Buddy Run

Final project

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GSND6340 Biometrics of Design

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Project Purpose

Buddy Run reimagines running training by **Actively Integrating** heart rate BPM into an **intuitive, emotionally resonant coaching experience**.

Buddy Run creates a dynamic relationship between runners and their physiology through **real-time cadence optimization** and adaptive pacing guidance.

The **core purpose** is to help runners of all levels, from beginners to experienced athletes, discover and maintain their individually optimal running cadence, reducing injury risk while improving performance efficiency.

What question are you trying to answer?

Can real-time biometric data help AI provide more customized training recommendations?

Are these recommendations useful for users' running goals?

Why we are creating this way

Data

We track runners' Time, Heart Rate, Avg Cadence, Pace, MaxHR, combined with their height, weight, age, and gender. This approach enables us to provide users with more personalized recommendations and training plans. These metrics are highly achievable, offer timely feedback, and are also the data points runners care about most.

APP Design

We adopted a gamified approach, featuring cartoon characters and friend-based mechanics, to make the experience feel approachable and encourage sustained engagement.

Experimental Approach

We established a baseline to capture users' fundamental data, then adjusted their cadence to achieve desired goals. Cadence is the metric most capable of instantly altering a user's running state.

Use of biometric

How was the biometric used/integrated into your project? Was it active or passive? [5 pts]

Input:
Gender
Age
Weight
Height

Baseline:
Time
Heart Rate
Avg Cadence
Pace
MaxHR

→ **personalized physiological profile** →

intervention run testing (zone 1 to zone 5):

Time
Heart Rate
Avg Cadence
Pace

→

- haptic vibration patterns matching target cadence rhythm
- audio tempo sounds synchronized to optimal cadence.

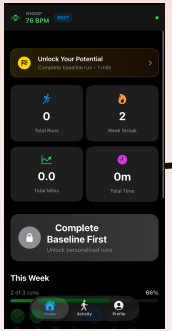
Cadence adherence (deviation from target in steps per minute)

heart rate range and stability

pacing consistency (calculated as standard deviation across run segments)

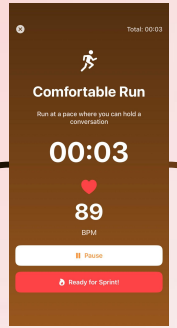
Use of biometric

How seamless is the integration? Did it distract from the experience? If the biometric tool is awkward or not especially natural, demonstrate how is it contributing positively to the overall experience. [5 pts]



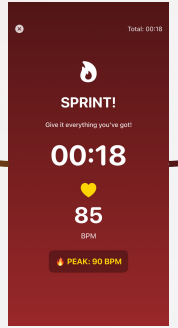
Passive Integration

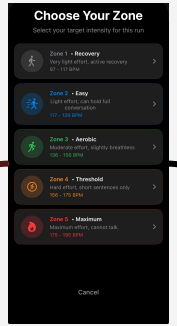
- Completely invisible — user doesn't even know it's already working
- No pairing, calibration, or HR-related confirmations needed



Design for Natual experience

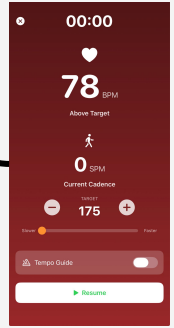
- Whoop has 10s delay in data transmission
- Sprint for better MaxHR capture



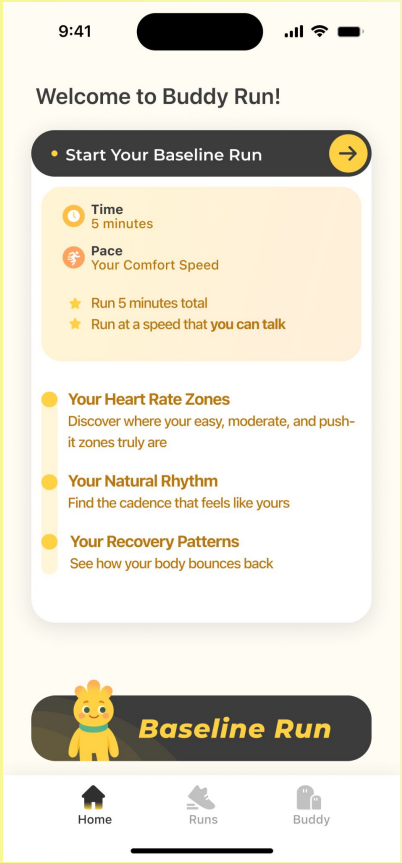


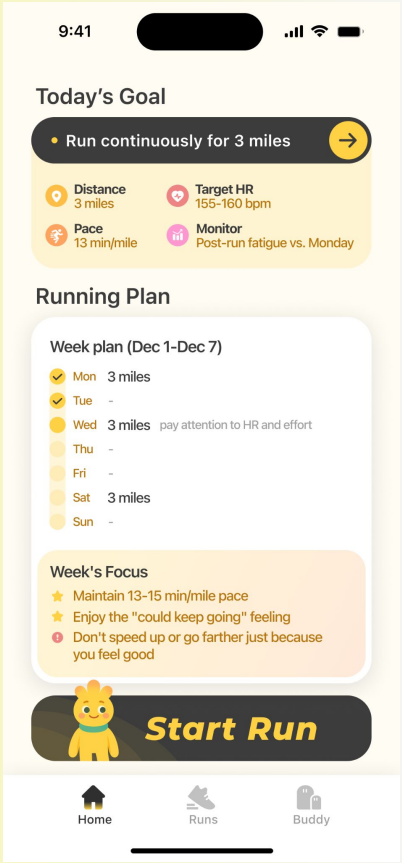
Active Integration

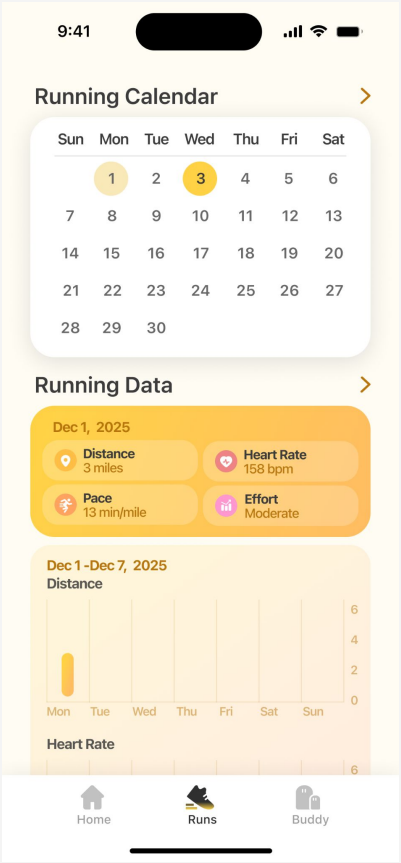
- Tempo Beaper changes when user deviate from target zone
- Change Tempo in longer period of HR change
- Helps to stabilize running speed in periodical real-time data

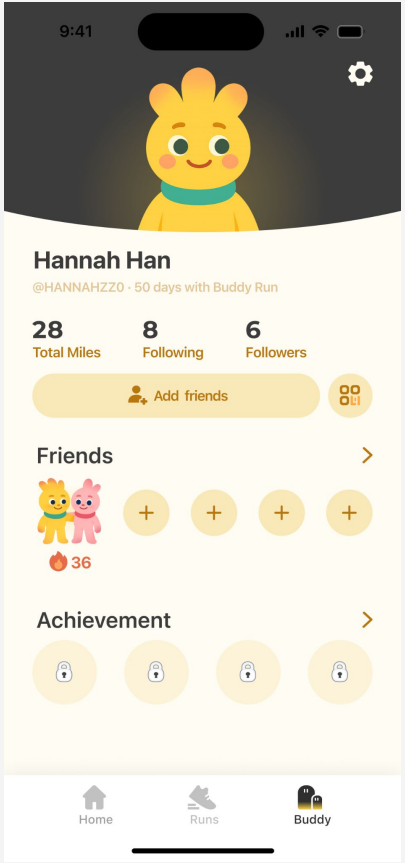


Application Overview

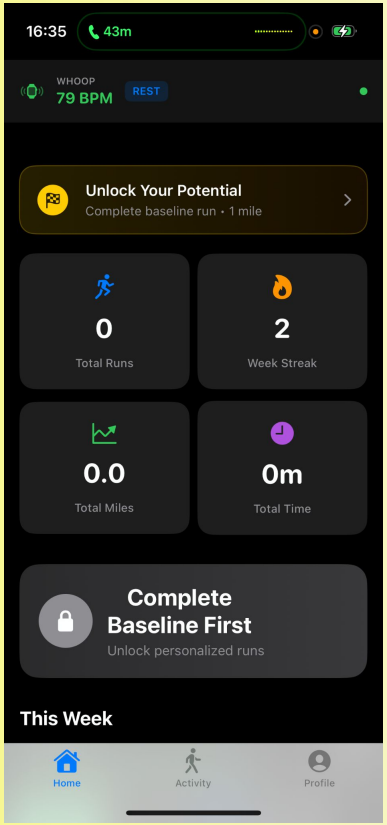


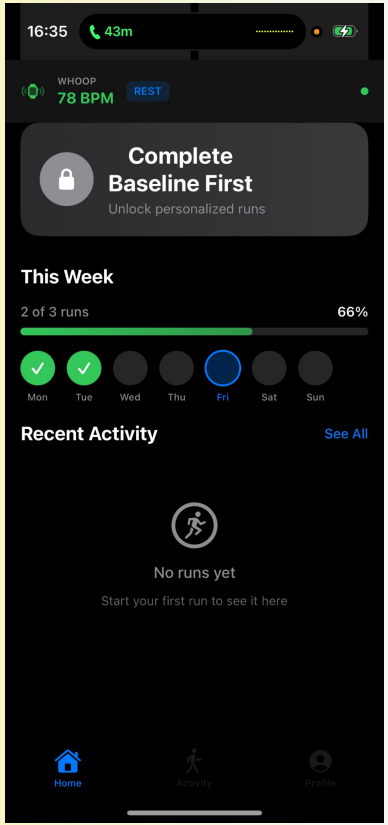


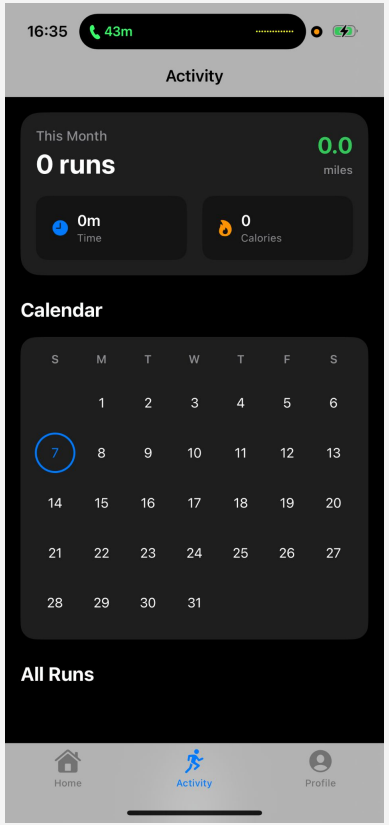


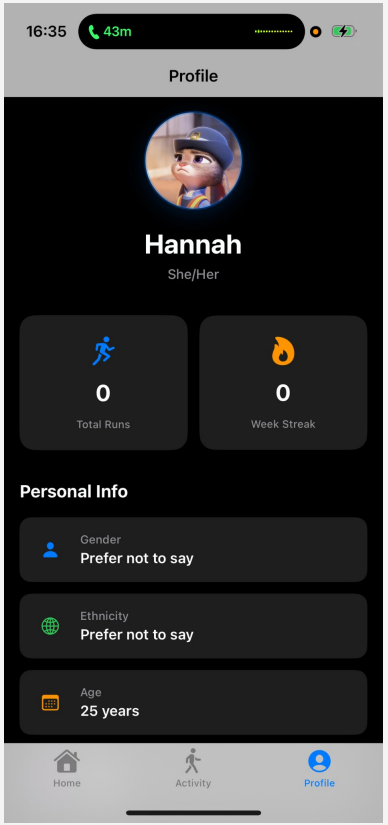


Application Overview - Demo



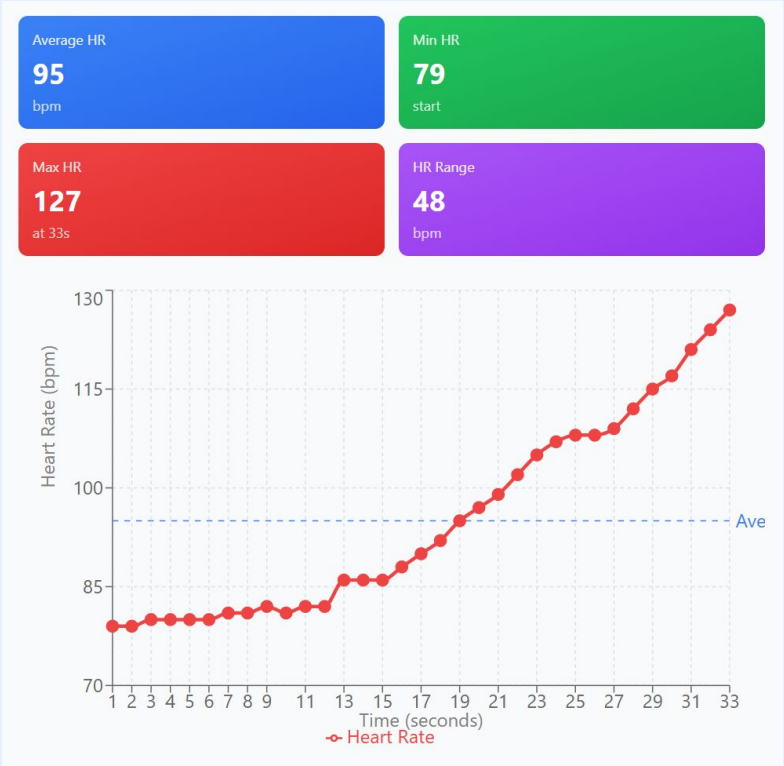






Presentation and evaluation of data

How were data from the game or designed experience used? [3 pts]



Real-Time Feedback

- Live HR → color-coded zones
- Cadence tracking → haptic tempo guide + visual bar

Personalization

- Baseline Run → individual HR zones
- Baseline cadence → progressive targets
- Height/age/weight → customize defaults

Progress Tracking

- Run history → dashboard stats
- Calendar visualization → shows patterns

Presentation and evaluation of data

Did the data lead to insights about the player/experience? If so, what were they? [4 pts]

Physiological Insights

- **Individual Capacity:** Baseline max HR can reveals true cardiovascular limits vs. generic age
  - Difficult to choose an algorithm to use such as 220-age, 208-(0.7 x age), 207-(0.7 x age), etc.
  - We wanted to analyze the range between the measured maximum and estimate max
    - For, example Komi's measured was 175 but the estimate is (207 - (0.7 x 24) =) ~190 so we have a 15 bpm range to work with.
- **Natural Rhythm:** Baseline cadence identified user's comfortable stride rate before optimization
- **Zone Accuracy:** Personalized threshold zones showed where actually performs best

Behavioral Insights

- **Pacing Control:** HR stability during runs indicated self regulation ability users who maintained green zones showed better body awareness
- **Overtraining Patterns:** Users frequently hitting red zones revealed tendency to start too fast
- **Adherence:** Run frequency data showed consistency in training habits

Presentation and evaluation of data

It is not expected that you'll have many participants, but more is expected for a UX study of an existing game/experience compared with a newly designed experience. Show the data and some estimate of the variability between participants and/or conditions. [3 pts]

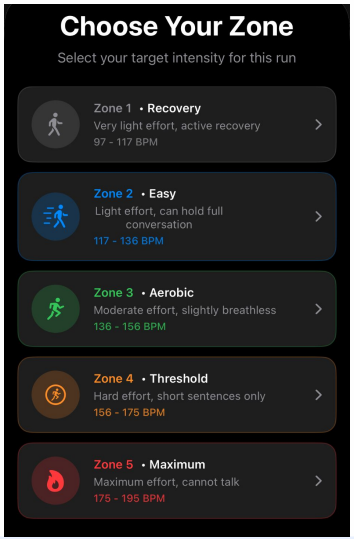
Physiological Characteristic Differences

- Gender, age (expected range 20-45 years), weight, height
- Individual differences in MaxHR can vary by 20-30 bpm
- These factors significantly impact heart rate response and pace performance

Study Design

- Autoethnographic approach due to time constraints and whoop functionality issues.
- Single participant (researchers) across multiple run conditions
- Baseline mile at your own pace so we can determine your cadence
- 30 sprint (or the best you can do so we can determine the max heart rate.

Test Case



What we learned & future work in this area

Heart rate lag: Optical heart rate sensors exhibit a 5-15 second delay during rapid changes in intensity.

Step frequency optimization is highly trainable: Through audio and tactile guidance, users can rapidly adjust their step frequency, with new habits expected to form after just 2-3 training sessions.

Progressive Guidance:
Segmented testing from Zone 1 to Zone 5 allows us to identify each user's optimal step frequency at different intensities, rather than using a universal 170-180 spm range

Future Work

By implementing **real-time feedback on the watch**, users won't need to constantly check their phones.

We aim to **reduce the lag** in data transmission between devices.

Currently, we're adjusting **Cadence**. In the future, we can explore other methods to help users achieve their goals, such as **breath rate and pace**.

Thank you