious situation by increasing job demands and regressing workplace motivation and well-being (Parker and Grote, 2022). Hence, it is crucial to comprehend the driving factors behind employee PWB and incorporate them into design.

2.2. Conceptualizations of psychological well-being

The achievement and maintenance of human PWB can be considered to be one of the central themes of human existence. It was a topic of extensive philosophical inquiry and debate in ancient times, and the discussion around what constitutes PWB, and how to achieve it, still continues to attract scientific interest and scrutiny.

According to Ryan and Deci (2001), our understanding of PWB can be traced back to two philosophical strands–the hedonic view, and the eudaimonic view. The word *hedonia* is related to the hedonist view of human happiness propagated by ancient Greek philosophers such as Aristippus, who argued that happiness be seen in terms of a maximization of pleasure. In well-being psychology, the hedonic side of PWB is captured by the concept of subjective well-being (SWB) (Diener et al., 1999) which measures three components - life satisfaction, the presence of positive mood, and the absence of negative mood.

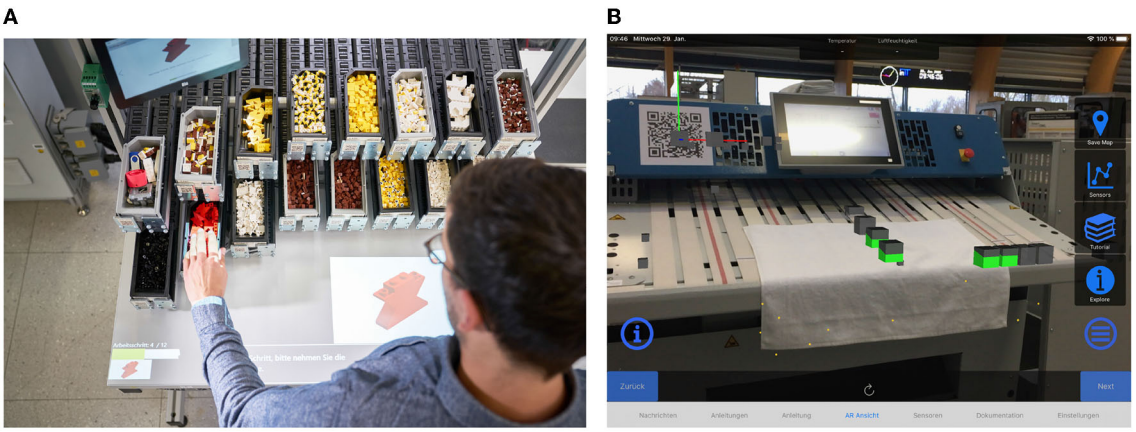

FIGURE 1
Two examples of assistance applications from the shop floor. **(A)** An augmented reality (AR) assistant for guiding through manual assembly. **(B)** A mixed reality assistant for machine maintenance.

Dimensions	Characteristics			
Definition categories	Orientation	Behavior	Experiences	Functioning
Core elements	Excellence	Growth	Meaning	Authenticity
Scope of orientation	Self & others	Beyond present	Beyond tangible	

FIGURE 2
Morphology of concepts related to eudaimonic well-being, as proposed by Huta and Waterman (2014) and Pearce et al. (2021).

In contrast, the eudaimonic view of PWB is often attributed to Aristotelian ethics (Aristoteles, 1962), where *eudaimonia* is used to characterize a life lived in accordance with the "highest human good", that is, a life that is purposeful and conforms to high moral standards. Well-being psychology borrows this term and uses it in a divergent manner (Fowers, 2016). In it, eudaimonia refers to a meaningful life characterized by personal growth, autonomy and a sense of vitality and thriving (Ryan et al., 2008; Ryan and Martela, 2016). According to Huta and Waterman (2014), eudaimonic well-being (EWB) converges around four key processes: *excellence* (striving for high standards and quality), *growth* (gaining knowledge, insight, and skill), *meaning* (experiencing significance and value), and *authenticity* (clarifying one's values).

Research shows that hedonic and eudaimonic well-being are somewhat related, but are still distinct components of PWB. Whereas the former refers to the affective experience, the other refers to cognitive evaluations of one's activities associated with what is worth doing (Waterman et al., 2008). Hence, not all pleasure inducing activities generate a sense of attaining valued objectives in life. For instance, when pleasure is pursued directly by engaging in activities that are instantly gratifying (e.g., consuming delicious food, watching a movie or going to the spa), the resulting change in positive affect only lasts for a short term, whereas pursuing activities that are aimed at achieving eudaimonic goals (e.g., helping someone, putting in extra effort in tasks, having meaningful discussions, taking time to introspect about one's values, organizing and cleaning one's surroundings) result in long term changes in positive affect (Huta and Ryan, 2010). Accordingly, several well-being researchers have argued for the superiority of the eudaimonic view. According to them, it is only when one is self-determined to pursue the ideals of meaning, growth, and excellence, that one achieves long-lasting PWB (Huta and Waterman, 2014).

Consequently, eudaimonia has been studied in psychology as different stages of human behavior, namely, orientations (priorities, motives or goals that are behind human activity), behaviors (specific activities that are pursued to fulfill these motives), experiences (state-level subjective feelings, emotions, appraisals that are indicative of how well an activity supports eudaimonia), and functioning (long-term trait abilities, achievements, habits, etc. that contribute to a general sense of PWB) (Huta and Waterman, 2014). Further, eudaimonic and hedonic orientations can also be differentiated on the basis of their focus of concern: *me vs. we*—eudaimonic goals reflect changes one wants to bring about in the self as well as beyond (self), whereas hedonic orientations are primarily focused on the self; *now vs. future*—eudaimonic orientations are about the future, whereas hedonic orientations relate to the present time perspective; *tangible vs. broad implications*—eudaimonic orientation focuses on how the concrete and tangible relates to the big picture, whereas hedonic

orientation is only about the concrete and tangible (Pearce et al., 2021). Altogether, these dimensions of eudamonic well-being can be grouped morphologically (Figure 2).

How are the components of and stages in Figure 2 linked? According to Ryan and Martela (2016), the process of EWB be explained via SDT: when one pursues intrinsic individual and social goals rather than extrinsic goals (orientation), regulates one's behavior autonomously (activity or behavior) and leads a reflective life (evaluating one's experiences and how they relate to the other two antecedent components), one can be expected to satisfy the needs for competence, autonomy and relatedness, which results in positive experiences at the state level, and over time, stable states of "vitality and thriving" at the trait level (functioning). This process is captured by the "Eudaimonic Activity Model" (EAM) proposed by Martela and Sheldon (2019). The EAM emphasizes that eudaimonia is both "doing-well" and "feeling-well" (Figure 3).

2.3. Role of workplace psychological well-being

The two conceptualizations of hedonic and eudaimonic well-being can also be found in studies of employee PWB, where the concept of job satisfaction has been termed a hedonic measure since it captures employees' pleasure or enjoyment derived from having or doing a job, i.e. subjective reports of positive affect (related to hedonia, i.e., feeling good, happy, and satisfied) (Rothausen et al., 2012; der Kinderen and Khapova, 2021). The eudaimonic perspective, on the other hand, examines the presence of factors that support outcomes related to one's skill development, growth, sense of contribution, personal relationships and the construction of life in a general sense (Rothausen et al., 2012; Budd and Spencer, 2015).

A number of such factors have been identified and are supported by extensive research. For example, the job characteristics model originally proposed five characteristics of satisfying work: autonomy, skill variety, task identity, task significance and task feedback (Hackman and Oldham, 1976). This was extended by Humphrey et al. (2007) further to also include social (e.g., social support, feedback from others) and work context characteristics. Research in the past few decades that highlights the role of the fulfillment of the psychological needs of competence, autonomy and relatedness, as proposed by self-determination theory (SDT) in supporting employee PWB (Broeck et al., 2010). More recently, der Kinderen and Khapova (2021) carried out a systematic literature review and identified the following drivers of EWB at the workplace: task/job significance, skill enhancement, learning new things, crafting feedback, opportunities to give/receive social support, utilization of strengths and skills, perceived control and autonomy and psychological safety. From an outcome perspective, they noted that fostering eudaimonia in work contexts positively affects several job and career-related outcomes, amongst them work-engagement and personal initiative (Hahn et al., 2012; Aiello and Tesi, 2017), willingness to invest time and energies beyond formal tasks (Turban and Yan, 2016; Sattar et al., 2017), contributing to organizational efficiency and performance (Turban and Yan, 2016), job satisfaction (Jones et al., 2015), and reduction of work stress and anxiety (Merrick et al., 2017).

2.4. Workplace psychological well-being and HCI

Technological efforts to enhance employee well-being at the workplace mostly view the term "well-being" in terms of physical well-being, with efforts directed at developing digital applications to persuade users to maintain physical fitness and physical health in sedentary or industrial work environments (Orji and Moffatt, 2018; Huang et al., 2019; Damen et al., 2020; Heikkilä et al., 2021). The problem of supporting workplace PWB via technology, however, remains largely unexplored. Although the hedonic and eudaimonic conceptualizations of PWB at work have been studied extensively in the domains of organizational psychology, they are only beginning to be explored by the HCI community. Recent studies have shown that, contrary to the hedonic aspect, technology-induced eudaimonic experiences are associated with long-term importance, need-fulfillment, positive affect, and meaningfulness (Mekler and Hornbæk, 2016; Laschke et al., 2020). Research shows that eudaimonia can be fostered by modifying non-technical aspects of work through interventions that consist of eudaimonic components, e.g., strengths based interventions (Oades et al., 2017) or job-crafting (Wrzesniewski and Dutton, 2001; Demerouti, 2014). As the ongoing discussion in well-being psychology further clarifies the notion of eudaimonia and its distinction from hedonia, it also opens up room for ideation on how to operationalize HCI techniques to practically apply the lessons of EWB in assistance applications at work. To this end, we carried out a literature review to synthesize design streams, strategies, methods and frameworks, with the aim of identifying techniques that could aid designers in the future.

3. Designing for eudaimonia: where we are now

We undertook a systematic literature review that analyzes and synthesizes all available research relevant to a research focus. While prior reviews dealt with design for total well-being (Kafaee et al., 2021) and physical well-being (health and wellness) (Orji and Moffatt, 2018), our review collects and organizes the frameworks, methods, and tools that have been developed for improving EWB. Because of its qualitative nature, this review employed qualitative analysis and synthesis of extant studies unlike meta-analysis. Informed by several recognized guidelines (Tranfield et al., 2003; Moher et al., 2009; Page et al., 2021), we followed three generic steps: (1) identification of candidate articles; (2) screening the candidate articles for relevance and eligibility; (3) qualitatively analyzing and synthesizing the final sample of eligible articles. Figure 4 illustrates a flow diagram (Page et al., 2021) for our review. The following sections describe the details of each step.

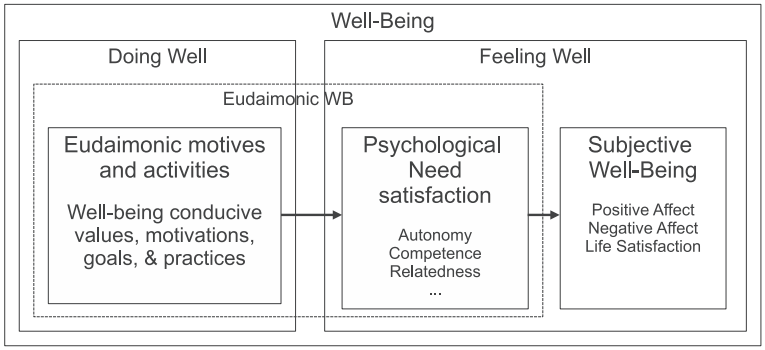

FIGURE 3
Eudaimonic Activity Model (EAM) proposed by Martela and Sheldon (2019).

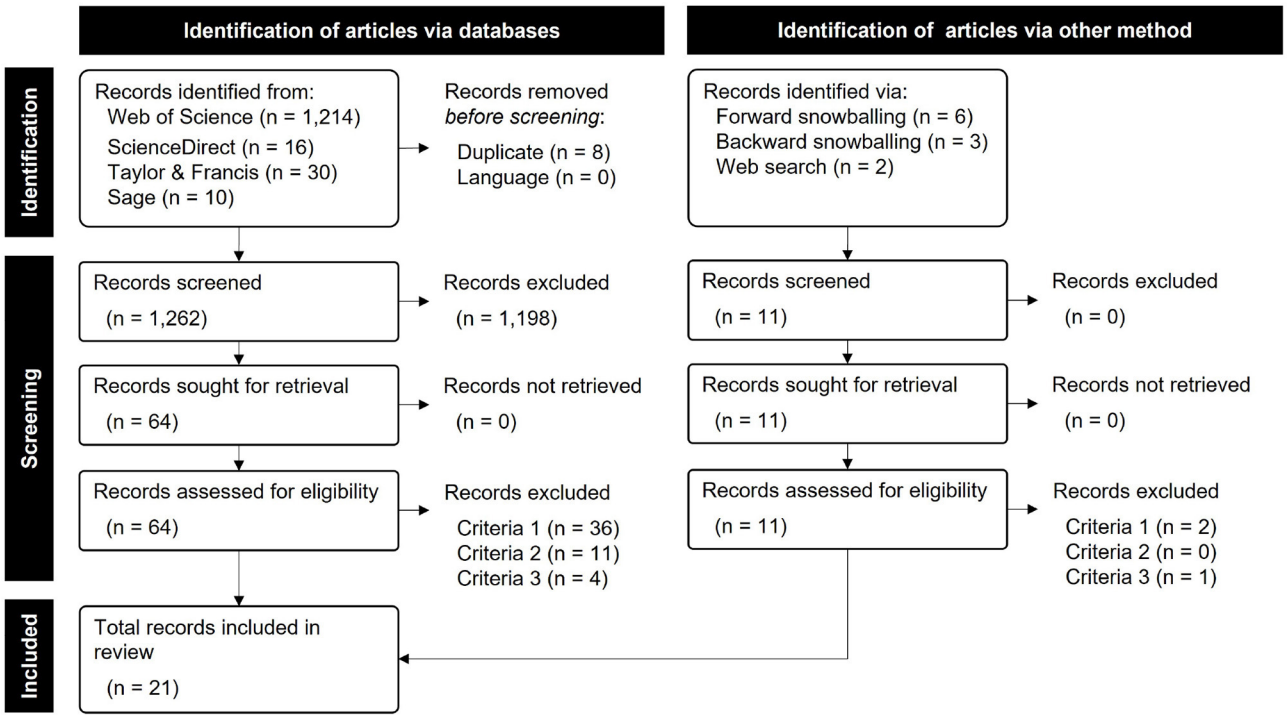

FIGURE 4
Flow of systematic literature review process.

3.1. Step 1: identification

Our strategy for literature identification was threefold. First, we chose Web of Science (WoS) as our primary database because of its broad coverage of qualified articles. In addition to this, we also selected databases from major publishers: Elsevier (ScienceDirect), Tayler & Francis, and Sage. These three were added to increase coverage. Second, the search string was designed by combining two sets of terms related to design framework, method, and tool (Set A in Table 1) and eudaimonic well-being (Set B in Table 1). Design scholars use disparate terms to describe something developed to help designers. Two of the authors, one from the design research and another from the HCI domain, collected typical terms for Set A from each research domain. For Set B, the synonyms of eudaimonic well-being were extracted from the previous review (Vittersø, 2016). Other often-used synonyms of well-being such as "physical health", "quality of life", and "welfare" were excluded to avoid papers that regard well-being as a physical health condition and socio-economic indicator. Third, types of articles were limited in original research papers written in English. According to the search strategy, literature was collected between 1st May and 10th May 2023. Our primary search using WoS resulted in identifying 1,214 records. The search string was restricted to Title, Keywords, and Abstract to find more relevant articles. Additionally, our complementary searches using the other databases allowed us to add

TABLE 1 Search terms.

Set A	AND	Set B
"Design method" OR		Eudaimon* OR
"Design methods" OR		*Well–Being* OR
"Design framework" OR		*Well-being* OR
"Design tool*" OR		*Happiness* OR
"Design guide*" OR		*Virtue* OR
"Design space*" OR		*Virtuous** OR
"Design principle" OR		*Flourish** OR
"Design support" OR		*"Mental health"*
"Design aid" OR		
"Design recommendation"* OR		
"Design process"		

The italics were not used when searching the secondary databases.

56 records. The total number of candidates became 1,262 after the removal of duplicates.

3.2. Step 2: screening

The screening process was separated to three steps. At first, the title and abstract of each record were checked to judge its relevance to our review. This step sifted out 1,198 records considered irrelevant. Then, the remaining 64 articles were retrieved and assessed for eligibility. We conducted a full-text review for each record and applied the following inclusion criteria:

1. proposing or customizing a specific design framework, method, and/or tool;
2. concerned with psychological well-being and not physical well-being;
3. useful in a broad context or applicable to designing assistance applications.

As a result, 13 eligible articles were left. Finally, further articles were searched through cross-reference snowballing and Google Scholar to be more comprehensive. We decided to include 8 of 11 additional candidates. In total, we found 21 eligible articles for analysis and synthesis.

3.3. Step 3: analysis and synthesis

The qualitative analysis consisted of three steps. First, one of the authors read and initially coded the 21 articles. The coding scheme had two categories according to our research questions: *what* facets of well-being each article postulates and, *how* each design method supports designers. In the "what" category, we used the morphological classification of eudaimonia (Figure 2) as an analytical lens. To be more precise, three dimensions in Figure 2 gave sub-categories and codes to the "what" category: design objects (which stage it takes into account), outcomes (which element it is intended to achieve or increase), orientations (which orientation it guides users and/or designers to). The "how" category included two sub-categories, the domain and type of method, but detailed codes were incrementally built through the analysis. The latest coding scheme was determined by two of the authors through discussions, and finally the articles were fully coded.

In the second step, a chronological analysis of the literature was conducted to identify the research streams that have different concerns and aims of design. The result was visually mapped, incorporating the "milestone" articles that were not in our literature base but additionally identified as the theoretical sources of each research stream. Through this analysis, we revealed four research streams that had a different tendency in the "what" category.

The third step aimed to organize design methods proposed in the literature. To do so, we created a matrix referring to the four research streams and the types of method in the "how" category. Each design method proposed in the literature was mapped in the matrix. It provides an overview of the available toolkits for eudaimonic assistant design and potential areas for the further development of design methods. We discuss the results in the next section.

3.4. Result 1: four research streams and eudaimonic well-being

Figure 5 shows the chronological map of the literature, and Table 2 reports the result of coding for each article. This map provides us an overview of the research streams. The design approaches considering eudaimonic well-being were presented in early 2010s. There are two different theoretical roots that influenced the articles: self-determination theory in psychology (Ryan and Deci, 2000, 2017; Ryan et al., 2008) and the capability approach in economics (Sen, 1999; Nussbaum, 2003). In the downstream, recent advancements could be synthesized into four streams with different aims. In the following sections, we explain each research stream, distinguishing its different points of view and treatment of eudaimonic well-being in design.

3.4.1. Design for positive experiences and emotion

The pioneering work that addressed PWB in design research was presented by Hassenzahl et al. (2010). They incorporated psychological needs (Ryan and Deci, 2000; Sheldon et al., 2001) in user experience (UX) design to broaden understanding of pleasurable experience. Based on the list proposed by Sheldon (Sheldon et al., 2001), they used six psychological needs, i.e., relatedness, stimulation, competence, popularity, security, meaning, to represent facets of UX. Subsequently, Desmet and Pohlmeyer (2013) offered a more holistic approach, named positive design, bundling three key components of subjective well-being: pleasure, personal significance, and virtue. Positive design has been applied not only to product design, but also to the work domain for meaningful experiences at work (Lu and Roto, 2015).

After the initial conceptualization, positive design takes an outcome-orientation, focusing on the emotional aspect of PWB.

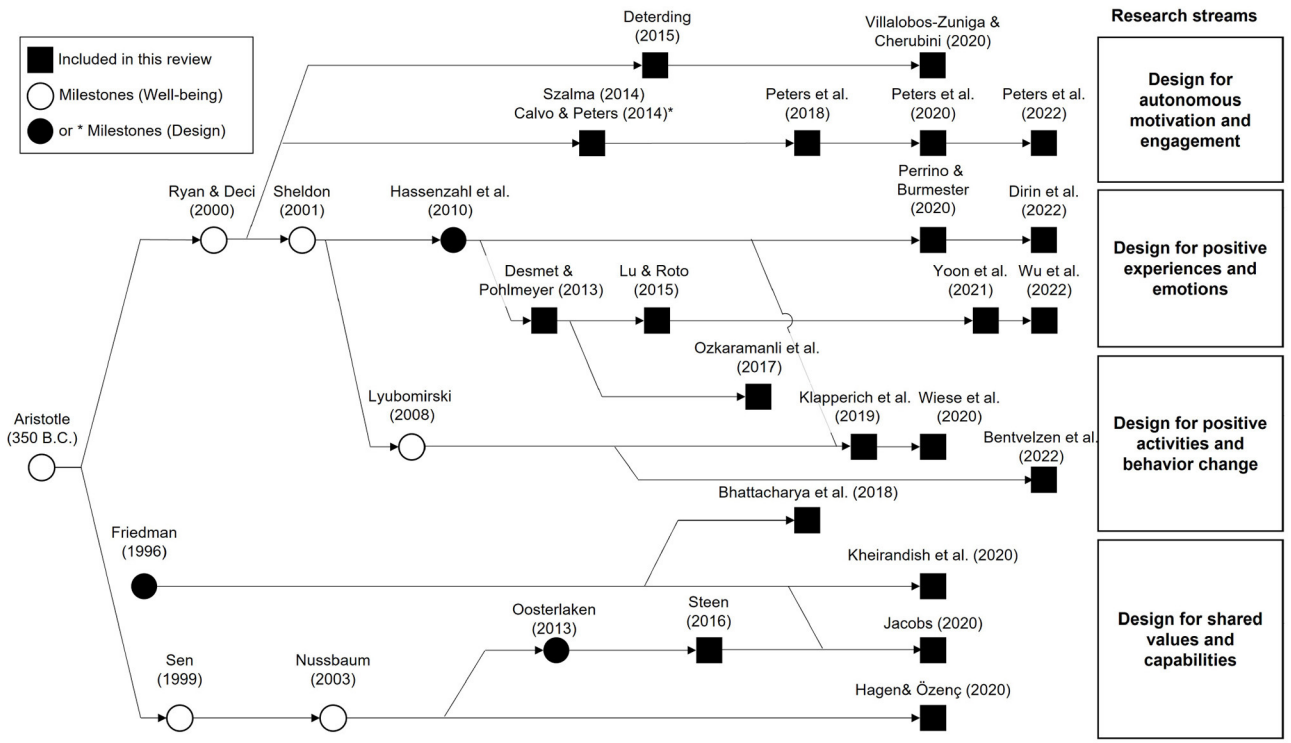

FIGURE 5
Chronological map of the various streams of psychological well-being and their milestone contributions upon which design tools/methods/frameworks are based.

Yoon et al. (2021) promoted design for positive emotions based on the typology of 25 positive emotions. Similarly, Dirin et al. (2022) consolidated 11 existential feelings and related emotions (e.g., feeling of engagement and emotions of boldness and confidence). They associated the existential feelings with phases of UX informed by the temporality of experience model (Karapanos et al., 2009). Perrino and Burmester (2020) expanded the temporal dimension of UX design by integrating time perspective theory (Zimbardo and Boyd, 1999). Their design framework aimed to realize temporal harmony that promotes users' PWB through evoking and balancing the past, present, and future positive experiences. Wu et al. (2022) devoted their attention to the positive emotional arousal when users are in negative moods. They integrated strategies for emotion regulation into five categories.

In summary, this research stream primarily aims at the "experience" stage of eudaimonia, i.e., positive experiences and emotions, but most studies did not provide certain design objects. Some authors viewed "meaning" and "excellence" as important components to make experiences positive (Desmet and Pohlmeyer, 2013; Lu and Roto, 2015). Others have been keen to encourage positive emotions, which would be indistinguishable from a hedonistic approach. Whereas most of them let design participants to think of emotional changes in the "self" (focal users) at "present" (or near future), one paper has attempted to extend their view to a long-term perspective "beyond present" (Perrino and Burmester, 2020).

3.4.2. Design for autonomous motivation and engagement

The second research stream has also, but more strongly, inherited self-determination theory (SDT) (Ryan and Deci, 2000, 2017). SDT as a meta-theory consists of six interrelated theories, including basic psychological needs satisfaction theory and other motivational theories (Ryan and Deci, 2017). The former theory elaborates on three basic psychological needs, namely competence, autonomy, and relatedness, universally essential for human thriving. The satisfaction of these needs leads to intrinsic motivation for the activity, distinguished from extrinsic motivation controlled by rewards, pressures, shame, etc. In our literature base, Szalma (2014) first explicitly employed SDT in proposing principles and procedural guidelines for motivational design in the domain of ergonomics. The guideline emphasizes the importance of task/environment analysis and interface design to prevent negative influences on competence, autonomy, and relatedness. At the same time, Calvo and Peters coined the term "positive computing" (Calvo and Peters, 2014) that systematizes well-being-supportive design for all technology. They offered a multidisciplinary review on the determinant factors of PWB in their book (Calvo and Peters, 2014), but recently have concentrated on SDT as the foundation of their detailed design methodology (Peters et al., 2018, 2020; Peters, 2022). Their core proposition, named METUX model, features the three basic psychological needs as reliable mediators of motivation, engagement, and PWB (Peters et al., 2018). In subsequent publications, they have investigated more practical design tools and heuristics based on the METUX

TABLE 2 The list of 21 articles with the result of coding.

References	Theoretical foundation of well-being	Design objects	Design outcomes	Design orientations
Design for positive experiences and emotions				
Desmet and Pohlmeyer (2013)	(No specific one)	(No focus)	Meaning / Excellence	(No focus)
Lu and Roto (2015)	(No specific one)	(No focus)	Meaning / Excellence	(No focus)
Perrino and Burmester (2020)	(No specific one)	Behavior	(No focus)	Beyond present
Yoon et al. (2021)	(No specific one)	(No focus)	(No focus)	(No focus)
Dirin et al. (2022)	(No specific one)	(No focus)	Meaning	(No focus)
Wu et al. (2022)	(No specific one)	(No focus)	Excellence	(No focus)
Design for autonomous motivation and engagement				
Szalma (2014)	Self-determination theory	Behavior	Authenticity / Excellence	(No focus)
Peters et al. (2018)	Self-determination theory	Behavior / Experiences	Authenticity / Excellence	(No focus)
Peters et al. (2020)	Self-determination theory	Behavior	Authenticity / Excellence	(No focus)
Peters (2022)	Self-determination theory	Behavior	Authenticity / Excellence / Meaning	(No focus)
Deterding (2015)	Self-determination theory	Behavior	Authenticity	(No focus)
Villalobos-Zúñiga and Cherubini (2020)	Self-determination theory	Behavior	Authenticity / Excellence	(No focus)
Design for positive activities and behavior change				
Ozkaramanli et al. (2017)	(No specific one)	Behavior	(No focus)	Beyond present
Bhattacharya et al. (2018)	(No specific one)	Behavior / Functioning	Growth	Beyond present
Klapperich et al. (2019)	Psychological needs	Behavior	(No focus)	(No focus)
Wiese et al. (2020)	Positive psychology interventions	Behavior / Functioning	(No focus)	(No focus)
Bentvelzen et al. (2022)	(No specific one)	Behavior / Functioning	(No focus)	Beyond present
Design for shared values and capabilities				
Steen (2016)	Capability approach	Orientation	Meaning / Growth	Beyond tangible
Jacobs (2020)	Capability approach	Orientation	Meaning	Beyond tangible
Hagan and Özenç (2020)	Capability approach	Behavior	Growth	(No focus)
Kheirandish et al. (2020)	Value framework	Orientation	Meaning / Growth	Beyond tangible

model (Peters et al., 2020; Peters, 2022). Similarly, some other authors have identified design strategies and patterns based on SDT's conceptualizations of intrinsic motivation (Deterding, 2015) and basic psychological needs (Villalobos-Zúñiga and Cherubini, 2020).

The studies mentioned in this section are targeting autonomous motivation and engagement in technology use. To this end, SDT supplies a useful set of basic psychological needs to be satisfied. If those needs are satisfied, user "behaviors" in technology use become more intrinsically motivated. The need for autonomy and intrinsic motivation emphasizes "authenticity" in interactions with technology, whereas the need for competence refers to "excellence" and "growth" in activities using technology. Although the need of relatedness implies the presence of others, their design activities are directed toward improving behaviors of the focal user.

3.4.3. Design for positive activities and behavior change

The third research stream is a collection of four studies concerning behavior that have branched off from several sources. Ozkaramanli et al. (2017) built a bridge from positive design to behavioral design, spotlighting on dilemmas between an immediate pleasure and a long-term achievement. They found three design strategies to change user behaviors that threaten long-term goals. Bhattacharya et al. (2018) zoomed on to a pivotal moment in behavior change, defined as "the time when a person decides to adopt new behavior(s) for their personal well-being and/or becomes ready to make progress toward positive change" (Bhattacharya et al., 2018, p. 130). From literature and interviews, they structured a design space that forms interventions for people who have not yet been motivated to change their behavior. Klapperich et al. (2019) focused not on behavior change, but on enhancing daily practice of the users. Informed by social practice

theory (Reckwitz, 2002), they proposed a design process that centers on gathering and analyzing positive everyday practices of the focal user, e.g., brewing coffee. The gathered practices "will serve as further inspirations to (re)design practices" (Reckwitz, 2002, p. 159) and supportive technologies. In addition, to foster sustained PWB by designing technology used in daily activities, Wiese et al. (2020) brought the knowledge of positive psychology interventions (Lyubomirsky, 2008), that is, intentional happiness-enhancing activities (e.g., expressing gratitude, savoring, etc.). In contrast to Klapperich et al. (2019), they took a theory-driven approach that incorporated 14 happiness-enhancing activities (theories) in their design process. Bentvelzen et al. (2022) concentrated on reflection, one of the important positive activities that nurture psychological well-being (Lyubomirsky, 2008; Ryan and Deci, 2017), and provided four design resource categories for supporting users' reflection.

As remarked above, this collection especially focuses on the "behavior" stage of eudaimonia because a positive experience comes from positive activities. This is similar to design for autonomous motivation and engagement, but this research stream is willing to proactively manipulate their behavior for the purpose of more "functioning" life. In terms of the four key elements, all could be covered depending on the behavior (change) actually targeted in the design, but the possible connotation would be "growth" as a change in behavior. It can be said that this research stream tends to see "beyond present" because changes in behavior require a long-term perspective and bring about sustained PWB.

3.4.4. Design for shared values and capabilities

The fourth research stream is more normative and broader than the others. It mainly stems from the capability approach and value sensitive design (VSD). First, VSD was originally proposed in Friedman (1996) with ethical concerns on the design of technology and has been developed further by many researchers. Values refer to desirable goals often shared by members of the society that guide their activities and serve as motivational components (Kheirandish et al., 2020). VSD is an approach to the design of technology that accounts for human values throughout the design process. Kheirandish et al. (2020) structured nine value clusters and developed educational design tools for students. The value clusters contain meaningfulness, personal development, and respect for oneself, which closely relate to eudaimonic well-being, and others such as status, justice, and ecology. It therefore could partially correspond to design for eudaimonia.

The capability approach was coined by the economist and philosopher Amartya Sen in the context of social justice (Sen, 1999). He argued that poverty and equity should be assessed by the extent of capabilities, not income and owned resources. The notion of capability has been described as the freedom that people have to be whom they want to be and do the activities that they wish to engage in Oosterlaken (2009), which stems from Aristotelian ethics. Subsequently, Nussbaum (2003) presented a more normative approach listing 10 basic capabilities, e.g., having good health, having emotions and emotional attachments, being able to play, etc. In design research, the capability approach was imported by Oosterlaken (2009). Steen (2016) advanced it by converting the Nussbaum's list of basic capabilities into a tangible design tool. With a specific concern on the design of complex legal systems (e.g., law, finance, and government services), Hagan and Özenç (2020) explored effective design patterns at the interface level that help people navigate the systems. The identified five design patterns can enhance people's legal capabilities, which in turn increase long-term well-being. Finally, the two streams of the capability approach and VSD have joined in their downstream. Jacobs (2020) criticized that VSD claims moral authority without founded ethical theories that provide grounds for its justification. To overcome this challenge, the author combined the capability approach as a substantive ethical theory and the methods of VSD, named capability sensitive design.

The studies in this research stream have highlighted both "orientation" and "behavior" stages of eudaimonic well-being, since they have paid much attention to which orientations one ought to develop. "Meaning" and "growth" have been explicitly intended, as shown in the value clusters (Kheirandish et al., 2020) and human capabilities (Hagan and Özenç, 2020; Jacobs, 2020). In addition, the target of design is no longer limited to technologies but sometimes zoomed out depicting a big picture of sociotechnical systems that enable and restrain people to achieve valuable beings and doings, i.e., "beyond tangible".

3.5. Result 2: organizing design approaches

The design approaches identified in the literature were mapped as Table 3. Through the analysis, we identified five types of approaches: methods/techniques, design spaces, design tools, frameworks and heuristics. The following sections summarize each type of existing design methods.

3.5.1. Methods and techniques

The first type of design approach offers practical instructions in a step by step manner to achieve particular design goals that can be applied in any design domain. Design procedures have been developed by scholars according to their concerns: seven steps of motivational design (Szalma, 2014), 5 steps in gameful design (Deterding, 2015), six steps for designing for well-being using the positive practices approach (Klapperich et al., 2019), three steps to design for temporal harmony (Perrino and Burmester, 2020), and a 3-step process to structure the logical design requirements from an abstract capability to concrete design requirements (Jacobs, 2020).

3.5.2. Design tools

Design tools are tangible objects for designers to ideate and record user experiences. Some of them suggest designers on how to conduct interviews and what questions to ask when gathering information from potential users (or focal actors in general). For example, the positive-practice canvas (Klapperich et al., 2019) provides a visual guide for a semi-structured interview and several key questions to find a positive daily practice and draw out contextual information about the practice. The time perspective persona

TABLE 3 Design approaches found in our review.

	Design for shared values and capabilities	Design for autonomous motivation and engagement	Design for positive activities and behavior change	Design for positive experiences and emotions
Methods	Capability hierarchy [10]	Sequential steps for including motivation in the design process [2] Gameful design [19]	Positive practice approach [8]	Designing for temporal harmony [12]
Design spaces	Design patterns for building capabilities [9]	12 persuasive design features [20]	Design space to catalyze pivotal moments [7] 14 well-being-enhancing activities [11] Design strategies for self-control dilemmas [5] 207 picture cards [13] 16 mechanisms to stimulate behaviors [11] Taxonomy of resources for designing for reflection [21]	5 emotional regulation strategies [18]
Tools	10 Capability cards [4] 45 Value words [13] Value wheel [13]	Well-being design cards [14]	Positive practice canvas Temporal experience interview [12] 25 positive emotion granularity cards [15]	Time perspective persona [12]
Frameworks		METUX model [6]	Framework for analyzing self-control dilemmas [5] Framework for sustaining well-being promoted by technology [11]	Positive-design framework [1] Positive design framework for work [3] Feeling of being model [16]
Heuristics		Questions to consider when designing technology to support identified, integrated and intrinsic motivation [2] 15 heuristics for well-being supportive design [17] Lens of intrinsic skill atoms [19]		
(Reference)	[10] (Jacobs, 2020) [9] (Hagan and Özenç, 2020) [4] (Steen, 2016) [13] (Kheirandish et al., 2020)	[17] (Peters, 2022) [14] (Peters et al., 2020) [6] (Peters et al., 2018) [2] (Szalma, 2014) [19] (Deterding, 2015) [20] (Villalobos-Zúñiga and Cherubini, 2020)	[8] (Klapperich et al., 2019) [7] (Bhattacharya et al., 2018) [11] (Wiese et al., 2020) [16] (Dirin et al., 2022) [21] (Bentvelzen et al., 2022)	[12] (Perrino and Burmester, 2020) [5] (Ozkaramanli et al., 2017) [15] (Yoon et al., 2021) [1] (Desmet and Pohlmeyer, 2013) [3] (Lu and Roto, 2015) [18] (Wu et al., 2022)

(Perrino and Burmester, 2020) provides a framework for representing users with the information of demographics, personality, scenario, past positive experiences, present hedonistic experiences, and preference for the future. To help designers stay sensitive to human values during the design process, Kheirandish et al. (2020) introduced the value wheel and value word cards. Similarly, well-being design cards are aimed at designers to incorporate psychological needs (Peters et al., 2020) and user emotions in design (Yoon et al., 2021).

3.5.3. Design spaces

Design spaces map the solution space for a particular problem domain in terms of the design decisions to be made along with alternatives (Shaw, 2012). Such pre-defined design patterns can give designers inspirations and partially change design actions from creating to choosing. In most cases, the authors use a process of literature review and workshops/qualitative research to create specific design patterns [e.g., patterns to enhance user capabilities (Hagan and Özenç, 2020), strategies to navigate self-control dilemmas (Ozkaramanli et al., 2017) or 16 mechanisms to stimulate behavior (Wiese et al., 2020)], specific activities [e.g., 14 happiness-enhancing activities (Wiese et al., 2020) and 207 picture cards including activity and product/service (Kheirandish et al., 2020)] and design spaces [e.g., design space to catalyze pivotal moments (Bhattacharya et al., 2018)].

3.5.4. Frameworks

Frameworks present an organization of concepts to introduce a topic or explicate the problem domain, and suggest broad themes for design. For instance, the positive design framework (Desmet and Pohlmeyer, 2013) offers a bundle of three directions: design for pleasure, personal significance, and virtue. It is rather abstract, but Lu and Roto (2015) made it slightly specific by associating experiential goals in the work domain with the three directions. Another example is the METUX model (Peters et al., 2018) that differentiates between the different spheres-of-experience that can be affected by interactions with the designed technology and argues for a holistic approach to design. Wiese et al. (2020) framework for sustained well-being aims to fill the gap between positive experiences and sustained well-being by linking product features to specific behavioral support, which can be leveraged to engage users in positive activities.

3.5.5. Heuristics

Heuristics are easy to use checklists, underpinned by empirical research, which can be used to quickly and inexpensively evaluate prototypes. While heuristics for usability are well known, our literature review revealed two guidelines that have been curated to evaluate if design fulfills psychological needs. The first is the list of questions proposed by Szalma (2014), and a similar list of heuristics has more recently been proposed by Peters (2022). Deterding (2015) developed the lens of "intrinsic skill atoms" that suggests seven questions to quickly check for completeness of design considerations.

4. Discussion

Given that there are various approaches to design for PWB, which approach should one take, and when? In this section, we identify the commonalities and points of divergence between these tools, methods and frameworks, and based on an understanding of the process and factors behind PWB, we synthesize the various design approaches into a simple heuristic to aid designers in choosing the appropriate design tool.

4.1. On the state of design methods and frameworks for eudaimonia

From a theoretical perspective, the field of design is rich with suggestions and frameworks for designing for PWB. As Tables 2, 3 show, design for PWB has been understood through various conceptual lenses, and among those frameworks adhering to the eudaimonic view, only certain aspects of eudaimonic categories and core elements are considered. Our classification of the various methods, tools and frameworks aims to complete the picture and while doing so, also highlights some inconsistencies. First, there is a considerable divergence in the level of abstraction of the design activity these tools and methods intend to support. In some cases, they intend to inspire (e.g., Desmet and Pohlmeyer, 2013; Dirin et al., 2022) while in others they offer procedural guidance (e.g. Szalma, 2014; Perrino and Burmester, 2020); whereas some offer methods and patterns to arrive at concrete design prototypes [e.g. (Bhattacharya et al., 2018; Klapperich et al., 2019; Hagan and Özenç, 2020; Villalobos-Zúñiga and Cherubini, 2020; Bentvelzen et al., 2022)], others present heuristics to evaluate the design effort (Peters, 2022). Second, we also see a difference in the sources from which these frameworks and methods draw their content from. While (Szalma, 2014) and (Peters et al., 2018) are based on theory (e.g., self-determination theory) and attempt to operationalize it, others propose mining situated human practice and experience to finalize design ideas for prospective users (e.g., Klapperich et al., 2019), and some reviews summarize concrete design features (e.g., Villalobos-Zúñiga and Cherubini, 2020; Bentvelzen et al., 2022). Finally, there is also differentiating focus on the temporal aspect of human behavior and experience. Some frameworks focus on envisioning a user's future-self (e.g., Lu and Roto, 2015), others focus more on shaping the interaction in the present (e.g., Peters et al., 2018) and some rely on comprehending and reflecting past user experiences and pivotal moments [e.g., (Bhattacharya et al., 2018; Klapperich et al., 2019; Perrino and Burmester, 2020; Bentvelzen et al., 2022)].

We presume that these distinctions are not completely arbitrary, but are contingent on the existence and significance of existing user experiences/activities, as well as the design goals. A theory-based perspective is helpful because it is based on justified, objective past knowledge, and can serve as a first recourse in novel situations or when behavior change is the aim. As Figure 3 suggests, eudaimonic well-being can be viewed as a process, beginning from specific motivations, goals to performing specific behaviors that lead to particular experiences and feelings. This can be clarified using a goal hierarchy (Höchli et al., 2018). Values are *superordinate goals*, they are identity based, entail an extended temporal perspective, and are linked to a broad scope of context. These superordinate goals are realized through *intermediate goals* that correspond to "a general course of action bound to a certain behavioral context" (Höchli et al., 2018). At the lowest level are *subordinate goals* that precisely define what and how to do something.

Analogously, one can initiate the design activity in a future oriented, top-down manner, (e.g., Hagan and Özenç, 2020;

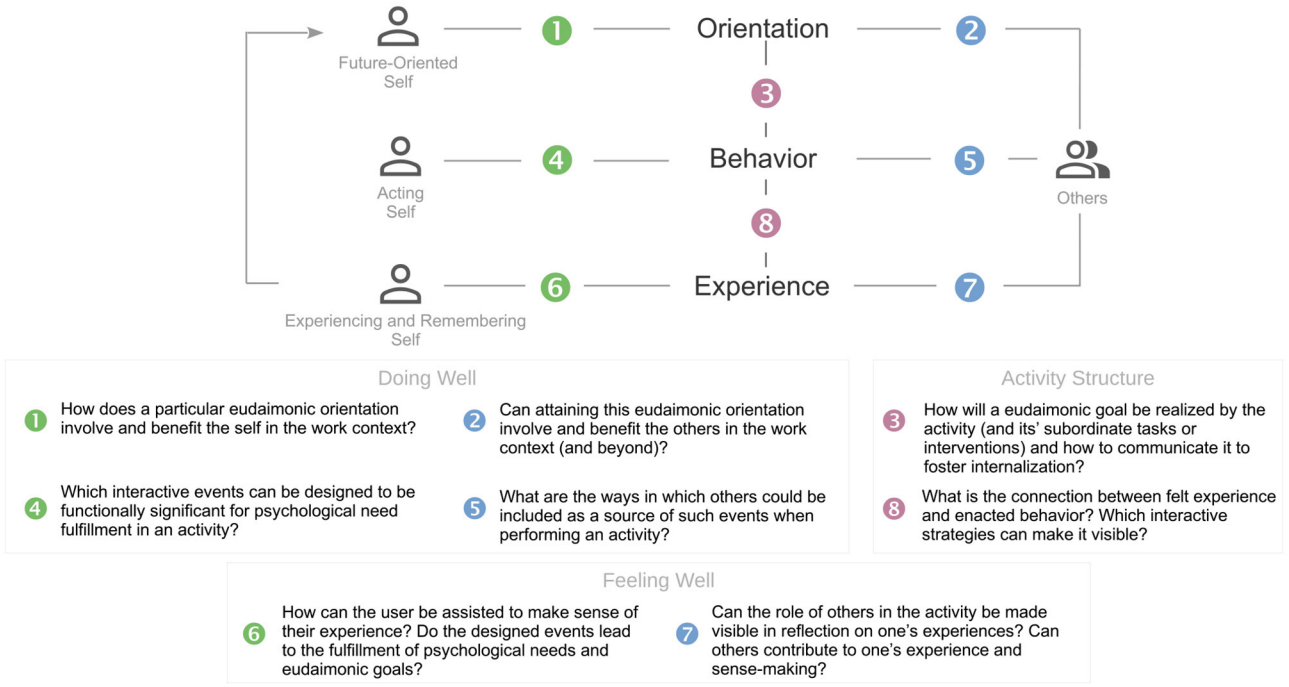

FIGURE 6
Facets of eudaimonic design synthesized from our literature review: vertices represent the core elements and actors, whereas edges highlight the relationships between them as units of design and analysis. The edges are color coded to reflect their emphasis on the self, others, or the activity.

Kheirandish et al., 2020) and bridge the gap between superordinate and intermediate goals by suggesting how the structure of an activity (or behavior) corresponds to a superordinate goal (or value) in a manner that facilitates internalization and endorsement by the self. Moreover, design patterns and strategies (e.g., Hagan and Özenç, 2020) can here serve as concrete suggestions that could help users meet subordinate goals, prompt pivotal moments (Bhattacharya et al., 2018) or help resolve dilemmas resulting from conflicting intermediate and superordinate goals (Ozkaramanli et al., 2017). The second step in Figure 3 refers to mechanisms whose presence during the behavior is necessary to enable PWB. Here, it is implied that intermediate goals that are endorsed by the participant, and, in the pursuit of which (via subordinate goals) the participant experiences events that are supportive of autonomy, competence and relatedness, contribute to well-being. Viewed in the top-down manner, a designer can rely on suggested patterns (Villalobos-Zúñiga and Cherubini, 2020), and in a prospective sense, check that the design provides adequate support for autonomy, competence and relatedness in the process, the material aspects of interaction (e.g., Peters, 2022) as well as opportunities for reflection (Bentvelzen et al., 2022).

The second case relates to (re)creating experiences that assume an existing activity context (or behavior) that may already be a well-established source of well-being within which users can express their imagined and lived experience, that is, their envisaged, perceived, and reconstructed experience (future-present-past) (Doherty and Doherty, 2018; Perrino and Burmester, 2020). Here, in a bottom-up manner, one can mine for the presence of particular behaviors (intermediate goals) and materials supporting both need satisfaction and superordinate goals that could form the basis of future products and applications (e.g., Klapperich et al., 2019), or ask users to articulate their imagined, future experience (Perrino and Burmester, 2020). At the same time, users' remembrances of the past are often colored by cognitive biases and, based on the design goal, may or may not be applicable as predictors of future choices in a given situation (Doherty and Doherty, 2018).

4.2. Designing assistance to support eudaimonia

In the context of our research focus, there are no specific design efforts or principles dictating the eudaimonic design of assistants or assistance applications. Rather, we think that a systematic mapping of existing approaches could provide various pathways to design.

As we mentioned previously, to enhance employee PWB, assistants ought to positively enrich an employee's possibilities of internalizing and achieving eudaimonic goals, and incorporate mechanisms that support them, among others, task/job significance (meaning), skill enhancement (excellence), learning new things (growth), crafting feedback (authenticity), opportunities to give/receive social support (meaning), utilization of strengths and skills (excellence), perceived control and autonomy (authenticity) and psychological safety. The choice of a particular design method, or framework, corresponds to the temporal perspective and level of goal hierarchy that the design process targets. To aid the choice of design methods, we have synthesized these facets in Figure 6. The nodes of the diagram represent the core elements of

TABLE 4 Various facets of supporting eudaimonic well–being through assistant design.

Dimension	Role of the assitant: To help the employee...	Guiding questions for designing assistance: How to...	Design patterns, tools and heuristics based on literature review
1. Orientation — Self	Clarify and endorse values, motives and set goals (why)	Help the employee set eudaimonic goals for growth and excellence. Support the employee in assessing their capabilities to pursue these orientations.	Capability cards Value words
2. Orientation — Others		Explain the scope of the activity beyond the self	Temporal interview Capability Hierarchy
3. Orientation — Behavior		Make the abstract eudaimonic orientations regarding self and others concrete in terms of the structure and choice of intermediate and subordinate goals. Represent and allow choice of goals and the criteria for meeting these goals. Check for presence of necessary tools and information for carrying out the activity.	Mechanisms to stimulate behaviors Heuristics for well–being supportive design Lens of intrinsic skill atoms
4. Behavior — Self	Behave in self-determined, goal-oriented manner (what and how)	Provide information and suggest actions to advance toward intermediate and superordinate goals.	Design patterns for building capabilities Lens of intrinsic skill atoms Well–Being design cards Heuristics for well–being supportive design Persuasive design features
5. Behavior — Others		Provide ways for others to contribute to the activity Provide ways for the employee to contribute to others beyond the self	Questions to consider when designing technology Mechanisms to stimulate behaviors Positive practice canvas Taxonomy of resources for designing for reflection Design strategies for self-control dilemmas Temporal interview
6. Experience — Self	Coherently interpret experiences and plan changes (why and how)	Help to record the experience of the self with respect to the events during an activity. Support mindful, non-judgemental evaluation of progress toward eudaimonic goals	Design space to catalyze pivotal moments Temporal interview Positive practice canvas
7. Experience — Others		Highlight the impact of the self on others and the broader context Support acknowledgment of the impact of others on the self and vice-versa	Mechanisms to stimulate behaviors Heuristics for well–being supportive design
8. Experience — Behavior		Help the employee reflect and make necessary changes to the goals, activity structure and information presented in the future.	Taxonomy of resources for designing for reflection

eudaimonia (orientation, behavior, and experience), and the actors (self and others). The edges denote the relationships between entities that can be supported via assistance. The role of the assistant can begin with helping the employee understand how a particular eudaimonic orientation (excellence, growth, meaning and authenticity) involves the self, how it contributes to the future-oriented self, whether it also involves others, and if yes, whom (Edges 1 and 2). For example, when it comes to work, excellence can be considered in terms of meeting standards of quality via one's skill, which involves the employee, but could also include it support from other, more experienced colleagues. Next, the assistance focuses on Edge 3 to support the employee to understand how a particular eudaimonic orientation can be achieved in an activity by setting intermediate goals (e.g. how is quality defined in terms of concrete standards of work tasks and how should the employee's skills be supported). Finally, the concrete activity of doing the

task, the entities involved in a particular activity and the support one receives from the assistant (*how*), its structure and the events that originate in the form of interaction with the assistant and others are taken into consideration (Edges 4 & 5) in the form of measurable, subordinate goals and design of feedback. Proceeding further, the emphasis lies on supporting the employee to reflect and remember the experiences (Edge 6, here excellence, that is, the actual quality of work achieved) and provide ways for others (Edge 7, e.g. colleagues) to help the employee reflect and make connections between the felt experience and components of the activity and one's behavior (Edge 8) to prompt changes to be initiated, e.g. re-defining goals, clarifying problems or customizing assistant features.

Table 4 consolidates the different themes each edge represents, and proposes design tools, patterns and heuristics that could be of use. Some methods or approaches, such as psychological needs, are arguably applicable in all situations, others could be used in a particular phase.

5. Conclusion

In this paper we have argued that the design of assistants or assistance applications could benefit both employees and organizations by moving beyond the classical outcomes of productivity and efficiency, and by adopting a more holistic, eudaimonic view of well-being which includes eudaimonic orientations (excellence, growth, meaning and authenticity) and psychological need fulfillment. In order to leverage existing design knowledge, we have systematically reviewed and organized different design models, frameworks, heuristics and tools. Finally, we have striven to complete the designers' tool set by connecting the various design methods to particular relationships between actors and core PWB entities and by suggesting guiding questions corresponding to each facet in order to facilitate future design activities.

5.1. Theoretical and practical contributions

The present article makes several contributions to the research communities of design and HCI. Although scholars have pointed out the importance of fostering workplace psychological well-being, no reviews until now have considered bringing together design methods, tools, patterns or frameworks to do so. Our first contribution is highlighting the implications of advancing the design of workplace assistance toward PWB and offering a consolidated set of options to aid developers and designers. Researchers could use the guiding questions and list of applicable design tools to inform their research efforts. The methods proposed here are not specific to designing assistance or to be used only in the workplace context, but could be extended to other design domains such as mobile apps, games, and human-robot interaction.

Second, it is the first paper that has gathered the diverse definitions and viewpoints through which design for PWB (and, EWB) has been proposed and/or achieved, revealing four research streams: design for positive experiences and emotions, design for autonomous motivation and engagement, design for positive activities and behavior change, and design for shared values and capabilities. This classification contributes to design research by identifying different design objects, outcomes, and orientations within the same overarching field of design. It would be helpful to theorize design for PWB, and useful for scholars to clarify their position within the research streams.

5.2. Limitations

While we have striven to carry out an extensive review with utmost care, we recognize that our review has some limitations. First, we took a deliberate but informed decision to focus on psychological well-being. While this provided us the opportunity to deeply study the design approaches in this area, we had to exclude reviews on physical wellness such as those by Orji and Moffatt (2018), Huang et al. (2019) and (Damen et al., 2020). Second, our review primarily focuses on promoting psychological well-being through the design of interactive artifacts. There are other reviews that summarize well established therapies, trainings and interventions that may be delivered digitally for enhancing workplace mental well-being (e.g Bartlett et al., 2019; Daniels et al., 2021), but which do not take up design as their object. A different review could address the possibility of identifying and organizing such methods to draw potential candidates for design. Finally, although activities form the core of mental well-being, our review does not engage with other theoretical frameworks such as activity theory (Kaptelinin and Nardi, 2009) or how domains and activities in a workplace context could be analyzed to find opportunities for enhancing psychological well-being. This could be the focus of future work, and we discuss some prospects next.

5.3. Other pieces of the puzzle

Along with the proposed design methods and approaches, there are several other areas which could be investigated further.

Other sources of design inspiration: An additional source of design inspiration, and one, which in our view, harmonizes well with the design process, especially in the eudaimonic sense, is that of psychological interventions, or activities that are deliberately designed to foster PWB (Lyubomirsky and Layous, 2013). We see these interventions as a part of a continuum of PWB related concepts, starting from the four core, but rather abstract themes of eudaimonia, followed by workplace drivers that have been demonstrated to enhance employee well-being, to concrete prescriptive interventions that could be implemented. The intervention approach offers actionable suggestions, since technology adoption at work occurs in the backdrop of existing work practices, which are already sources of workplace joy or frustration. Interventions are designed to bring about change in people's behaviors or emotional states in everyday life, and since assistants are intimately tied to work practices, they can serve as the technological mechanism to introduce them in the workplace. Furthermore, interventions offer us concrete, prescriptive methods rather than abstract concepts such as psychological need fulfillment. The framework proposed by

Wiese et al. (2020) already includes positive activities and behavior change interventions, but there are also sources of interventions especially tailored for the work domain, for instance the job demands and resources (JDR) based job-crafting interventions (Demerouti, 2014) and positive-psychology interventions for resilience (Seligman et al., 2005). These could be mined for potential design patterns and strategies.

Existing domain knowledge and organizational constraints: In industrial contexts, it is the system and process characteristics that delineate the problem space within which workers act. Furthermore, depending on the level of manual involvement, there may be differentiated levels of worker experience and know-how necessary to complete the tasks. How do we extract existing know-how that workers already posses and input it into the design process? And how can expert knowledge be used to design assistants to observe, evaluate and provide feedback to novice workers? Here, we propose that tools for activity analysis (Kaptelinin and Nardi, 2009) and in the organizational sector, participatory domain modeling and collaborative learning workshops such as Event Storming (Brandolini, 2017) and machine learning techniques are crucial to better understand and capture the context of work and recognize opportunities to provide assistance. Still, the room for improving worker well-being through technological interaction may be constrained by the overall structure of the worker's activities and their relationship to broader organizational contexts, a view which is echoed in the analysis of eudaimonia in work contexts (der Kinderen and Khapova, 2021). Work design as an area of research is already well established, and may be used as an investigative lens to distinguish those aspects of work that can be enhanced with, or risk regressing, via digital assistance and digitalization (Parker and Grote, 2022).

Evaluating eudaimonic experiences using digital applications at work: Efficiency and productivity is relatively straightforward to measure—as completion time, error rate, or recall rate in an experimental setting. Cooper (Fisher, 2014) provides an overview of instruments for measuring hedonic and eudaimonic well-being at work. Other measures include flow and interest (Bakker, 2008), work motivation (Gagné et al., 2015), scales for meaning of and in work (Both-Nwabuwe et al., 2017), psychological need satisfaction (Reis et al., 2000; Peters et al., 2018), meaning experience and elevation (Huta and Ryan, 2010), authentic pride (Tracy and Robins, 2007) and goal commitment (Seijts and Latham, 2000). At present, most of the discussion about user experience centers around technologies designed for leisure, and the work domain has largely been neglected (Bargas-Avila and Hornbæk, 2012). Research shows that positive experiences brought about by need fulfillment in work contexts differ from those in leisure contexts (Tuch et al., 2016). Investigating the hedonic and eudaimonic aspects of user experience at work would advance our knowledge in this domain.

Our hope is that the overview of design approaches and the synthesized toolkit presented here enables designers and developers to design assistants that not are only targeted at improving employee productivity, but also their psychological well-being.

Author contributions

HD and YN contributed to the writing of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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