Flexible and Mindful Self-Tracking: Design Implications from Paper Bullet Journals

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ABSTRACT
Digital self-tracking technologies offer many potential benefits over self-tracking with paper notebooks. However, they are often too rigid to support people's practical and emotional needs in everyday settings. To inform the design of more flexible self-tracking tools, we examine bullet journaling: an analogue and customisable approach for logging and reflecting on everyday life. Analysing a corpus of paper bullet journal photos and related conversations on Instagram, we found that individuals extended and adapted bullet journaling systems to their changing practical and emotional needs through: (1) creating and combining personally meaningful visualisations of different types of trackers, such as habit, mood, and symptom trackers; (2) engaging in mindful reflective thinking through design practices and self-reflective strategies; and (3) posting photos of paper journals online to become part of a self-tracking culture of sharing and learning. We outline two interrelated design directions for flexible and mindful self-tracking: digitally extending analogue self-tracking and supporting digital self-tracking as a mindful design practice.

Author Keywords
Bullet journaling; personal informatics; self-tracking; self-monitoring; self-care technologies; habit tracking; mood tracking; symptom tracking; Instagram.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Personal informatics technologies aim to support the collection of personally relevant data for the purpose of self-reflection and gaining self-knowledge [41], and include systems such as wearable fitness tracking devices, food journaling tools, and smart journals [20]. These self-tracking tools offer many potential benefits, such as providing automated data capture and visualisations of behavioural and physiological data to become *"fitter, happier, and more productive"* [19]. However, the design of automated self-tracking technologies lacks flexibility [36] and often fails to support people's practical goals and emotional needs. For example, prior works suggest that people abandon consumer health technologies over time because of a lack of personally meaningful insights [22,38], and switch to paper notebooks to avoid unintended effects and to overcome technological boundaries [3,33]. Addressing these issues, recent research has proposed leveraging flexible self-tracking to account for people's individual and changing self-tracking practices [10,30,36].

To inform the design of flexible self-tracking technologies, this study examines the contemporary phenomenon of paper bullet journaling [7,18,25,47]: an analogue and customisable system that aims to support a reflective and productive life in the digital age [7]. It consists of different components for rapid logging, such as bullets and short sentences which are typically organised in monthly and daily logs. Millions of bullet journalists customise this system to *"track the past, organize the present and plan for the future"* and share their best practices on Instagram, Twitter, Pinterest, and YouTube [47]. Analysing posts of paper bullet journals on Instagram, this study focuses on examining what bullet journalists track in their paper notebooks and how they design them. Our findings inform research on self-tracking in personal informatics [2,35] and self-monitoring with self-care technologies [48], and provide two contributions.

1. We improve understanding of the design and content of paper notebooks illustrating bullet journaling not only as an organisational and documentary system, but also as a visual and social self-tracking culture spanning the analogue and digital worlds.
2. We inform the design of personal informatics systems and self-care technologies by outlining two design directions for flexible and mindful self-tracking: *digitally extending analogue self-tracking with additional values,* rather than replacing the use of pencil and paper, and *supporting digital self-tracking as a mindful design practice*, as opposed to focusing only on passive automation and predefined presentation of personal data.

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RELATED WORK

Journaling practices have been investigated in many fields such as personal information management [31,60], life logging [56], chronic illness management [48,64], personal informatics [20,35], and applied research methods [8,21]. To provide background to this research, we begin by describing works on paper journaling and then outline related studies on self-care and self-tracking in HCI.

Journaling with Paper Notebooks

Self-tracking is not a new phenomenon: it probably began with one of the oldest tool sets: pencil and paper. Engaging in paper journaling is a fundamentally human reflective practice, involving the documentation and organisation of everyday experiences. Psychologically-informed studies suggest that diary keeping can be an effective strategy to cope with stressful events. In particular, expressive writing might promote positive health and wellbeing [18,40]. Elsden et al.'s [20] interview study of paper and smart journal use highlights the positive experience of writing and reminiscing. Self-tracking with paper can also play a significant role in self-managing personal health and wellbeing. For example, a national survey [26] suggests that 69% of U.S. adults keep track of at least one health indicator (e.g. diet, exercise, or symptom). 49% recorded this information *"in their heads"*, 34% using pencil and paper, and 21% using technology. Clinically-informed studies suggest that paper dairies are feasible and usable data collection tools [64], especially when tailored to chronic conditions and research settings [61]. Studies in HCI indicate that individuals prefer the flexibility and tangibility of paper notebooks over digital products, when technology appropriation is perceived as an effortful barrier, and when poor design causes critical incidents and does not meet security and privacy needs [3,23,33].

Self-Monitoring with Self-Care Technologies

Self-monitoring personal health and wellbeing is a central part of self-managing chronic conditions [6,48]. Research in HCI has focused on the understanding of self-management practices and the use of self-care technologies [48]. In contrast to personal informatics systems, self-care technologies are specifically designed for people with chronic conditions and typically support individuals in monitoring and managing primary disease indicators with or without the involvement of caregivers and clinicians. Prior research has explored self-monitoring of: blood glucose levels in diabetes [46,49]; blood pressure by people with hypertension [37]; mood in those affected by bipolar disorder [4]; and migraine triggers [50]. These studies show that self-monitoring tools can aid individuals in engaging in reflective thinking, developing causal relationships between disease indicators and health behaviour, and adjusting to their respective conditions in everyday life [48]. Highlighting the idiosyncratic character and open-ended nature of self-care and self-monitoring practices [48], research suggests that self-care technologies should support personalisation [9] and customisation [58].

Self-Tracking with Personal Informatics Systems

Congruent with the rise of consumer health technologies, HCI research has increasingly examined the use of personal informatics tools [2] involving physical activity [27,30], food intake [15,16], sleeping behaviour [52], productivity [13], mental wellness [34], menstrual cycles [23], disease progression [3] and care-giving [63]. Rooksby et al. [15] characterise these self-tracking practices as *'lived'* - enmeshed in everyday life - and identify overlapping self-tracking styles, such as *documentary tracking* and *diagnostic tracking*. While Elsden et al. [19] have provided a design perspective on *documentary tracking*, highlighting self-expression and remembering, Karkar et al. [32] have examined *diagnostic tracking* in the context of detecting individualised food triggers in irritable bowel syndrome. People gain self-awareness through self-tracking, and use technologies to develop or maintain good physical and nutritional practices [35]. Moreover, self-tracking is a social practice [44]. Chung et al. [12] revealed people's adaptive practices and motivations for self-tracking and sharing food pictures on Instagram, namely providing motivation for peers and seeking support for their own nutritional behaviours and eating goals. Gui et al. [28] suggest that sharing fitness data within pre-existing networks can foster motivation and enhance social relationships. Nevertheless, a significant proportion of people stop using self-tracking tools because of a lack of actionable insights, poor aesthetics, and unmanageable maintenance [30,38,53]. Notably, some people stop using self-tracking technologies after having gained new insights or developed new routines [17], and a few people lapse and resume self-tracking because of shifting life priorities [22,38,53]. Considering these circumstances and limitations of current personal informatics tools, recent research has highlighted the importance of supporting personalisation [29], customisation [30], and flexibility [10,36].

Summary and Research Questions

Research has developed a detailed understanding of self-tracking in different domains by individuals who use both self-tracking technologies and paper notebooks [3,20,23,45]. Recently, there has been a push to semi-automated [10] and flexible self-tracking [36] to overcome the limitations of current self-tracking technologies. However, there is a lack of dedicated research on how individuals use and especially design paper notebooks to engage in self-tracking [20], and what this understanding might imply for the design of flexible self-tracking systems. In this study, we aim to inform the design of self-tracking tools through an analysis of paper bullet journal photographs and related conversation on Instagram, examining the following research questions: (1) how do bullet journalists design their paper notebooks; (2) how do bullet journalists use their notebooks to engage with others online; and (3) what design implications can be derived for future self-tracking technologies?

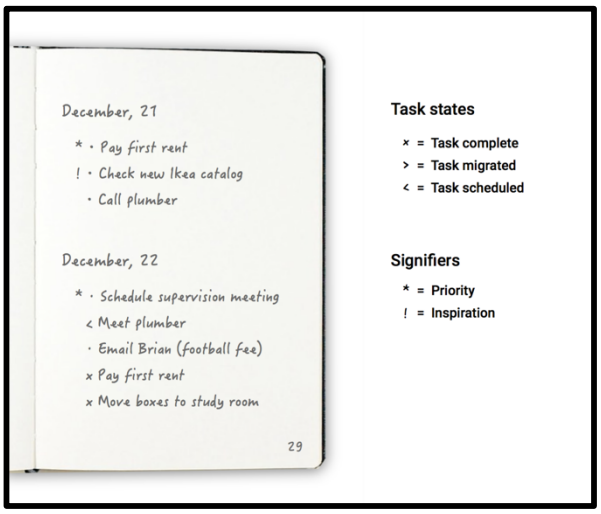

Figure 1: Example of a daily log according to [7].

METHODOLOGY

To address the questions described above, we analysed posts of paper bullet journals on Instagram. According to our university guidelines, ethical approval was not required since the data was freely available in the public domain. However, drawing on best practices on using public social media data [39,59,62], we shared a paper draft with those bullet journalists whose photos and comments we present in this paper and obtained permission to anonymise and present images and comments.

Context

Bullet journaling is an analogue and customisable system for tracking, organising, and planning [7]. It consists of different building blocks [ibid]: components for rapid logging, such as short sentences, bullets, and signifiers; and modules, such as the index, and future, monthly and daily logs. Modules help to organise the components (see Fig. 1), as well as various representations, such as to-do lists, sketches, and diary entries. Instagram is a suitable field site for gaining an understanding of bullet journaling design practices since it is a social network for sharing photos and has an active culture of sharing best practices (e.g. [12]).

Data Collection and Analysis

Data collection and analysis were conducted within an interrelated process which involved a thematic analysis of photos and related comments [5]. Microsoft Excel was used for analysing photos, and comments were analysed in NVivo. Firstly, we used the search box on Instagram's public website entering the hashtag #bulletjournal which led to 1,063,790 posts[1]. The first 100 most recent posts were manually included in an Excel sheet, grouped and analysed according to visual similarities and differences. In doing so, we identified the following tags: #habittracker, #foodtracker, #sleeptracker, #exercisetracker, #weighttracker, #moodtracker, #healthtracker, and #symptomtracker. We decided to focus on #habittracker (16,627 posts), and #moodtracker (4,861 posts) because they were most frequently used and because #habittracker was used in combination with other tags, such as #exercisetracker. Although #symptomtracker (104 posts) was less commonly used, we included it because it depicted a contrastive numeric case. In the next phase, the three hashtags were used to extend our corpus. We excluded photos that had obvious commercial purpose, low quality, insufficient legibility, and did not show pages of a paper bullet journal. All photos were classified by type of tracker (habit, mood, symptom), type of visualisation (e.g. matrix, graph, table), and temporal dimension (daily, weekly, monthly, annual). Data were iteratively coded along visual clusters of trackers which led to descriptions of why and how bullet journalists created different types of visualisations for different trackers. At later stages, axial coding resulted in cross-cutting themes, such as self-reflective strategies. Data collection and analysis ended when we reached theoretical saturation [14]. Our final corpus comprised 386 photos and related comments, including 54 photos of typical bullet journaling elements, and 152 habit-, 136 mood-, and 44 symptom trackers.

It should be considered that this methodology has limitations: additional interviews would strengthen findings regarding peoples' motivations and engagement. Involving individuals who do not share journals online would also help to uncover everyday bullet journaling practices.

FINDINGS

Drawing on our corpus of paper bullet journal photos and related conversations on Instagram, we found that individuals extended and adapted bullet journaling systems to meet their practical and emotional needs through an interplay between: (1) crafting, combining, and switching between personally meaningful textual, numeric, and symbolic representations of different types of trackers, such as habit, mood, and symptom trackers; (2) engaging in mindful reflective thinking through design practices and self-reflective strategies; and (3) posting photos of paper journals online to become part of a self-tracking culture of sharing and learning.

Evolving and Flexible Journaling Practices

The design of bullet journals varied from functional to artistic. Functional designs were minimalistic and focused, whereas artistic designs included a wide range of design practices involving re-using existing materials (e.g. scrapbook paper), decorating with stickers, creating collages, and digitally crafting, printing, and pasting textual and visual objects into paper dairies. Bullet journalists developed and switched between styles depending on skill, goal, and time available. For example, BJ163 explained:

> *"Planner Evolution! [F]irst I tried to make every spread very artistic and fancy (..), this just took too much time, so my style has evolved towards more simplistic weekly and daily spreads."*

[1] https://www.instagram.com/explore/tags/bulletjournal

Figure 2: A) Sketching practices; B) To-do list (matrix); C) Phone app use (list); D) Combination of sleep (line graphs) and habit tracker (matrix); E) Weight tracker (progress visualisation); F) Habit tracker (calendar view)

Individuals appropriated the bullet journaling system as intended using standard elements, such as signifiers and monthly logs. Moreover, they extended the bullet journaling system with different elements highlighting that they liked having control over the design of their paper notebooks. BJ12, for example, reported conceptualising and designing her journal with the help of modules:

> *"I have had so many #weeklyspread layouts over time, I now think of my #bulletjournal as #modular - and every week I pick the bits that I think I'll need. Last week, #moodtracker and #tasklist for the week. This week, #moodtracker and #meditation #quote."*

Bullet journalists explained adding, combining, testing, and switching between different types of trackers: modules used to record personal data over time. We identified 35 different combinations of trackers, and considered a tracker combination as a group of at least two different types of tracker visualisations on a single photo. The top 10 combinations were: habit & mood (n=42), habit & sleep (n=11); habit & symptom (n=7); habit & mood & sleep (n=5); mood & sleep (n=4); symptoms & sleep (n=4); habit & physical activity (n=3); habit & finance (n=3); habit & mood & finance (n=3); and mood & symptom (n=3). In the following sections, we describe the design and use of habit, mood, and symptom trackers.

Habit Trackers

Bullet journalists tracked a wide range of habits to document everyday aspects of their lives and to pursue better health and productivity, including fitness activities (e.g. running, weight lifting, meditation), food and nutrition (e.g. water, veggies, home cooking), bedtime routines (e.g. up at 7am, nap time, bed by 11), hygiene (e.g. shower, wash face am and pm), social activities (e.g. phone calls, go out), hobbies (e.g. reading, Nintendo, piano), health (e.g. period, symptoms), medication intake (e.g. drugs, vitamins), mood (e.g. tired, happy), resolutions (e.g. no junk food, no spending, no alcohol, no smoking, no tech after 11pm), and personal development (e.g. creativity, productivity, compassion, courage). In doing so, they documented defined goals with numbers (e.g. +3 fruits, 10mins outside, 10k steps), and when keeping track of fitness routines in paper diaries, many manually recorded data from fitness tracking applications, such as number of steps and sleeping time using similar or alternative types of visualisations.

We identified several different types of textual and visual representations of habit trackers (see Fig. 2): matrix (n=89), calendar (n=53), object display (n=18), list (n=18), graph (n=17), table (n=11), progress (n=8), timeline (n=3), and mandala (n=2). Habit trackers were integrated in weekly and monthly logs to structure daily routines, and combined with other types of trackers to explore relationships

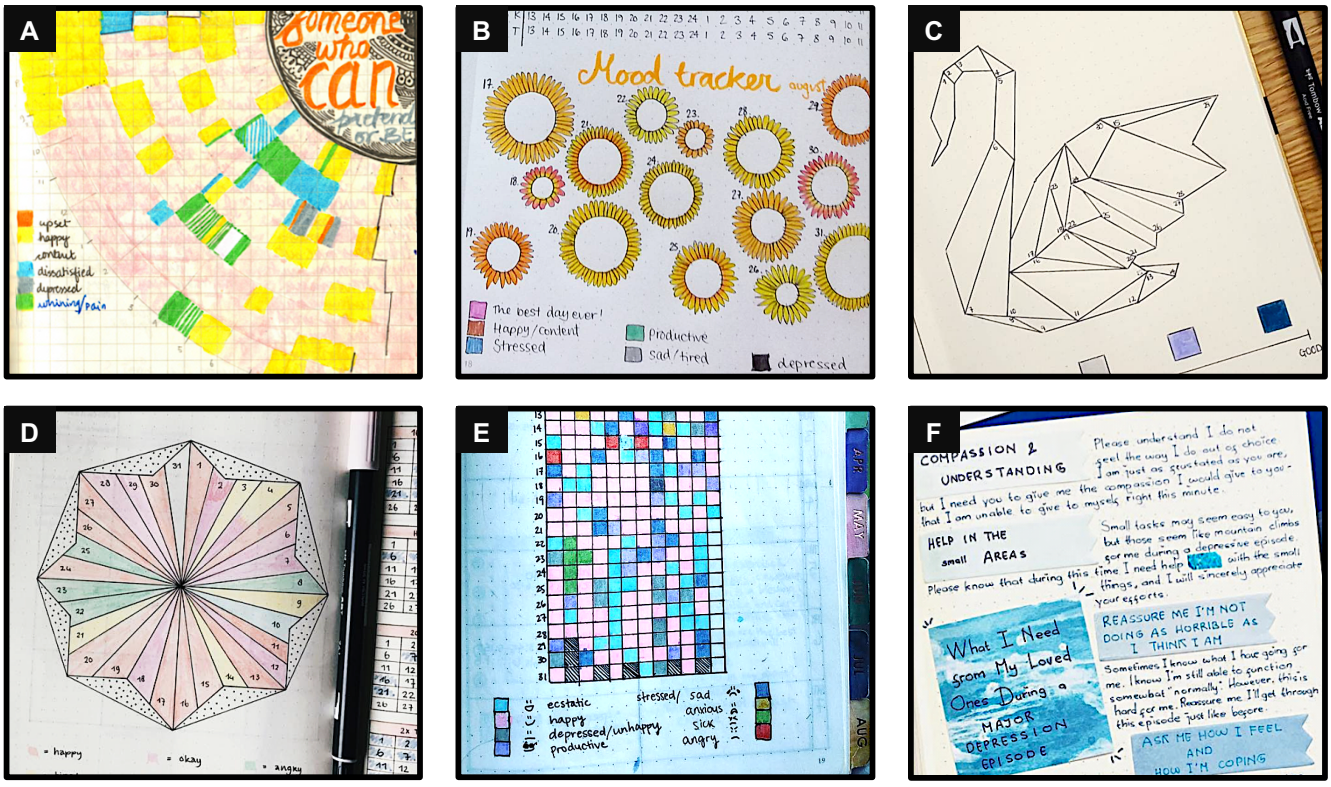

Figure 3: Mood trackers: A) Matrix; B) Object display; C) Origami; D) Mandala; E) Matrix F) Text narrative.

between habits and personal wellness (see Fig. 2, D). By choosing a specific type of visualisation, bullet journalists crafted certain perspectives on their data. For example, they created matrices to be able to compare several habits in one view or used one dedicated calendar view for each habit to focus on one habit at a time. The temporal perspective also affected people's engagement: for example, BJ54 realised that weekly logs held her more accountable than monthly trackers. Visual progress bars and counters were often attached with a clear statement of intent and created to build motivation in pursuing and maintaining health behaviours (e.g. BJ269: *"Tracking my Keto journey has really helped me adapt to this way of eating."* (see Fig. 2, E).

Visualisations also led to gratifying and sobering insights. BJ95, who documented her media consumption, reported realising that she had lost 3 hours of her life on YouTube and BJ4, who kept track of her app use with her smartphone and bullet journal, explained (see Fig. 2, C):

> *"Last week I spent almost an entire day of the week on my phone. I got an app called Ubhind that tracks how much time I spend on my phone using which apps (...). An entire day! And this is a huge improvement to the week before when I spent a whooping 28 hours on my phone. Eye opening."*

Mood Trackers

Bullet journalists posted that tracking mood was relaxing and therapeutic. It supported them in assessing their emotional wellbeing and coping with everyday life. In contrast to habit trackers, representations of mood were more individualised, decorative, and artistic, and involved the following types of visualisations (see Fig. 3): object display (n=65), matrix (n=45), graph (n=16), calendar (n=15), mandala (n=12), list (n=4), origami (n=4), and text narrative (n=4). Most visualisations involved colour codes which were described with more than one adjective covering spectra of feelings, such as *"sad, lonely, disappointed"* or *"joyful, happy, silly, content, satisfied, fulfilled, blessed."* One bullet journalist used personifications, such as *"frustrated, angry day"* and *"ehhh… day"* transferring the internal emotional state to the given day and focusing the attention on external factors.

Individuals explained having a positive emotional attachment to object displays that depicted geometric shapes, architecture (e.g. houses), vehicles, animals (e.g. cats, owls, turtles), food (e.g. pineapple, ice scream), flora (e.g. tree, flowers, leaves), and household items (e.g. cup). For example, one bullet journalist visualised a camper van, because it was her goal to own a T5 VW Transporter to travel Europe someday, and another one decided to draw and colour her favourite animals, namely, cats:

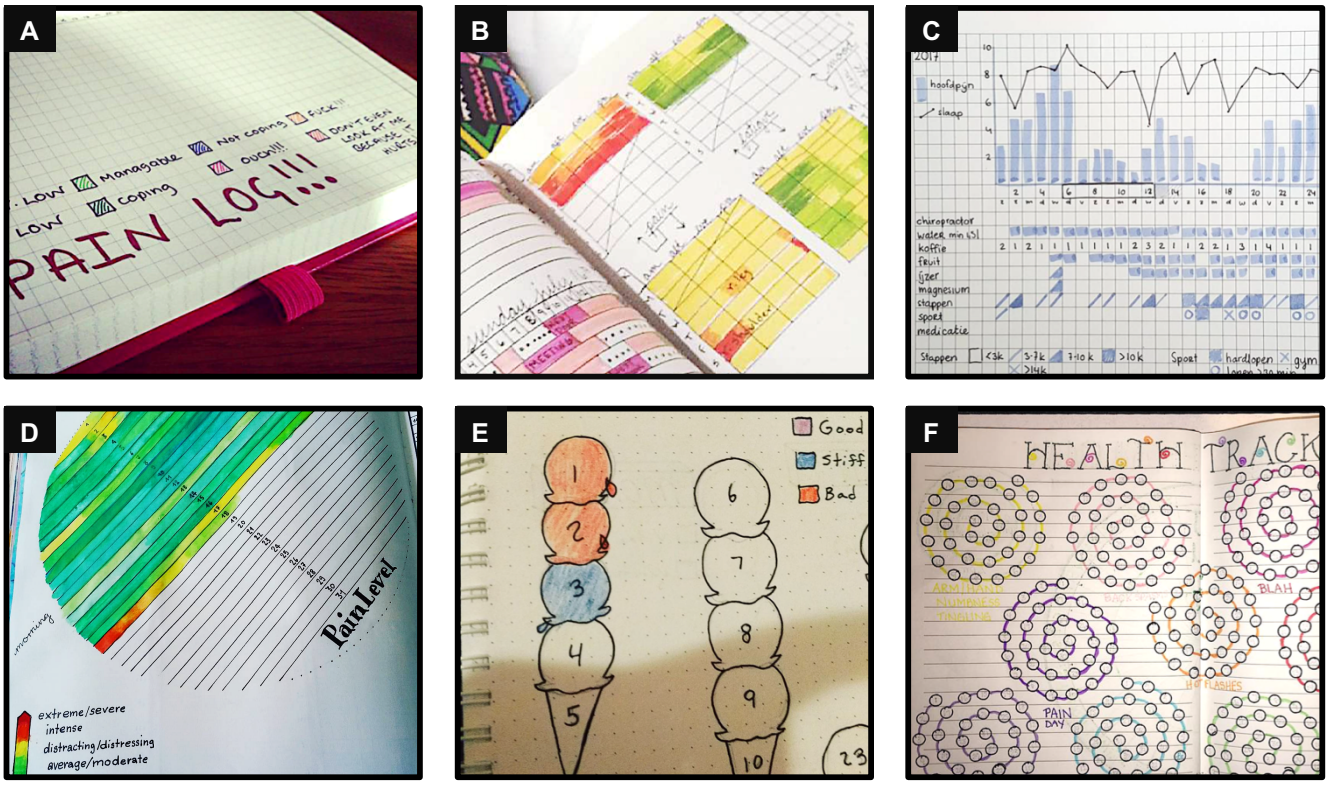

Figure 4: Symptom trackers: A) Legend; B) Matrices; C) Graphs and matrix; D) Matrix; E) Object display; F) Object display.

> *"📝 I'm setting up my #bulletjournal for the month of September. I picked a cat theme, since I obviously love cats and I didn't quite feel the autumn yet. I just created this amazing idea for a mood tracker, where I will just color a cat with my main mood each day 😻 already looking forward to September!"* (BJ63)

On one hand, individuals posted that creating, visualising, and viewing the colourful representations, such as mood mandalas and origami, positively affected their emotional wellbeing (e.g. BJ18: *"I'm really liking how it's turning out, and I love how it reminds me that even the stressful, frustrating days can make something beautiful.")*. On the other, they realised that positive feelings evoked by visualisations might also affect the accuracy of reporting their mood (e.g. BJ297: "*I don't know how accurately I'll be recording my moods since just looking at this makes me cheery!* 😁").

Mood matrices helped develop understanding fluctuations of mood over a defined period of time. Most bullet journalists tracked their mood daily once or twice (e.g. AM, after work), and created weekly and monthly overviews, while a few documented their mood over one year. When creating and reflecting on tracked mood, one bullet journalist mentioned that it can be *"frustrating to put a lot of crosses down* [fill out a tracker]*"* (BJ23). Most comments highlighted that self-tracking supported bullet journalists in recognising and overcoming bad days and gaining emotional strength, as BJ220 said:

> *"I really feel that tracking my mood for the past year and a half has helped me realise when I've been sinking down, where I would have previously been ignorant to it until it was too late to turn it around. It's not always possible to stop those bad periods, but being able to look back and know that it will only last {so} long is reassuring enough to take some of the hopelessness out of it."* (BJ220)

By combining mood and habit trackers, individuals were able to realise how certain practices can impact their mood, as BJ7 wrote:

> *"I found that the afternoon at work vs. evening at home could be drastically different, the dates in blue are the weekend, which tend to be better moods* ☺️*"*

Symptom Trackers

Photos of paper bullet journals including the hashtag #symptomtracker illustrate people's documentary and diagnostic self-tracking practices. They reported engaging in symptom tracking, because it helped in recognising warning signs and relationships between health behaviours and symptoms, and gaining scaffolding in self-managing the complexities of a chronic condition. Furthermore, individuals explained that documenting symptoms supported them in communicating their health and wellbeing to clinicians.

Descriptions of symptoms covered day, time, body site of symptoms, and, in addition, emotional wellbeing, related activities, and everyday events. They documented symptoms using clinically-informed terms (e.g. *"low blood pressure"*), descriptive language (e.g. *"raspy voice, dry eyes, mouth sore, always hungry, scratchy throat"*), comparisons (e.g. *"sick like flu"*), metaphorical constructs (e.g. *"brain fog"*), and brief narratives of related activities (e.g. *"slept bad"*). Individuals captured a wide range of physical (e.g. *"fatigue, nausea, congestion"*) and psychological (e.g. *"anxiety, insomnia"*) symptoms, and described their wellbeing (e.g. *"weak, dizzy, shaky, calm"*).

Most bullet journalists documented the day of symptom onset in monthly overviews and the day and time of symptom onset in weekly overviews. Timeframes of occurring symptoms were broadly defined as *"am, noon, pm," "am, pm, and evening,"* or *"am, afternoon, evening, and pm."* Most individuals did not track the exact time that symptoms started or improved on a given day. The location of symptoms was tracked by using general terms, such as *"bones and muscles"* or specific human body parts, such as *"base head, shoulder, lower arm, hand, hip, upper leg."* One bullet journalist reported that she printed out and included a printable online template of a body shape in her diary, which she used to mark exact locations of symptoms.

Bullet journalists most frequently created matrices (n=22), followed by text lists (n=14), object displays (n=8), graphs (n=8), calendars (n=2), and mandalas (n=1) to track symptoms (see Fig. 4). They tracked symptoms in combination with everyday habits and events. For example, matrices were used because they helped identify relationships between habits and symptoms in one single view. Indeed, many bullet journalists suggested gaining valuable self-knowledge over time, such as insights about perceived relationships between medication and symptoms (e.g. BJ219 *"As the chart shows, the pain meds were definitely not causing the headaches."),* and trends of symptoms (e.g. BJ254: *"Sometimes over a long period of time you can figure out Cycles. I usually get warning signs like my hands start to hurt.").*

Mindful Experiences of Designing Paper Journals and Engaging in Self-Reflective Strategies

When engaging in habit, mood, and symptom tracking, bullet journalists expressed not only the challenges of designing paper journals but also described their positive, mindful experiences of colouring tracker visualisations and engaging in self-reflective practices.

Effort and Joy in Designing Spreads and Trackers

Bullet journalists developed a positive, multi-faceted textual and visual language spanning different trackers, symbols, sketches, themes, and narratives. However, they also made clear that the design of bullet journals involved a learning curve and many also posted trackers that included minor flaws, such as false labelling, major mistakes (e.g. BJ47: *"I messed up on the first page and ripped the whole thing[s] out* 😂*"*), and layouts that might not meet their goals (e.g. BJ150: "*This setup is not going to work for the long run...*"). Furthermore, they reported experiencing challenges in terms of planning, constructing, and extensibility of created trackers and required effort and time. For example, BJ164 expressed the tensions between the static form of created matrices and the unpredictable nature of occurring and disappearing symptoms:

> *"I still don't have enough room for my #symptom tracker so I have to figure out what else to do there. I don't have some of the things marked at all. Plus, if you have #autoimmune #illness you know this, things pop up that never occurred before here and there throughout your days so you have to have room to add those. Ugh..."*

To overcome challenges regarding effort and time required, individuals developed workarounds, such as using alternative visualisations that looked less visually pleasant but that could be constructed more quickly. They also took advantage of rulers, dividers, and paper templates for re-use, as BJ61 expressed:

> *"Then I traced them around my pages. It was kinda difficult, (I suck at math), and very time consuming (I think I made 4 templates before I got it right), but I LOVE the effect, so it was well worth it!!* 💜💞💜*"*

Despite existing challenges and workarounds, bullet journalists expressed that design practices positively affected their emotional wellbeing. For example, BJ310 decorated her weekly log with owls and made clear she was not the best at drawing but was enjoying the process of drawing. A conversation of bullet journalists revealed the visual aesthetics of using colours and its potential positive, therapeutic effect on emotional wellbeing, as BJ257 wrote: *"Colors make me happy too* 🌈*;"* and BJ53 explained: *"I love how my habit tracker is always the most colorful page in my bujo* 🌈 *and filling in the squares is so fulfilling and satisfactory* 😁*"*

Many expressed their joyful anticipation of filling out, seeing the progress in, and completing visualisations, such as matrices, (e.g. BJ219 *"I am looking forward to filling up the Monthly Chart!").* Furthermore, they explained that the visual theming can also help in coping with the challenges of setting up the layout of tracker visualisations, as BJ164 described:

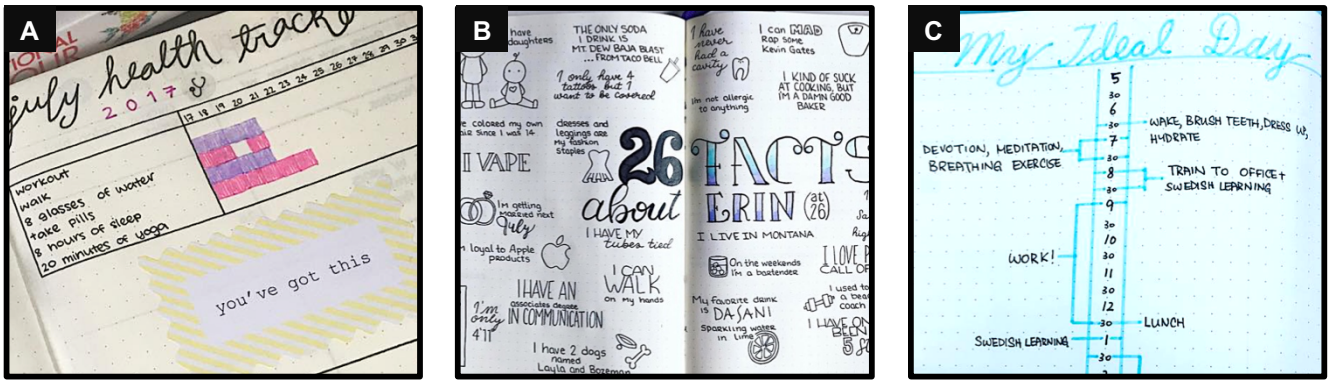

Figure 5: Examples of self-reflective strategies: A) Mindful quote; B) Facts about oneself; C) Ideal day.

> *"Oh my gosh, my head can't wrap around this [how to construct a flexible symptom tracker]. But at least the #pages are really #cheerful.* 😊*"*

Another design practice and coping strategy that became apparent across the creation of habit, mood, and symptom trackers was the shared use of positive symbols and metaphors. For example, many bullet journalists used the symbol of a cactus to represent endurance, not only in their notebooks but also in the comments sections on Instagram.

Self-reflective Strategies

When designing and completing spreads and trackers, bullet journalists reported developing self-reflective strategies to support mindful, reflective thinking. We identified different self-reflective strategies that focus on the present, past, and future self (see Fig. 5).

Firstly, there were reflective practices that concentrate on present experiences. For example, bullet journalists engaged in autobiographical writing, complementing their diaries with narratives of mundane happenings, positive events, such as having a management review and receiving "*nothing but positive feedback, praise & recognition"* (BJ116), and also revealing negative experiences (e.g. BJ147: "*When my fiancé can't deal with my depression, it broke my heart to million pieces").* Another self-reflective strategy was to incorporate mindful quotes along with mood and symptom trackers, such as, *"Just remember: even your worst day lasts for 24 hours"* (BJ124). Moreover, some bullet journalists created gratitude trackers to write down one good thing about every day to remember or had a dedicated page where they documented stressors to let go of, as BJ225 explained:

> *"My "let it go" page: […] Each day, before I leave work, I am going to choose one major stressor to let go of before leaving for home. Hopefully it helps me be more conscious of my mental well being."*

Secondly, bullet journalists engaged in retrospective, reflective thinking, remembering and processing the past by creating documentations of, for example, books read and movies watched. One bullet journalist, made a list of 26 facts about himself which was a challenging, yet "*nice self-reflective practice."* (BJ170), and BJ217 created a *"Life at Level Ten"* log to evaluate where she is in life rating her health, social relationships, personal development, recreation, and contributions.

Thirdly, they visualised and described prospective thoughts, goals, and intentions about their future self. For example, creating a timeline of *"my ideal day"* provided orientation when engaging in daily task and habit logging. Bullet journalists also included desirable personal characteristics in their habit and mood trackers, such as being positive at work, and tracked their intentions (e.g. BJ248 *"giving back, no fighting, trust, courage, and play").*

Social Learning through Online Engagement

Through sharing paper bullet journals online, individuals bridged analogue and digital and, in doing so, reported experiencing additional value in becoming part of an online community, receiving inspiration, citing each others' works, learning new best practices from peers, and having conversations around and beyond the design of paper bullet journals. Sharing photos often involved staging (e.g. choosing the background), preparation (e.g. blurring sensitive information), and providing descriptions and reflections on how and why bullet journalists designed their notebooks. For example, BJ34 described her graph in the following way (see Fig. 4, C):

> *"So I stopped taking anything on June 1st, and made this chart to keep track. The headache intensity is the blue bar, sleep the black line. I also tracked water and coffee intake, supplements (iron and magnesium), number of steps and exercise (running, hiking, gym)."*

Best practices on how to design visualisations and the kinds of tools to use, were also discussed (e.g. BJ310: *"I put little guide dots in before drawing the lines so I know where I'm heading, I've found it works a lot better than doing is freehand straight away!"*). They also motivated each other providing support and guidance. BJ83, who revealed feeling overwhelmed with tracking too many aspects of her life using different layouts, appreciated BJ82's advice:

"Make it part of your daily routine. Stick with it for at least one month and don't overcomplicate it. If you see that your productivity is increasing because of it, you can slowly start adding fun pages, but don't overwhelm yourself so that it feels like a chore."

Moreover, sharing paper bullet journaling online empowered cooperative practices: individuals teamed up to pursue and document weekly and monthly health challenges. Furthermore, they sent design challenges to each other, for example, *"to create an origami swan as next month's mood tracker"* (BJ64, see Fig. 3, C). In doing so, bullet journalists compared themselves with peers. BJ14, for example, found her symptom tracker "*plain and boring"* compared to BJ219's *"pretty January tracker."* While many appreciated the interactions with peers (e.g. BJ386: *"Thank you very much for your support […]. I'm very happy to be a part of this creative community* 😘*"*), BJ257 addressed the negative effects of social comparison: she made clear that although she is not an artist, bullet journaling made her feel happy and has lowered her anxiety. She encouraged other bullet journalists not to compare themselves with the skilled artists but to seek inspiration from them and just enjoy themselves (ibid).

DISCUSSION

Drawing on our analysis of photos of and conversations about paper bullet journals on Instagram, we have illustrated unique characteristics of paper bullet journaling: (1) being an mindful, visual journaling practice based on subjective experiences; (2) involving not only the organisation of everyday living but also documentary, exploratory, and diagnostic self-tracking styles which cover quantifiable and intangible aspects of the past, present, and future self; and (3) spanning the analogue and digital world through the creative use of pencil and paper, translating digital data into paper journals, and sharing digital representations of paper journals online within a community of practice. Based on these findings, we discuss two interrelated design perspectives: the first motivates maintaining and digitally extending analogue journaling practices rather than replacing the use of pencil and paper; the second highlights how the design practices of bullet journalists might motivate digital self-tracking as a mindful design practice as opposed to passive automation and predefined presentation of personal data.

Digitally Extending Analogue Self-Tracking

The use of paper journals remains common practice, as research studies within and beyond personal informatics suggest [3,23,26,33]. Material qualities and affordances of pencil and paper provide unique physical values and support experiences of ownership, control, and joy. Sellen and Harper [55] have compared affordances of the physical properties of paper (e.g. being *"thin, light, porous, opaque, and flexible"*) with those of digital technologies and explored how paper and digital tools could work in tandem. In this vein, our findings illustrate that analogue journaling can be digitally supported, rather than being imitated or replaced by digital technologies. Bullet journaling on Instagram exemplifies how digital technologies can *"work in concert"* [55] with analogue self-tracking tools and, in doing so, extend self-tracking experiences by supporting additional affordances and human values, such as instant communication and social learning. Here, we revisit transitions from analogue to digital and from digital to analogue to map out design spaces for future exploration.

Bullet journalists took advantage of Instagram's existing infrastructure to participate in an online community of sharing and learning, whilst being able to engage in their offline, analogue journaling practices. Through these transitions from the analogue to digital space, paper journaling - considered to be deeply autobiographical and private - became social and public (c.f. [12]). The online conversations between bullet journalists on Instagram remind us of the analogue data drawing project *Dear Data* [43] that exhibits the communication between Giorgia Lupi and Stefanie Posavec, who visualised and shared everyday experiences via physical postcards. Bullet journaling goes beyond a visual communication between two actors. It has characteristics of a community of practice with a shared language and *"self-tracking culture"* [44] encouraging the sharing of tool-based expertise. The appropriation of Instagram for sharing photos of paper notebooks online suggests that transition work, such as taking and uploading photos, could be extended by new social values, such as collaboration, playful competition, coaching, and augmenting the application with a wide range of digital actions, from copy and paste to edit and share. For example, the design of *Documentary Informatics* tools [19] could facilitate the creation and curation of digital possessions of selected experiences and memories captured in paper journals within more private social settings. The *Bullet Journal Companion* app [7] exemplifies how organisation of, searching in, and reflecting on paper notebooks can be digitally supported.

Furthermore, we observed transitions from the digital to the analogue realm: for example, bullet journalists designed mindful quotes that they printed and stuck into their paper diaries, as well as translating different types of digital data (e.g. step counts) to their paper diaries. However, they explained experiencing challenges when repetitively drawing layouts of trackers on a weekly and monthly basis and, therefore, used not only tools, such as rulers and compasses but also digitally designed and printed templates for re-use. To support these types of transitions, tailored interfaces could allow individuals to create and manage templates of trackers and use, for example, wearable fitness tracking devices and smartphones solely as data collection tools to import, arrange, and visualise data of interest. In doing so, digital personal data could be printed to gain a physical form able to be incorporated into existing paper notebooks to support design practices, from annotation to bricolage by hand.

Digital Self-Tracking as a Mindful Design Practice

Whilst the use of bullet journals mirrors characteristics of *Lived Informatics* [53] and *Documentary Informatics* [19], the design of bullet journals is at odds with the design of current self-tracking applications, especially, consumer health technologies. Here, we discuss paper bullet journaling as a mindful design practice to provide an alternative design perspective for self-tracking tools.

Rooksby at al. [53] introduced the notion of *Lived Informatics* to characterise the use of wearable fitness tracking devices as prospective and enmeshed in everyday life. In contrast to consumer health technologies that typically concentrate on automated capture of fitness data to optimise health behaviours, *Documentary Informatics* tools, such as smart journals, focus on the documentation of personal data to support remembering and reminiscence [19]. The phenomenon of paper bullet journaling on Instagram illustrates the two notions of personal informatics as a community-driven practice and presents a unique orientation towards mindful design activities: the creative, sketchy, illustrative, and artistic use of pencil and paper to keep track of and cope with felt experiences in everyday life. These design practices focus on the experience of self-expression and self-exploration highlighting that visualising data by hand can be an end in itself. They contrast with the orientation of the quantified self - *self knowledge through numbers* - and data presentation in self-tracking tools in which data collection and visualisation are predefined [36], aggregated, and separated in different views.

In contrast to separating data collection and visualisation, bullet journalists created trackers and collected data through completing trackers at a glance (e.g. filling out a matrix). In doing so, they were able to view the past, colour the present, and speculate about the future. These practices combine *stages of collection and reflection* [41] and mirror Schön's notion *reflection-in-action* [54] and lived nature of self-tracking [24]. Furthermore, bullet journalists, created overviews to visualise, for example, their mood with the help of symbolic representations that supported a positive emotional relationship to the data being presented (e.g. cats). Here, not researchers, but bullet journalists themselves created their own, personalised *"depictions of data in everyday life"* that go beyond the traditional, analytical information visualisation vocabulary [51]. In this way, they not only gained visualisation insights [11] but also engaged in mindful, reflective, and therapeutic thinking through designing and completing their visualisations, as previously reported in research interventions on art therapy (e.g. [57]).

Prior research has examined the use of organic representations to encourage physical activity [42], explored a range of design alternatives to support tailored momentary self-assessments of chronic pain [1], and empowered individuals to bridge automated and manually tracked data streams [36]. We have presented paper bullet journaling as a mindful design practice and illustrated that manual self-tracking is not necessarily a *"burden*" that needs to be overcome with automated capture. It can be an effortful, yet powerful tool for creative and reflective self-expression, self-exploration, and communication. Especially, when manual self-tracking is not forced and when values, such as flexibility and practice-based scaffolding in the form of supporting social interaction and inspiration, outweigh efforts. Building on design practices of paper bullet journalists we draw attention to the potential to explore and supporting underrepresented values and actions in the design of self-tracking technologies, such as:

- creating personally meaningful textual and visual representations and describing related legends and tracking experiences with own words and symbols
- collecting personal data through completing long-term tracker visualisations at a glance
- combining and switching between different self-tracking styles, such as organisational, documentary and diagnostic tracking
- engaging in self-reflective strategies to cope with negative and focus on positive experiences
- authoring, staging, preparing, and sharing selections of tracked data across analogue and digital worlds

CONCLUSION

The design of self-tracking technologies tends to be predefined and, therefore, often fails to support people's practical goals, emotional needs, and changes in individual living circumstances [22,36,38]. To inform the design of more flexible self-tracking tools, we have examined the analogue and customisable bullet journaling approach for tracking, organising, and planning [7]. Analysing a corpus of paper bullet journal photos and related conversations on Instagram, we found that individuals extended and adapted bullet journaling systems to meet their practical and emotional needs in everyday life. They crafted and combined personally meaningful textual, numeric, and symbolic representations of different types of trackers (e.g. habit, mood, and symptom trackers). Through design practices and self-reflective strategies, they engaged in mindful reflective thinking, and posted photos of their paper journals online to become part of a visual self-tracking culture of sharing and learning. Based on this understanding, we have discussed two interrelated design directions for flexible and mindful self-tracking: *digitally extending analogue self-tracking with additional values,* rather than replacing the use of pencil and paper, and *supporting digital self-tracking as a mindful design practice*, as opposed to concentrating only on passive automation and a predefined presentation of personal data.

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