Breaking it Down: Micro Goals in Physical Activity Tracking

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Abstract

Physical activity trackers rely on fixed daily step goals, treating the day as the primary unit for planning and evaluating activity. However, these goals often misalign with everyday life: schedules fluctuate, opportunities for movement vary, and long-term targets can be difficult to sustain, leading to frustration and disengagement. Despite growing evidence that short bouts of movement can meaningfully improve health, current systems provide limited support for acting on these brief, situated opportunities. This paper investigates micro-goals (*i.e.,* brief, situated goals) as an alternative framing for supporting physical activity. We developed *Mikro*, a smartwatch app enabling on-the-go micro-goal setting, and deployed it in a 27-day field study with 16 participants. Our findings show that micro-goals encouraged frequent tailoring, supported immediate action, and helped participants capitalize on small opportunities for movement. We argue that micro-goals can complement daily step targets by scaffolding more flexible, adaptive, and engaging ways of staying active.

CCS Concepts

• **Human-centered computing → Empirical studies in HCI**.

Keywords

Goal Setting, Physical Activity, Self-Tracking, Micro-Goals

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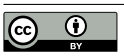
1 Introduction

More than one-third of adults worldwide fail to meet the minimum recommended levels of physical activity, a figure that has worsened over the last decade [70, 71]. Meanwhile, the dominant strategy for encouraging movement - fixed "daily step" or "minutes per day" goals [44] - often proves misaligned with people's busy daily lives. While 10,000 steps may be a familiar target, recent large-scale studies show substantial health gains from much lower thresholds (*e.g.*, 7,000 steps/day) [10, 25] and that most people average far less than these targets [4].



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Commercial trackers have reinforced this paradigm, embedding daily targets as one of the most common strategies to motivate action, and as units for measuring progress [22]. But in practice, daily goals often fail users: they offer only a single chance at success or failure each day, rarely adapt to the variability of people's routines, and can turn into constant reminders of missed expectations. Instead of motivating, daily goals frequently produce frustration, disengagement, or abandonment when repeatedly unmet.

At the same time, emerging epidemiological evidence suggests that short bursts of physical activity can have outsized health benefits. Even 1 to 3 minute bouts of brisk movement (*e.g.*, walking to catch transport) have been linked to lower cardiovascular and all-cause mortality risk, independent of the amount of daily structured exercise [61]. These findings challenge the dominance of daily aggregate metrics by highlighting how small, opportunistic actions can carry meaningful health value.

In this study we explore the adoption and value of physical activity micro-goals: *brief, situated goals (e.g., "walk 300 steps in the next 10 minutes") aiming at short bursts of physical activity* . We report on a 27-day field trial of *Mikro*, a smartwatch interface that enabled individuals to set micro-goals, and explored individuals' practices and motives around micro-goal setting as well as the impact that micro-goals had on physical activity.

Among others, we found four different practices and related motives for micro-goal setting: having fun, triggering action, documenting and learning about walking activity, and capitalizing on physical activity that would happen anyways. Micro-goals provided individuals the motivational structure for leveraging small opportunities for walking in daily life. While the impact of micro-goals on distal outcomes (*e.g.*, daily steps) were mixed, we found strong effects of micro-goals on proximal outcomes (*e.g.*, time to initiate a new walk after setting a new micro-goal), particularly in the case of short, 10-minute goals.

This papers makes the following contributions to the existing body of work on behavior change technology for physical activity promotion. First, it introduces the concept of micro-goals as a lens for physical activity tracking. We articulate micro-goals as brief, situated goals aiming at short bursts of physical activity, and argue for their potential to better align with people's everyday practices. Second, through a field trial of *Mikro*, it offers an empirical inquiry into the practices surrounding micro-goals, and their impact on physical activity. Third, it draws a number design implications for self-tracking technologies: a) on defaults as negotiation rather than anchors, b) on physical activity redistribution as a design objective, and c) on notifications as an awareness mechanism rather than a trigger. All in all, the paper identifies how goal-setting systems can move beyond static daily targets by scaffolding more flexible and proximal forms of engagement.

2 Related Work

2.1 The Pitfalls of Daily Goals and Goal Setting

While goal-setting and daily goals have been widely adopted in self-tracking and behavior change technologies, a growing body of work shows how they are often misaligned with people's everyday realities, and produce unintended effects, such as demotivation when repeatedly missed.

A central critique has focused on the use of frameworks such as SMART goals (Specific, Measurable, Achievable, Realistic, Time-bound), which are unevenly applied in practice and often operationalized as rigid daily targets that fail to accommodate fluctuations in people's routines and capacities [9, 66, 79]. A goal that feels achievable on one day may be overwhelming or impossible on another, and repeated shortfalls under such rigid framings can turn goals into a source of demoralization rather than motivation, ultimately undermining adherence [7, 41, 77, 80]. Ordóñez et al. [69] further argue that overprescribing goals can create a narrow focus that neglects broader aspects of behavior, encourage risky or unethical choices, and suppress learning and intrinsic motivation.

This mismatch is compounded by the fact that people rarely pursue health goals in isolation [26]. Research on multiple-goal shows that individuals constantly balance competing priorities: work, health, family, and that rigid daily goals can exacerbate these conflicts, producing stress, reduced well-being, and impaired self-regulation [56]. When failure is experienced under such conditions, the consequences can spiral: Cochran and Tesser [21] describe the "lost day" or "what-the-hell" effect, where missing a daily target leads people to abandon the day's effort altogether. Their work illustrates how small lapses, once framed as failure, can cascade into larger disengagement, whereas more proximate and flexible subgoals may help sustain motivation. Other studies show that goals can be demotivating when misaligning with people's abilities and motivations. Anson and Madras [7] demonstrated in a randomized controlled trial that low step-count goals inhibited walking behavior, suggesting that setting targets below an individual's perceived capability can reduce rather than encourage activity. Similarly, Hollenbeck and Klein [41] critique goal-setting theory for neglecting goal commitment: without sufficient buy-in, people may fail to engage with even moderately difficult goals, or worse, abandon effort entirely when the goal feels unattainable.

HCI and personal informatics research further illustrate these problems showing how self-tracking tools often lock users into static goals that fail to evolve with them. Gouveia et al. [36] found that users of Habito - a mobile app for promoting physical activity, rarely updated their daily step count goals, even when they consistently failed to meet them, suggesting that static, ill-calibrated goals can leave users trapped in patterns of repeated failure. In a similar fashion, Gulotta et al. [38] and Sjöklint [77] highlight how personal informatics users often encounter misalignments between system-defined goals and their own personally meaningful goals. Niess and Woźniak proposed the Tracker Goal Evolution Model precisely because static numeric goals fail to evolve with users' changing circumstances and values [66]. The model describes how people's engagement with self-tracking goals shifts over time, in some cases moving to abandonment when goals remain misaligned. Studies on the abandonment of self-tracking tools further show that goal non-attainment and misfit are among the most common reasons why people disengage from these systems [9].

Researchers have also pointed to the normative assumptions embedded in self-tracking goals. People's goals are often complex, qualitative, and evolving, yet technologies typically only support narrow, quantitative proxies [1]. Homewood's [42, 43] autoethnographic studies within clinical contexts shows how activity trackers designed to promote "more" activity were instead repurposed by users to support pacing and rest. Niess et al. [67] extend this critique by showing that many activity tracking users track primarily for monitoring or reflection rather than for chasing daily targets. In these contexts, numerical step goals were seen as irrelevant or even intrusive, leading some to explicitly reject the very idea of daily goals, insisting "I don't need a goal"— highlighting tensions between imposed numerical targets and diverse user values.

Together, this body of work reveals some of the pitfalls of daily goals and goal setting: goals are often too rigid, misaligned with individual circumstances, and prone to unintended negative effects - from misalignment and conflict, to demotivation, abandonment, and reduced flexibility in behavior.

2.2 Goal Flexibility

HCI research has begun exploring ways to introduce flexibility into goal-setting, exploring how backup and secondary goals [20, 64], goal margins [49] and duration tailoring [68], can better accommodate the realities of everyday life.

One approach is supporting multiple goals simultaneously, such as primary and secondary goals, which help users adjust effort without abandoning their intentions. Consolvo et al.'s [23] UbiFit Garden enabled both a main and an alternate weekly goal, so that progress toward the alternate could still feel like a success during busy or difficult periods. Munson and Consolvo's [64] GoalPost similarly showed that secondary weekly goals served as motivating fallbacks when the primary goal felt out of reach. Gupta et al. [39] found that backup goals helped patients avoid guilt when primary goals were missed. Beyond health, secondary goals in digital games have been shown to improve satisfaction and sustain engagement [20], though players may stop once the easier goal is met. Andersen et al. [6] further showed that secondary goals can enrich engagement when they reinforce the player's primary goals.

Another line of work has redefined goal outcomes beyond strict success or failure framings. Jung et al. [49] proposed margin-based outcome evaluation, where performance within a margin of the original target is treated as "good enough" rather than a failure. Participants who engaged with these margin-enabled goals felt less pressure, rated their performance more positively, and remained more motivated to continue pursuing their goals, even when they narrowly missed the target.

A further approach to achieving goal flexibility is to adapt goals to users' momentary capabilities. Alqahtani et al. [3] introduced goal moderation, a technique that tailors daily physical activity goals based on users' self-efficacy ratings. Others have explored negotiation-based approaches, where goals are reframed, or collaboratively configured to better reflect lived realities [32, 52, 53]. Collectively, this work shows the value of flexible goal structures that adjust to context, capability, and personal meaning.

2.3 Micro-Goals

A complementary line of research has explored flexibility by minimizing the size and duration of a goal. In the context of collaborative writing, Teevan et al. [81] proposed MicroWriter, which decomposed writing into micro-tasks, which led to improved idea generation and document coherence. Digital health research similarly shows that very short interventions - from sub-two-minute stress management to 20-second self-compassion practices [78] and digital social micro-interventions [8] - can improve wellbeing, motivation, and habit formation. Such brief and targeted approaches are often referred to as "micro-interventions", short activities embedded in daily life and designed to affect proximal outcomes such as standing up and taking a break from sedentary activity or engaging with a 20-second self-compassion practice [31, 63]. Conceptual work highlights their value in lowering both initiation barriers and sustained engagement effort with the intervention [13].

In the context of physical activity, Gouveia et al. [36] showed that people already create opportunistic "micro-plans" by checking activity trackers before and after short activities, such as a commute or a household chore, to learn how many steps it added and decide whether walk more. However, such practices were not explicitly supported by existing trackers; users had to rely on workarounds, like strategically timing glances at their devices, to make these "micro-plans" possible. Our work formalizes these practices into an explicit system of micro-goals.

We extend this work by formalizing micro-goals as *brief, situated goals* for physical activity that leverage small opportunities embedded in daily life. Unlike daily step goals or planned exercise sessions, micro-goals are designed to fit seamlessly into the flow of real-world activity, supporting movement in ways that are flexible, opportunistic, and minimally disruptive.

Briefness can be understood along three dimensions. First, micro-goals are short: Evidence from physiology and sedentary behavior research shows that even 3-10 minutes of moderate movement interrupting sedentary time has measurable cardiometabolic benefits [17, 90]. Second, micro-goals should minimize perceived effort and reduce mental barriers to initiation. A micro-goal should not require time or mental effort for planning, changing clothes, preparing equipment or commuting to a workout location. Third, micro-goals should have a near-term temporal window such as "climb the stairs once in the next 5 minutes", or "walk 300 steps in the next 10 minutes", motivating individuals to capitalize on the moment when an opportunity for physical activity arises.

The *situatedness* of micro-goals emphasizes that they should fit into a person's *current context*, while minimizing disruption of ongoing activities. A micro-goal is something one can begin *right now*, where they currently are, using the affordances of the physical and social environment, such as a hallway for quick walks, stairs nearby, a garden for a 3-minute stroll, idle time (*e.g.*, waiting for a kettle to boil), and transition moments (*e.g.*, ending a meeting, arriving home). Micro-goals should not disrupt ongoing activities. For instance, taking the stairs instead of the elevators, taking a 3-minute walking break during desk work, or taking a short detour while shopping in the supermarket, all add physical activity without significantly disrupting the primary task.

Taken together, micro-goals form a distinct category between incidental movement and planned exercise. They also differ from the short-term goals found in commercial activity trackers, such as hourly stand reminders or nudges to walk a small number of steps [30, 47], which are often system-initiated through prompts and notifications, and minimally customisable [34]. In contrast, micro-goals, as explored in this paper, are user-initiated and adjustable by design, enabling individuals to set and tailor goals in the moment based on their immediate context.

Moreover, micro-goals differ from *implementation intentions* [35], which require users to anticipate opportunities for physical activity and to develop a plan. Micro-goals reduce prospective load (individuals do not need to forecast the day), executive planning (do not need to schedule) and self-regulatory demand (goals are small and easier to achieve and embed in daily practice). These two approaches are not mutually exclusive: *implementation intentions* suit predictable routines and complex activities requiring preparation, while *micro-goals* help leverage brief opportunities for physical activity. Following Xu et al. [89], who showed that people plan in small iterations rather than rigid commitments, we propose that micro-goals can complement implementation intentions by anchoring them in daily activity flows.

3 Field study of Mikro

We designed and developed a field study using *Mikro* as a technology probe [46], with the objective of recording practices associated with micro-planning physical activity. We aimed at addressing two key research questions:

- Why, when and how do people plan *mikro goals*, and how does this change over time?
- How does micro-planning affect physical activity outcomes?

3.1 Mikro watchface

Mikro was developed as a smartwatch watchface on Android Wear. We focused on the smartwatch because of its portability and frequency with which it is checked, making it particularly suited for "on-the-go" goal setting. Prior work has shown that users interact with smartwatches 100 times per day, most often when checking for the time [72]. These brief, routine interactions provided an opportunity to integrate micro-goals into the background of everyday activity.

The design of *Mikro* was guided by the need to support micro-goals as brief, opportunistic actions that users might start while engaged in other tasks. This required an interface that could be accessed quickly, with minimal interaction and cognitive effort. Towards this, we drew on prior work on glanceable feedback for physical activity tracking [37], which emphasises presenting information in abstract, persistent visual forms that can be understood at a glance . Glanceable feedback is designed to surface core information in the background of everyday, brief interactions with technology, such as time checking, making it a natural fit for micro-goals. Following this work, we embedded Mikro directly into the main watchface using an abstract two-ring representation, keeping micro-goal progress persistently visible alongside the time, enabling users to monitor progress in the periphery of routine watch use.

Figure 1: Users create a micro-goal by double-tapping the smartwatch screen. They start by setting the target duration (b) and number of steps (c) for the micro-goal. *Mikro* then displays users' micro-goal progress through two rings (d): the outer ring represents step count progress - filling up as steps were accumulated towards the target, while the inner ring shows elapsed time. When no micro-goal is active, *Mikro* displays feedback on progress towards a daily step count goal (a).

We developed, debugged, and field-tested *Mikro* on the LG G Watch and Motorola 360 Generation 2 smartwatches.

To create a micro-goal, users long-press the watchface to open the goal-setting interface. They first choose a target goal duration (see Fig. 1b). By default, the duration is 10 minutes, adjustable via +/− buttons in 10 minute increments, with a minimum of 10 minutes. We chose a default to keep perceived effort low and to fit micro-goals into short windows during the day (e.g., between meetings). We added fixed increments to enable goal adjustment with a few taps and avoid manual typing, which is slow and error-prone on smartwatch screens, particularly while walking [86].

After selecting a duration, users choose a target number of steps. *Mikro* presents a suggested preset target, which users can accept or adjust in increments of 100 steps (see Fig. 1c). Presets are calculated from users' past data, by looking at how many steps they typically walked in a two-hour window around the same time of day on previous days (e.g., a goal set at 12:00 would draw on step data from 11:00–13:00 on earlier days). This way, presets reflected recurring time-of-day patterns while smoothing day-to-day fluctuations [19].

Once a micro-goal was set, *Mikro* displays progress towards the step target together with time remaining (Fig. 1d). When no micro-goal is active, the watchface defaults to a daily-activity view (Fig. 1a), intentionally resembling commercial activity tracker feedback (*e.g.*, Apple watch's progress rings).

Mikro also supported scheduled prompts, where users could be reminded at self-selected times of day to set a goal (see section 3.5 for more information on this selection). Prompts remained visible until accepted or dismissed and served a dual purpose: reminding users to create micro-goals, and to examine whether participants could anticipate suitable moments for physical activity. Because micro-goals were designed to be situated and brief, we were particularly interested in whether notifications helped participants forecast and capitalise on short windows of opportunity for movement.

3.2 Study Design

The study lasted for 27 days and followed a simple within-subject factorial design with three phases:

- *Baseline* (days 1-7). Participants used a stripped-down version of *Mikro*, that displayed progress toward a daily step goal (Fig. 1a) but did not support creating micro-goals. A preset goal of 10,000 steps was used, which participants could update. Baseline data was later used to generate preset step suggestions in the experimental phase, and to compare activity and practices when only a daily goal was available versus when micro-goals were introduced.
- *Experimental phase* (days 8-27). During this phase, participants used the full version of *Mikro*, which supported creating and modifying micro-goals, visualizing micro-goal progress, and receiving prompts and preset target step suggestions. The 20 days of this phase were split into two conditions (10 days in each):
  - **100% condition**: suggested step targets were based on participants' typical step rate at that time of day.
  - **200% condition**: suggested step targets were doubled in regard to participants' typical step rate at that time of day.

Participants spent 10 consecutive days in each condition, with order counterbalanced. The 200% condition was introduced to examine how participants would respond to unusually high goal suggestions. Prior work has shown that people often stick with default goals, even when those goals prove unattainable [36]. By inflating presets beyond realistic ranges, we sought to test whether participants would accept these defaults or instead take an active role in tailoring them. Importantly, participants were not informed about the change in condition, allowing us to observe whether and how they noticed on the altered recommendations in natural use.

3.3 Participants

Participants were recruited through an online questionnaire posted on Reddit, in the *lggwatchr* and *moto360* subreddits. The questionnaire covered demographics, smartwatch use, and attitude towards physical activity. To qualify, participants needed to (a) own an LG G Watch R or a Motorola 360 Generation 2 smartwatch - the devices we had tested Mikro on, running at least version 2.0 of Google's Wear operating system, and (b) commit to keeping *Mikro* installed and set as their primary watchface for the 27 days study. Widely adopted smartwatches with larger and more diverse user bases (e.g., Apple Watch, Fitbit) do not support fully custom watch faces, which influenced our choice of devices.

In line with prior work [23], we aimed to recruit participants preparing to increase their physical activity. We used the stage of change towards physical activity questionnaire [51] to measure attitude towards physical activity - which identifies individuals' intention to commit to physical exercise, according to Prochaska's and Velicer's stages of behavior change [73]. We focused on individuals in intermediate stages - those intending, or trying to change their behaviors, but not yet exercising regularly. Prior work suggests such individuals more likely to adopt and benefit from activity tracker features such as self-monitoring and goal setting [36, 59].

A total of 53 participants pre-enrolled (all male). After noticing the lack of gender diversity in early sign-ups, we broadened recruitment to smartwatch Facebook groups and broader subreddits (e.g., r/digitalhealth, r/quantifiedself), but no additional eligible participants enrolled. Of the 53 people, 16 (30%) were excluded for not owing the required smartwatches, 8 (15%) were unsure they could commit to the full study, and 13 (25%) were excluded for being in initial (2, 7%) or advanced (11, 38%) stages of behavior change. The final sample consisted of 16 participants (median age = 28, IQR= 21 – 33). Ten were located in the United States, two in the United Kingdom, and one each in Canada, France, Italy, and India. Most (12 of 16, 88%) were employed full-time: half in desk-based jobs (*e.g.*, software developer, accountant, administrative assistant) and half in roles involving regular movement (*e.g.,* waiter, retail worker). The remaining four were students, one of whom worked part-time.

All participants were regular smartwatch users and familiar with activity tracking. Thirteen (81%) reported prior use of physical activity tracking technologies and had previously followed a daily walking goal. Participants received a $50 voucher upon completion of the study.

3.4 Challenges and Limitations of the Methodological Approach

Because we viewed micro-goals as inherently situated and opportunistic, we designed our study as an in-the-wild deployment of a technology probe [46]. However, conducting such a deployment also introduced methodological challenges, particularly around participant recruitment and sample diversity.

A first challenge concerns technical dependencies of deploying novel probes as they often require specific devices to be installed on. When these devices are unevenly adopted across the population, they can narrow participation. [16].

Secondly, identifying such participants can funnel recruitment through niche, technically oriented communities that reflect their own demographics. Our recruitment through two device-specifc subreddits (r/LGGWatchR and r/Moto360) exposed us to a predominantly young, male, technically engaged community. Although we also posted across broader subreddits and smartwatch facebook groups, no additional participants enrolled. We suspect this reflects a combination of limited ownership of the required smartwatches and lower visibility of such owners in these broader communities. While recent Personal Informatics studies have achieved more gender-balanced samples on Reddit (e.g., [40, 74]), these studies did not depend on participants owning a particular device model, likely resulting in a more diverse sample.

These challenges are not unique to our study. In-the-wild deployments of custom wearable applications remain rare. A recent review of Personal Informatics work identified only three published field studies involving smartwatch prototypes [27]. Two provided smartwatches to participants (which introduces novelty effects) [18, 60], while the third recruited existing smartwatch owners and similarly reported an all male sample [37].

Taken together, these methodological constraints mean our findings primarily reflect the experiences young, technically oriented men. We therefore caution against generalising our results beyond this group. More broadly, our experience shows that studying early-stage wearable probes "in the wild" may amplify structural barriers to diversity when new systems can run only on a narrow set of existing devices. We articulate these trade-offs not only as limitations of our study but as methodological realities facing researchers investigating emerging personal informatics technologies in real-world use.

3.5 Study Procedure

The study started with an onboarding session via Skype, where we guided participants in installing *Mikro* on their smartwatch. They were told that during the first 7 days they would have a daily walking goal and that *Mikro*'s interface would display their progress towards this goal. They were also shown how to adjust this goal. Participants were asked to keep *Mikro* installed and set as their primary watch face for the full duration of the study, and informed that their physical activity and smartwatch interactions would be tracked.

At the end of this first week (day 7), participants took part in a short debriefing session (median duration = 15 minutes). In this session, they were asked about their (1) general experiences with the daily goal, (2) strategies for reaching it, and (3) impact on motivation and physical activity. Participants were then introduced to the micro-goal feature and shown how to set and adjust a micro-goal's duration and step target. They were told that there were no requirements for how many micro-goals they should set, and encouraged to create them whenever it felt relevant. Participants were also informed that the recommended step target for each goal was based on their recent walking behavior, and that the app would adapt over time as it "learned" from their activity. Finally, participants indicated the times at which they would like to be notified to set micro-goals, and were shown how to adjust these notification times through a web interface. They were told they could specify different notification schedules across the week (*e.g.*, setting distinct times for weekdays and weekends, or within weekdays).

To gain a deeper understanding of participants' experiences with micro-goals, semi-structured interviews were conducted weekly throughout the remaining 20 days of the study. While similar studies involving artifacts and technology probes have typically relied on a single interview following the intervention (*e.g.*, [55]), we opted for more frequent interviews because of the short and situated nature of micro-goals. Each interview lasted on average 20 minutes (min = 5, max = 35) and was audio-recorded. The interviews explored the following aspects: (1) general experiences with micro goals, (2) reasons for setting micro-goals, (3) contexts and timing of goal setting, (4) strategies for tailoring goals to activities or recommendations, (5) the value of notifications, (6) impact on motivation and physical activity, and (7) changes in practices over time. To facilitate recall of specific experiences, participants were also asked to choose up to two micro-goals they had set in the previous week and to describe them with respect to these same aspects. This helped ground reflections in concrete examples, while still allowing participants to speak more broadly about their overall experiences. The study was approved by our local University's ethics review board which approves human-subjects research.

3.6 Data and Analysis

In the following section, we describe the data captured through *Mikro* during the study, and methods used to perform data analysis.

3.6.1 Logged Data. We logged participants' physical activity and smartwatch use in order to investigate their goal setting practices, and respective interactions with physical activity. To log physical activity, we used Google's activity recognition API to track the start and end of walking activities, as well as the respective time and steps taken within these activities.

In addition, we logged all micro-goals created by participants. Each log included the goal's target duration and target step count, as well as the time at which the goal was set. We also captured participants engagements with notifications, including if they accepted or rejected a prompt to complete the micro-goal or set a new one.

We also tracked the instances in which participants interacted with their smartwatch, which we refer to as usage sessions. A single usage session was defined as the interval between the smartwatch screen being turned on (*i.e.*, interactive mode) and turned off or timed out (*i.e.*, ambient mode). Participants were asked to disable the smartwatch option "Tilt to wake" to prevent automatic screen activations. For each session, we tracked its start time, duration, and any interactions within (*e.g.*, launching other apps).

Before analyzing the data, we checked if participants were consistently using their smartwatch with *Mikro* set as the primary watch face. Since *Mikro* only logs data when active as the main watch face, days without usage could bias the results by not reflecting participants' actual behavior. To identify such cases, we examined daily counts of usage sessions (*i.e.,* instances in which participants activated the watch screen and viewed *Mikro*). Days with zero sessions were flagged as potential non-use. Across the study we found five such instances. However, these days still contained step count data, suggesting that participants were wearing the watch but did not actively check *Mikro* or set micro-goals. We therefore retained these days in the dataset, interpreting them as valid days of watch use without active engagement with the interface.

3.6.2 Analysis. We analyzed the previously described logged data and qualitative insights from participant interviews, focusing on three areas:

(1) **goal choices**, including the frequency with which micro-goals were set as well as their target duration and step counts;

(2) **defaults and suggestions**, where we analyzed the extent to which participants updated or followed *Mikro*'s default goal duration and step targets, and how this shaped physical activity outcomes (i.e., completion rates and steps walked). Particular attention was given to the 100% and 200% conditions, which enabled us to understand whether participants actively tailored more challenging suggestions, and

(3) **notifications**, where we investigated the timing of notifications relative to goals created, and whether notifications served as effective reminders or instead highlighted the difficulty of forecasting short windows of opportunity.

(4) Finally, drawing on Klasnja et al. [54] we inquire into both **proximal** as well **distal physical activity outcomes of micro-goals**. Distal outcomes reflect the ultimate objective of the intervention. In the case of *Mikro*, one distal outcome is the daily steps walked. However, distal outcomes are "(presumably) achieved through the accumulation of [proximal] outcomes brought about by the repeated delivery of the application's intervention components" (Klasnja et al. [54], p. 6). Each time one sets a micro-goal, an immediate effect on physical activity is likely to occur, as individuals may stand up an initiate a new walking activity to fulfill their set micro-goal. In our study we conceive the *"time to initiate a new walking activity after setting a micro-goal"* as a proximal outcome.

We first analyzed the quantitative log data. This provided an overview of how participants engaged with micro-goals, the extent to which they accepted or modified recommendations, and how notifications related to subsequent goal setting. We then turned to the qualitative interview data to contextualize and expand upon these findings. While the logs revealed what participants did, the interviews offered richer descriptions of practices and motivations that were not apparent in the quantitative data alone. For instance, while log data provided initial insights into how frequently people set micro-goals, interviews provided detailed insights into what motivated goal setting and if motivations varied over time.

Interview data were transcribed and analyzed using an open-coding approach structured around our four areas of interest—goal choices, responses to defaults and suggestions, notification use, and physical activity outcomes. Rather than coding transcripts line by line, we extracted and organized segments in which participants described their motivations, decision-making processes, and everyday practices surrounding micro-goal setting. These excerpts were then compared to patterns observed in the logged behavior data to surface convergences, discrepancies, and additional emergent themes.

Coding proceeded iteratively: the two first authors independently grouped excerpts within the four analytic areas, then collaboratively refined these groupings by subdividing or merging categories as new thematic distinctions became apparent. Through several rounds of discussion, this process yielded a set of stable

themes that captured how and why participants created micro-goals, how their strategies evolved over time, and how these choices related to physical activity outcomes. Our analytic procedure followed established guidelines for qualitative analysis as described by LeCompte [58].

4 Findings

All in all, participants set a total of 599 goals over the course of the 20 days of the experimental phase, with a median of two goals per day, per participant (IQR = 1-3, min= 0, max= 11). One third of the goals (35%, N=209) were brief, with a duration of 10 minutes (the default duration set by the application), while 76% of the goals had a duration of 30 minutes or less (see Fig.2). Participants often reflected on the practicality of short goals for being less disruptive and allowing them to retain control over them:

> "*For me, these goals should be set short, because you have more control over them. It was nice... if you had a free period, to set this goal and try to do it. You could set it for a couple of minutes and forget it. If you set them for longer, more things can get in the way and disrupt them*" (P13).

Nevertheless, 11% (N=64) of the goals had a duration of 60 minutes, while another 3% (N=19) had a duration of at least 120 minutes, suggesting that different practices were developed around the use of Mikro (see next section). Micro-goals were also set with low target steps, with 10-minute goals aiming for a median of 200 steps (IQR=100-500), and approximately 100 steps added for every additional 10 minutes of goal duration, reaching 600 steps for 60-minute goals (IQR=500-1000, see Fig.2). These are relatively low walking targets compared to typical recommendations for moderate-intensity walking, which is estimated at about 100 steps per minute [85].

4.1 Motives and Behavioral Practices around Micro-Goals

Drawing on interview data, we classified participants' motivations to create micro-goals into four main categories: having fun, triggering action, documenting activities, and capitalizing on physical activity that would happen anyways.

4.1.1 Having fun. Micro-goals were often referred to as a source of fun and excitement. Part of the fun of micro goals resulted from the ephemeral nature of their feedback - that goal-related feedback was not viewable after a goal ended. Some participants described how this made them feel less hesitant to set a goal since a potential failure would be visible briefly: "*it doesn't keep telling me that I suck when I'm less active*". While daily goals might remind users of their failures through persistent feedback, micro-goals opened space for more playful and less planned interactions. P7, for instance, pointed to the brief nature of a micro-goal as a rationale for creating goals sporadically, "*out of fun*" rather than a "*serious, planned goal*". When asked about this, he explained:

> "*it is just more of a fun thing to do and you don't feel as pressured to take it too seriously. The other one* (daily goal) *is always there and keeps you thinking: have I done enough? It forces you to think more. This small one* (micro-goal) *is gone quick and doesn't keep nagging and pushing. It is like the idea behind it allows it to be more carefree*" (P7).

A similar experience was shared by P4, who mentioned how micro-goals reduced goal-meeting anxiety: "*you could set if for a couple of minutes and do it and forget it. It's not something you have to keep remembering to do all day. It's kind of nice to get something quick.. for 10 minutes and then get back to your day*" (P4).

Another participant noted that micro-goals felt playful because they were disconnected from established targets and norms: "*it's common knowledge that you should do 10 000 steps per day, but with this smaller goal it feels more free. I just set it and see how many steps I can get in this short amount of time* (P5)".

Micro-goals were also used to make walking fun, reframing commutes as small challenges: "*It was more like a game. If I go to lunch, or this place, then I think I will walk 500 steps. That's good for 1hour.. and this becomes a small challenge*" (P12). In this sense, micro-goals resemble Whitson's notion of gamified places [88] - where everyday and sometimes monotonous tasks are overlaid with game elements to enhance engagement, satisfaction and interest. As described by P7: "*It made something normally not fun, into something really fun*". Participants described using micro-goals to make various everyday activities more enjoyable: walking to work, picking up groceries, or simply taking a break.

Further, contrasting to a daily goal - where users have only one chance per day for success or failure, micro-goals enabled participants to experience multiple small successes throughout the day. This motivated some participants to set multiple, back-to-back goals: *"Last week I set two goals back to back and got both of them"*. The same participant elaborated: "*I feel more motivated with these small goals because I can feel accomplished many times in a day* (P13)". Munson and Consolvo [64] describe the value of multiple goals, including having fallback options. We observed similar benefits. Micro-goals offered extra chances to succeed and made participants feel less guilty if a goal was not met. In this sense, micro-goals responded to the unpredictability of daily life: "*I work at Subway and whenever we were closing the store, I would say: you know what, I don't have anything to do for 10 minutes, let me walk around the store. So I would set the goal, walk around the store. That happened a couple of times, other times I'll be busy, have to quickly mop and go*" (P11). The short timeframe also made success easier to anticipate: "*It's not like I always get it right but I feel more in control of how physically active I will be than thinking ahead for the full day* (P4)".

4.1.2 Triggering action. Micro-goals served as immediate, brief prompts for action, helping participants overcome inertia and take steps towards being active. Unlike daily goals, which for some participants felt easy to put off, micro-goals created short-term motivational structures by creating a fine period where they had to achieve a defined result. As P8 explained:

> "*I think the toughest part is getting started. It's kind of a reminder, or motivation to just get started and do something instead of waiting and seeing where I end up over the course of the day (…) because it's short it kind of makes you move instead of just waiting and thinking you can do it later"*(P8).

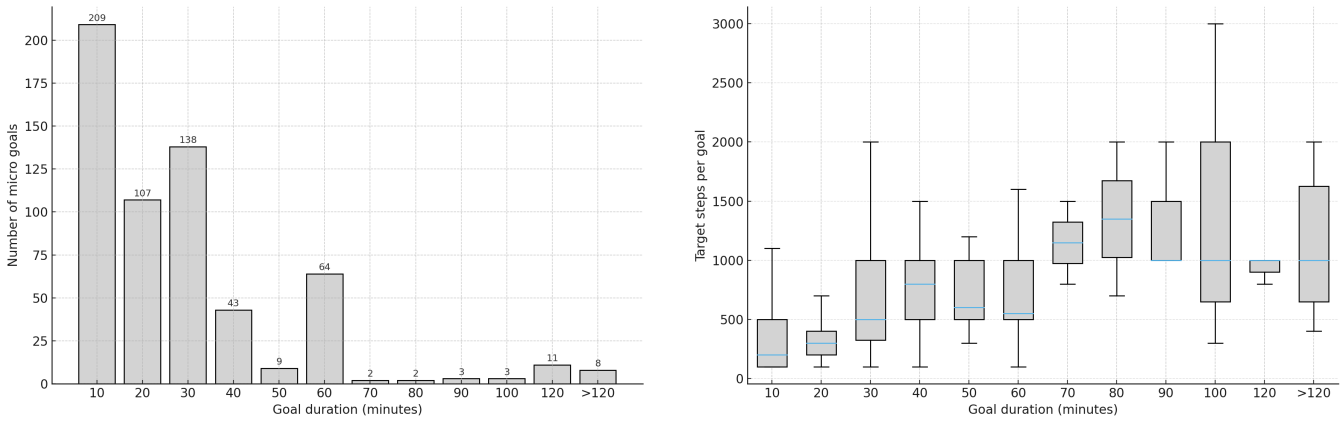

Figure 2: Distribution of micro-goal durations (left) and target steps per goal (right). Most micro-goals were short, with 10–30 minute durations being most common, while target step counts generally increased with longer durations.

For some participants, the main value wasn't the step count itself, but the nudge to to start moving: "*it's more about getting something done. In the other (daily) goal, I would look much more and see how many steps I had already, rather than thinking: oh I should jump up and move*" (P7).

While encouraging action, participants often described fitting micro-goals in existing routines rather than disrupting them: "*since I choose when I want it, it doesn't compete for so much attention. I do one when I find time for a break, or want to get up*" (P11). Similarly, P14 commented: "*Whenever we were closing the store, I would say: you know what, I don't have anything to do for 10 minutes, let me walk around the store*"?

Micro-goals were often created around moments of decision such as whether to walk or take transport. For instance, three participants set micro-goals shortly before leaving home, to force themselves walking instead of taking the bus (P2, P3, P10): "*If the weather is crap, I often tend to catch the bus. But if I set a small goal, I tend to actually make myself walk. That's why I set it 10–15 minutes before I leave home*".

While a daily goal would say achieve a certain number steps by the end of the day, a micro-goal was more proximal. This helped some participants better plan and stay aware of their activity throughout the day: "*I noticed that if I set smaller goals at certain times of the day, I would be more conscious and aware of them and be willing to strive for them. Because I constantly check my watch making sure if I was reaching them (...) With a bigger goal, you might set it, but end up forgetting about it over time* (P11)".

4.1.3 Documenting and Learning about activities. Six participants described setting micro-goals not to increase their activity, but to better understand how active they were during routine activities. These goals served as a way to explore and learn about physical activity embedded in daily life, such as commutes and errands. As P9 explained: *"I set goals when I'm walking between sites to log those walks and see how much I walk."*.

This documenting practice was often driven by curiosity. Some participants set micro-goals to tell stories or validate assumptions about themselves or others. P4, for example, set a micro-goal while Christmas shopping to prove to her husband that they always walked too much. At a music festival, P2 used micro-goals to challenge his girlfriend's teasing: *"She always calls me a lazy dancer, and I wanted to show her how wrong she was."* In these cases, micro-goals were not just about documenting an activity, they were a means to tell a story. Participants set them with a specific narrative in mind, using the data to support something they wanted to express.

For some, documenting was closely tied to learning and self-experimentation, where micro-goals were used to test small hypotheses about their activity. Participants speculated about how active they were, or how different conditions might affect that activity, and used micro-goals to find out. This type of experimentation - trying, comparing, failing, and learning seemed to be supported by the control micro-goals offered. Because participants could decide when, where, and how long a goal should be, they felt more aware of their behaviors and learning, as described by P3:

> *"Since I'm the one that's setting the goals, I get more excited in checking and am way more aware of how many steps I get to go to this place or that place. You don't think of walking to school and thinking of how many steps you take within. But this kind of gets you thinking and planning, and that helps the number make more sense."*

While in most cases action was not the primary goal, learning often led to action. P5 initially used micro-goals simply to gain awareness: *"It's something you normally don't know of. You don't think of walking to school and thinking of how many steps you take within"*, but later began setting them to monitor changes in his activity: *"Now that I have a basic understanding of how much I walk, I can see if I am slipping and need to be a bit more active."* This lead some participants to set micro-goals repeatedly around particular activities. For instance, P3 would set micro-goals before starting his daily commute to, and back from school. He described how this helped him understand how active he typically was during that commute, and monitor the impact of any changes to his commute and activity levels: "I was starting to set these habits, with more or less consistent times in which I would set these goals, like when

walking to school, or back home. That helped understand how many more steps I could get with a longer walk or some detour".

4.1.4 Capitalizing on physical activity that would happen anyways. Some participants also set micro-goals to "get credit" for already planned physical activity. Unlike goals set to encourage walking, these goals were typically set just before or during a planned activity. One participant described this as a way to *"feel good about something that was already done"* (P7).

Some seemed to be setting goals this way to benefit from the potential of achieving a goal, without having the added effort of planning a goal or striving to reach it. As described by one participant:

> "*I set these goals when I am doing certain activities, and I don't check them within these activities, because I'm busy. Like when I go shopping I set a goal but don't check it because I'm focused on buying my things and getting out. I only check at the end and think "oh cool, I reached it*" (P12).

Micro-goals, in this way, were a low-effort mechanism to avoid missing out on small wins. For example, P8 reflected: *"most of the time I was setting goals when I knew I was going to do some walking, so I figured that I might as well get credit for it"*.

A key part of this appeal was the little effort it took to set a micro-goal. Participants didn't have to reflect, plan, or calculate in advance. Goals could be created immediately before or during an activity, without needing to strategise around step targets or think hard about feasibility. This reduced load made it easier for participants to keep setting goals, especially in moments when time and bandwidth might have been limited. As one participant described, "It's nice to just set it and forget about it, I don't overthink it. If I reach it, great. If not, it's still something I tracked.". This sense of added value also meant that not setting a goal in time could feel like a missed opportunity. As one participant put it: "*I keep forgetting to set a goal, and get pretty upset that I didn't.*" (P3). The frustration wasn't about missing out on physical activity, but about not recognizing it through a goal.

4.2 Did participants adjust micro-goals?

We were surprised to find that, most of the times, participants adjusted their goals, rather than adopting the default, both in terms of duration as well as steps. 65% of the times (N = 390), participants set a goal with a duration other than the default of 10 minutes, while more than half of all micro-goals (55%, N = 336) were set with a different target step count that the one suggested to participants. The tendency to override recommendations increased over time, from 40% (N = 93/234) in the first week of setting micro-goals to 55% (N = 109/198) in the second week and 80% (N = 134/167) in the third week (see Fig. 3). However, while participants, in week 1, had about equal likelihood to decrease (19%) and to increase (21%) a recommended step goal, in week 3 they were 50% more likely to decrease the recommended step goal than to increase it (49% versus 32%, $\chi^2(1, N = 134) = 5.85$, $p < .05$).

Mean daily steps remained stable (4,200–4,400 steps per day) indicating that participants did not decrease targets as a consequence of becoming less active over the course of the study. We also inspected the number of steps participants had already accumulated

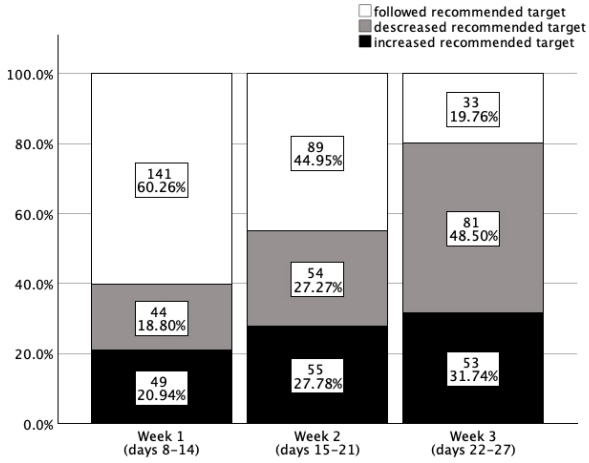

Figure 3: Adjustments to step target recommendations during the 20-day experimental phase (Days 8–27). The tendency to override recommendations increased over time, with participants in later weeks more likely to lower step targets than to increase them.

at the moment of goal-setting and found no relation between having fewer steps and either overriding recommendations or setting smaller targets. Participants set micro-goals at a range of daily activity levels, indicating that adjustments were driven by situated, agentic calibration rather than reduced activity.

These results were observed irrespective of condition order or the change in condition. Participants followed goal recommendations less frequently over time, even when switching between conditions. For those who began with the 100 % → 200 % order, the proportion of changed goal recommendations rose across weeks, from 38% ($N = 41/109$) to 51%($N = 40/79$) and 79% ($N = 45/57$). For those who began with the 200 % → 100 % order, the rates were 42%($N = 52/125$), 59%($N = 70/119$), and 81% ($N = 89/110$).

Participants would initially adopt the goals recommended by Mikro as they had limited familiarity with how much they could walk, and they deemed that Mikro made "reasonable" (P2) recommendations, and assumed that Mikro *"knew what was best for [them]"* (P16), or that *"it was doing it for a reason"* (P13). However, over time, they would gain better familiarity regarding their walking performance:

> *"In the first few days I would set it to the default one, because I wasn't very sure… I would set these small goals for 10 minutes, and see that I had already reached them in 5 minutes. I started getting a better feeling of how much I would be able to achieve. If I feel that the goal is too short or long, I change it*" (P7).

Participants often noted that this increase in goal adjustment was driven by the realization that their physical activity varied considerably with context, something the Mikro's recommendations often failed to capture:

> *"While it (Mikro) was learning how much I walk, I don't have a very fixed schedule. I usually don't wake up at the same time, or go to school at the same time. They (goal recommendations) gave me a starting point, but now I often think about them and change them when I feel it is a little short, or too much"* (P3).

These changes were also often tied to anticipating upcoming activities and contrasting them against recommendations. For instance, participants raised goal recommendations when expecting to walk more: *"when I was walking with my girlfriend I knew I was going to be walking more than at work"*, and lowered them when anticipating less activity: *"I wasn't sure if I was going to reach the 100 in time… I was busy with work"* (P9). Some found that the short time windows of a micro-goal made these judgments easier: *"you see straight away if you're going to make it"* (P3)- while others framed it as low-risk experimentation: *"If I change it and it's too much, it's only for 10 minutes"* (P11). For some, this also meant adding extra challenge as their goals changed: *"at first, it was more 'let's see what I can do,' and now it is more 'let's see how much I can push myself, now that I know what I can do'"* (P1).

Interestingly, participants were found to walk more within micro-goals where goal recommendations where changed (median 464 steps, IQR = 206–1000) compared to when following them (median 266 steps, IQR = 101–599; Mann–Whitney U = 55182, $p < .05$). Participants were also more likely to achieve a micro-goal when they changed the recommended target (54.6% completion rate, and 44.9% when recommendations were followed; Mann–Whitney U = 49250, $p < .05$). Interviews suggest this may be due to increased ownership: "I set it myself, I feel like I should to do it" (P14), and better tailoring to one's context: "when I change it, I make it better fit what's coming up" (P11); "sometimes it looked too high for me, so I lowered it" (P9)), or, conversely, more engaging when the default felt too easy ("if it was too easy, I added more (...) I wanted a bit more of a challenge" (P13)).

4.3 How did the default step recommendation influence participants' behavior?

As mentioned earlier, a default number of steps was recommended by the application when setting a micro-goal. To inquire into the power of this default, we experimented with two variations: a) the *100%* condition, where the recommended step count was participants' average walking performance during that period of the day, over the past days, and b) the 200%, where the recommended step count was doubled.

Did participants walk more in the *200%* condition? We found a marginally significant difference between the two conditions. Participants walked 38% more steps in the 200% condition, with a median of 426 steps (IQR = 160–831), versus 309 steps (IQR = 128–740) in the 100% condition (Mann–Whitney U = 48351.5, $p < .07$).

While participants were recommended double the steps in the 200% condition, we found that participants' behaviors varied considerably across those two conditions in terms of accepting the default goal, or adjusting it, upwards or downwards (see Fig. 4). In both conditions, participants had about equal likelihood of accepting the default goal (46% in the 100% condition, and 41% in the 200% condition). When adjusting a goal, however, its direction was flipped in the two conditions. Participants were more likely to decrease the recommended step count in the 200% (increased: N=57, 18%; decreased: N=132: 41%, $\chi^2(1, N = 189) = 29.76$, $p < .001$), whereas they were more likely to increase the recommended step count in the 100% condition (increased: N=100, 37%; decreased: N=47, 17%, $\chi^2(1, N = 147) = 19.11$, $p < .001$).

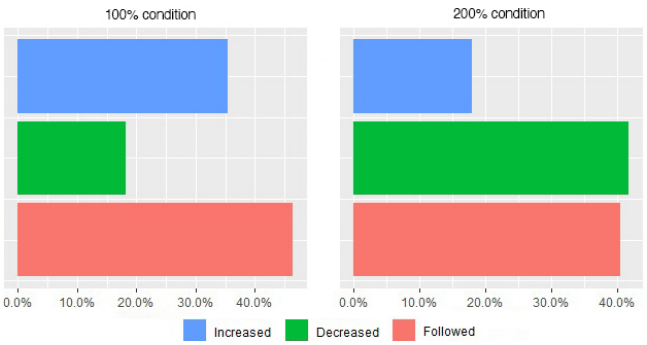

Figure 4: Participants' responses to default step recommendations in the 100% condition (left) and 200% condition (right). While defaults were accepted at similar rates across both conditions, participants were more likely to increase defaults in the 100% condition, and more likely to decrease them in the 200% condition.

4.4 How good were participants in predicting moments of opportunity for micro-goals?

On the first day of the study, participants were invited to define the number and times of reminders for setting micro-goals. All participants set goal reminders, with most setting them early on, during the first (12 participants) and second day (4 participants) of using Mikro. Most (14 of 16 participants, 89%) kept the same reminder times through the study, even though they were able to change them.

Participants set a median of 3 daily reminders (IQR = 2-4, min = 1, max = 8) to set a micro-goal. Seven participants scheduled reminders at the same times every day of the week, while the remaining nine showed variability in the times they chose, either across weekdays or between weekdays and weekends.

Notifications were distributed throughout the day, but with peaks in early morning (08:00–09:00, n = 95), midday (12:00–13:00, n = 84), and evening (18:00–19:00, n = 87). These peaks reflected how participants anchored reminders to their routines: commuting to and from work, and lunch breaks. In stable and well-defined routines, participants often purposefully timed reminders with precision in an attempt to change these routines. For example, one participant described setting a notification at 10:00 am, a time she knew she would be on the way to the University, in an attempt to "force [herself] to walk" instead of defaulting to the bus (P10).

Reminders, however, had only a minor proximal effect on the setting of micro-goals. Of the 735 notifications set, only 10 (1.4%) and 41 (5.6%) were followed by the creation of a micro-goal within the

next 5 and 30 minutes, respectively. This was not because reminders were not seen; the median time between the arrival of a reminder until it was opened on participants' smartwatches was 2 minutes (IQR=0.2-7 minutes). Instead, the gap reflected the nature of micro-goals themselves. As goals were short and designed to be acted on immediately after being set, participants had to be in, or about to enter, the "right" moment for them. Reminders often arrived when participants were busy with other tasks, or when circumstances did not match their expectations of when activity would be possible, as described by P10: "*it's just not consistent day to day" so he cannot appoint micro-goals whenever he receives a notification*" (P10). This highlights the difficulty of forecasting brief windows of opportunity in advance: even when notifications were well-timed in theory, in practice they often clashed with immediate demands of daily life.

4.5 Did Micro-goals increase physical activity?

Given the complexity of this question, we approached it in several ways. First, we examined whether participants, on average, walked more during the 20-day experimentation period compared to the 7-day baseline period. Because multiple observations were available for each individual and walking behaviour varied substantially across participants, we employed a linear mixed-effects model with random intercepts for participants. The analysis showed no significant effect of condition (experimentation vs. baseline) on daily step counts, $F(1, 413) = 0.06$, $p = .808$. At baseline, participants walked an average of 4,222 steps per day, and the experimentation was associated with a non-significant increase of 71 steps/day. The conditional R^2 indicated that 26.7% of the variance in daily steps was explained when individual differences were taken into account, whereas the marginal R^2 suggested that the condition itself explained virtually none of the variance (coefficient = 0.0001).

Next, we ran a multiple linear regression to examine whether the number of micro-goals set per day, their average duration, and average target step count predicted participants' daily steps ($R^2 = .35$, $F(3, 253) = 46.17$, $p < .001$). The number of goals one set on a day and the average step target of these goals were strong positive predictors of daily steps walked. Each additional goal set was associated with an increase of 926 daily steps ($\beta = 925.95$, $SE = 95.44$, $t = 9.70$, $p < .001$), and for each unit increase in average target steps, participants walked an additional 2.28 steps ($\beta = 2.28$, $SE = 0.37$, $t = 6.18$, $p < .001$). The average duration of goals showed a small negative trend ($\beta = -12.77$, $SE = 6.89$, $t = -1.85$, $p = .065$), though this did not reach significance.

Last, we looked at the proximal effect of micro-goals and, in particular, the time participants took to initiate a new walk after setting a new micro-goal. We included in this analysis only the micro-goals that were set while participants were inactive; these constituted the vast majority (85%, $N = 511$) of all micro-goals.

Figure 5 displays the time to start a new walking activity after setting a micro-goal, for four different goal durations: 10, 20, 30 and 60 minutes. One may quickly notice that 10-minute goals have a radically different profile that the remaining three categories. Such short-goals seem to be more effective at prompting immediate action: 29% of them ($N = 51/180$) were followed by walking within the first minute of setting them. In contrast, this occurred in only 14% ($n = 13/94$) of 20-minute goals, 9% ($n = 11/118$) of 30-minute goals, and 14% ($n = 7/51$) of 60-minute goals. A Spearman correlation further confirms a significant positive association between goal duration and time to next walk ($\rho = .31$, $p < .01$).

These results to some extend reflect the different behavioral practices outlined in section 4.1. Shorter goals were more often aligned with contexts where participants were ready to act immediately and served to motivate immediate physical activity (see section 4.1.2), whereas longer goals were more often associated with different practices, such as documenting and learning about their physical activity (see section 4.1.3), or acted as a *logged-commitment* for the near future: *"I keep these these longer ones to remember to get up and walk a couple of times in the next hour or so" [P5]*. Participants also commented that short goals had a lower threshold for action - they *"felt easy enough to start right now and get them done quickly"* [P5], without needing to plan ahead or wait for better circumstances.

5 Discussion

Our findings highlight three key themes in how micro-goals shaped participants' engagement with physical activity, which we discuss below.

5.1 Defaults as negotiations rather than anchors

A striking finding of our study is that defaults were frequently overridden: participants adjusted the preset duration of micro-goals 65% of the times and the step count 55% of the times, with adjustments increasing to 80% by the third week. This contrasts with prior work on daily goals, where defaults are rarely updated. For example, Gouveia et al. [36] found that only one in three users of a mobile step-count app ever changed their default daily goal.

Work on goal proximity helps explain this difference. Proximal goals have been found to be easier to predict and feel less effortful than distal ones [45], which are harder to anticipate and often experienced as abstract [11, 75]. Proximal goals also often serve as immediate benchmarks that support planning and make outcomes more foreseeable [87]. Research on implementation intentions similarly show that concrete, near-term "if–then" plans improve action by reducing uncertainty at the moment of action [35, 76]. In our study, micro-goals were short and situated, often described as tied to immediate circumstances, which likely made them easier to assess and adapt in the moment. By contrast, daily goals span multiple, variable contexts and are partly defined by normative recommendations (e.g., 10,000 steps per day), whose prescriptive authority can make them harder to challenge or tailor. In this sense, the frequent overriding of defaults in our study seems to reflects not resistance to system suggestions, but rather the predictability of proximal goals: their brevity invites tailoring, and users feel confident making changes when outcomes are immediately foreseeable.

Crucially, this engagement with defaults mattered. Participants walked nearly twice as many steps within micro-goals when they adjusted defaults (median 464 steps) compared to when they followed them (median 266 steps), and were more likely to complete these goals. Interviews suggested this was due to increased ownership and better contextual fit. Defaults served as useful starting points, especially early on, when some participants felt the system knew "what was best for them" [P3] or were unsure what was realistic. Over time, participants increasingly overrode presets,

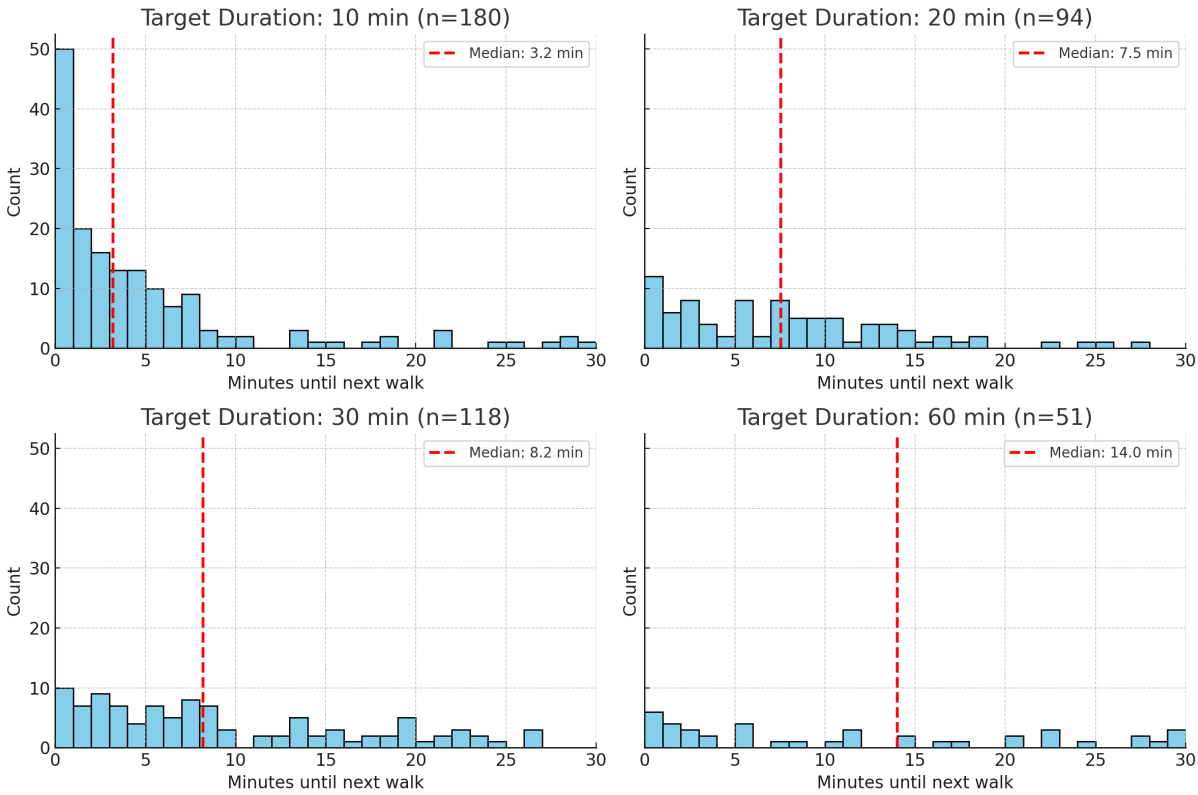

Figure 5: Distribution of the time until participants began walking after setting a micro-goal, shown for the four most common target durations (10, 20, 30, and 60 minutes).

which we interpret as growing self-efficacy: as they accumulated experiences with micro-goals, they felt more confident in setting goals. This aligns with prior work showing that autonomy and self-endorsement in goal setting are linked to higher motivation, persistence, and effectiveness [28, 82]. Similarly, systematic reviews have found that effectiveness is amplified when goals are self-endorsed and personally meaningful [33].

We also found that the direction of adjustment depended on default difficulty. When recommendations were lower (100%), participants often increased them to add challenge; when higher (200%), they tended to reduce them. This echoes Chevance et al.'s [19] "optimal goal-setting zone," where goals should be challenging enough to motivate but not so demanding that they become demoralising. It also resonates with broader goal-setting literature warning that goals set too low can inhibit behaviour [7], while overly difficult ones undermine commitment [19]. Relatedly, Alqahtani et al.'s work on goal moderation [3] showed that dynamically tailoring daily step goals to users' self-efficacy helped maintain motivation, reduce discouragement, and encourage more frequent goal adjustment. Whereas in their work goals were recalibrated automatically, Mikro made this calibration process user-driven: participants used them to exercise agency, add challenge when appropriate, or create targets that felt personally meaningful - highlighting the value of of goal flexibility that is shaped *with* the user.

At the same time, our findings highlight a design challenge: how to support people in continuing to set micro-goals over time. Participants walked more when they adjusted goals, underscoring the motivational value of agency. Yet, motivation and attentional bandwidth can fluctuate, and participants may not always initiate micro-goals even when good opportunities exist. People may therefore benefit from strategies that help surface opportunities for setting a micro-goal—such as detecting short pauses or likely windows for walking and flagging them to the user. Rather than replacing user control, such semi-automated approaches such as these could complement self-directed micro-goals, sustaining engagement during moments of low motivation or awareness, while preserving the flexibility participants valued.

5.2 Increasing or redistributing physical activity?

Did *Mikro* lead to an increase in physical activity? Our results were mixed. We found no significant difference in daily steps between the 7-day baseline and the 20-day treatment period, where participants interacted with *Mikro*. However, during treatment, the number of micro-goals set in a day was a strong predictor of daily steps, with each additional goal set being associated with an increase of 926 daily steps. We cannot infer causality here - on more active days people may simply have had more opportunities to set micro-goals

- but the association suggests that micro-goals and higher-activity days co-occur.

Even if *Mikro* had no effect on individuals' overall daily steps, we did find a strong proximal effect of micro-goals. Default, 10-min goals were particularly effective at triggering immediate action, with about 29% of them being followed by walking within the next minute. This dropped to about half (9-14%) for goals of other duration (i.e., 20, 30, or 60 minutes). This suggests that *Mikro* may have helped redistribute activity into short bursts rather than increasing total volume. In other words, it may have supported individuals in seizing small opportunities for breaks from sedentary behaviour. Such a redistribution might have significant positive health outcomes. For instance, recent studies have highlighted the beneficial effects of *VILPA* - Vigorous intermittent lifestyle physical activity. One study [29] found that brief (about 3.5 minutes) bouts of intense physical activity embedded into daily life were associated with lowers risks of adverse cardiovascular events, even among non-exercisers. Similarly, sedentary behaviour research has consistently highlighted the risks of prolonged sitting, independent of total physical activity [50]. Despite this, breaking sedentary activity rarely is an explicit design objective in physical activity tracking applications, with the vast majority emphasizing daily and weekly physical activity goals [12].

The question then raised is, if redistribution is a design objective, how can we best achieve it? This study suggests that a promising path is to engineer the motivational structure of those moments where individuals have the opportunity to add short bursts of physical activity. Contrary to daily goals that require planning, volition, and self-control, we should be asking: how can we make short bursts of physical activity salient, enticing and easy? Our qualitative results suggest that Mikro, and particulary, 10-minute goals, re-frame goal setting from an obligation to an opportunity. *Mikro* provided the structure for individuals to add short bursts of physical activity, without disrupting existing routines, and while removing the anxiety and need for self-control associated with daily goals. A similar strategy was taken by Gouveia et al. [37]. Their study aimed at exploring the design space of glanceable physical activity feedback. Taking a research through design approach, they ended up prototyping and deploying four glanceable displays. Two of those are particularly interesting here: TickTock and Normly. *TickTock* portrays sixty dashes in the periphery of one's smartwatch, each representing one of the past 60 minutes, marked as white or blue, depending on whether the user was active during that minute. Their design rationale was bifold. First, by making physical activity feedback a scarce resource (as they only presented the past 60 minutes of physical activity), they expected to build "checking habits", frequent monitoring of the smartwatch to make sure that no feedback goes unnoticed. Secondly, they expected that presenting physical activity of only the past hour would inherently lead participants to strive for keeping a balance of physical activity throughout their days, thus, re-framing users' physical activity objective from "walking a minimum of X steps per day" to "avoiding prolonged periods of sedentarism". *Normly*, on the other hand, was closer to that of a daily goal, but with a twist. Along with a ring representing one's progress towards her daily physical activity goal, it included a second ring, that represented the average progress, at that time in the day, of others that had the same physical activity goal. Every time one would look at her watch, the authors argued, would get immediate, normative feedback on how well they are doing. As they argued:

> "Consider, for instance, Fitbit Flex's glanceable feedback. The wristband features five LEDs that illuminate for each 20% of a daily walking goal achieved. However, even this seemingly simple display requires some quite difficult projections, if one wants to use it for immediate self-regulation. Since for an office worker physical activity is not a constant background task, users need to estimate how likely it is to meet the daily goal based on the distance walked so far and opportunities to walk in the future" ([37] p.146).

Interestingly, while none of the four interfaces led to significantly different levels of physical activity, the authors found subtle variations in how participants interacted and responded to feedback from each interface. For instance, in *TickTock*, participants were more likely to initiate a new walking activity if they just saw that they had been quite sedentary over the past hour. Similarly, in *Normly*, participants were more likely to start a new walk, and to walk for longer distances, when they interacted with feedback that showed them being closely behind or ahead of others (as compared to times where the distance to others was higher, in either direction).

Combined, our study and that of Gouveia et al. [37], seem to suggest that purposefully structuring these opportune moments can lead to systemic proximal effects. We would like to also note how the design strategy of *Mikro* and that of Gouveia et al. [37] differs from other types of micro-interventions, and in particular Just-in-Time-Adaptive-Interventions (JITAIs) [65] and implementation intentions [35]. Different from JITAIs, *Mikro* and Gouveia's et al. [37] glanceable displays do not require inferring an opportune moment for intervening, but rather remain passive, responding to users' voluntary engagement. Differently from implementation intentions, which require planning and effort in developing response strategies, and have shown mixed effectiveness [14, 24], a central design tenet both in *Mikro* and in Gouveia's [37] glanceable displays is to simplify, and reduce cognitive and motivational demands.

5.3 Notifications as awareness rather than triggers

In our study, reminders had a minor proximal effect on micro-goal setting. Of 735 notifications delivered, 10 (1.4%) led to a micro-goal being created within 5 minutes, and only 41 (5.6%) within 30 minutes. This contrasts with prior work where notifications substantially increased short-term engagement. For instance, Bell et al. [15] found that a single notification increased engagement with a behavior change app to reduce alcohol consumption by a factor of 3.5 within the following hour. However, in that study participants were asked to engage with app content at a time of their choosing, without the expectation of taking immediate action. By contrast, micro-goals were designed to be acted on shortly after being set, which means notifications must align with very narrow windows of availability.

This helps explain why static notification schedules were unlikely to succeed. Prior HCI work shows that notifications are more likely to succeed when arriving at opportune moments, when users are both receptive and able to act [62]. Our findings suggest that this challenge is amplified in the context of micro-goals. Unlike daily or long-term goals, which can be acted upon at many points throughout the day, micro-goals depend on short, situated opportunities (*e.g.,* "I have ten minutes right now"). Because such opportunities are difficult to forecast, fixed-time reminders will often miss them.

Yet reminders were not irrelevant. Several participants described notifications as gentle prompts that kept physical activity "in mind," even if they did not act immediately. In this sense, notifications functioned more as cues for ongoing awareness than as direct triggers of behaviour, echoing Iqbal and Horvitz's view of notifications as supporting background awareness rather than immediate task-switching [48]. These findings suggest that, in the context of micro-goals, notifications may be best designed as lightweight awareness cues with potential delayed effects, complemented by more adaptive strategies that infer when users are available and receptive to act.

5.4 Mikro as a reward system

Our interview data suggest that micro-goals also operated as a reward system. Participants frequently described satisfaction in "ticking off" small goals and appreciated the frequent sense of achievement that micro-goals afforded. This is of particular interest as the nature of micro-goals offers multiple opportunities of recognition due to the achievement of many micro-tasks. This is contrary to traditional goal-setting where the achievement of a complex goal (comprised by multiple tasks), might only be acknowledged once. The latter leads to less opportunities to receive recognition and thus suppresses the sense of achievement. Interestingly, participants were sometimes upset when they completed a micro-task but forgot to report it denoting that the feeling of frustration was not attributable to the physical activity itself but the lack of recording it and thus receiving recognition for it.

These findings highlight the promise of micro-goals as vehicles for frequent effort acknowledgment. At the same time, reward systems that are built around frequent small achievements may risk "rest-on-laurels" effects [5], where early successes lead to reduced subsequent effort. Future work should examine how to balance recognition for micro-goals with incentives to sustain effort toward more substantive objectives [83], ensuring that micro-level rewards support rather than displace longer-term progress.

6 Future work

Our findings are shaped by a participant group that was younger, male, and technically engaged. Prior work suggests that men often are guided by performance and competition driven motivations for physical activity, whereas women tend to prioritise wellbeing, and social connection [2, 57, 84]. These perspectives may explain some of our results. For example, participants competition and performance often appeared in participants' micro goal setting practices ("pushing myself," "adding a bit of challenge," "beating the suggestion"), with participants often overriding default recommendations to increase difficulty.

Future work should therefore examine micro-goals with more diverse populations, including women, older adults, people with lower self-efficacy for physical activity, and individuals less familiar with wearable technologies. This work could explore how micro-goal designs might need to use different framings or feedback structures for different user groups. Understanding how different groups interpret, set, and negotiate micro-goals will be key to avoiding designs that inadvertently reinforce gendered or demographic biases.

A second direction concerns the temporal scope of micro-goal use. Our 27-day deployment captured early adoption, but it remains unclear whether micro-goals sustain motivating over longer periods, become routinised or fade. Longitudinal studies could examine how practices of initiating and tailoring micro-goals evolve, and what forms of support—such as light-touch prompts or adaptive suggestions help maintain engagement.

Third, our design constrained durations to 10-minute increments, which may not have matched all situated opportunities. Future systems could explore finer-grained durations or adaptive defaults that better reflect users' contexts. Semi-automated scaffolds that surface opportune moments for micro-goal initiation, while preserving users' sense of agency, are another promising direction.

Finally, micro-goals operate within a broader ecosystem of activity targets. We examined them largely in isolation, but in practice, people juggle daily, weekly, and long-term goals. Future work should investigate how micro-goals complement, conflict with, or reshape these broader objectives—whether they increase total activity, primarily redistribute it, or help users adjust expectations when traditional daily goals feel out of reach.

7 Conclusion

We presented *Mikro*, a smartwatch-based technology probe that supports micro-goals—brief, situated activity goals designed to fit into the flow of everyday life. Our mixed-methods study shows that, although *Mikro* did not significantly increase overall daily steps, micro-goals shaped when and how participants were active, supporting short bouts of movement that broke up sedentary time. Participants frequently negotiated default suggestions, adjusting micro-goals to fit their context; these adjusted goals were more likely to be completed and involved more walking, underscoring the value of agency and calibration in short-term goal setting. Notifications, meanwhile, functioned less as direct triggers and more as light cues that sustained awareness. Taken together, our findings suggest that designing for micro-goals requires rethinking defaults, reminders, and reward structures - not as mechanisms for enforcing fixed daily targets, but as supports for opportunistic, user-driven action. We encourage future work to explore micro-goals with more diverse populations, over longer timescales, and in combination with other activity goals, to better understand how brief, situated commitments can contribute to sustainable physical activity in everyday life.

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