

# A Survey of Wearable Tracker Version Updates

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As part of a requirements elicitation process for the design of improved interfaces to system-level data, this short paper compares and contrasts wearable tracker 'changelog' documents that communicate software and embedded firmware updates. Seventeen models of five device families of heart rate sensing wearable trackers (from four manufacturers) conformed to specified selection criteria. The changelogs for these devices over a two-year period were analysed for content, style and consistency. Although the emphasis of all changelogs was on reporting improvements and fixes, markedly different styles were observed between manufacturers. The number of update items per version entry for the seventeen tracker changelogs varied from 1 to 6.5 and the number of words per item varied across manufacturer changelogs from 4.6 (Withings) to 18.9 (Fitbit). Changelog entries for Garmin and Withings devices employed a bullet point presentation style whereas Fitbit and Polar changelogs employed a combination of prose and bullet points. In contrast to the concise bullet points of Withings changelogs, Fitbit changelogs had a more conversational style and addressed the user in 2<sup>nd</sup> person (you/your). Ideally, the presentation, detail and relevance of changelog content would be tailored according to the needs and preferences of stakeholders such as user wearers, researchers or health professionals.

*Changelog, Release notes, Health technology, Wearable trackers, Updates*

## 1. INTRODUCTION

Wrist-worn consumer-grade wearable trackers have evolved and increased in popularity in recent years. They enable the estimation and logging of health-related metrics such as heart rate, steps per day, stairs climbed, energy expenditure and sleep quality (Godfrey et al, 2018). Although popular consumer-grade trackers are not medical devices (Fitbit, 2023a; Garmin, 2023), their potential to afford the real-world monitoring of health-related data and incentivise users toward specified goals, has led to their transitioning from the wellbeing market into health insurance, 'corporate wellness', healthcare, and health research (Woolley, 2023). Indeed, there has been a notable rise in research studies and clinical trials making use of consumer-grade wearable trackers<sup>1</sup> despite concerns about their accuracy (Bent et al, 2020) and their performance in diverse cohorts (Colvonen, 2021; Zinzuwadia and Singh, 2022; Ray et al. 2023). At the same time there are concerns about the iterative nature of devices and the quality of system

data reporting in studies, with many works omitting to report software version data and some not distinguishing between physically distinct models of the same family (Collins et al, 2019).

## 2. BACKGROUND

Changelogs are documents that record changes for the different software versions of a given system or model. As summarised in Table 1, a *changelog* comprises entries for software versions that themselves communicate one or more items of updates that might, for example, relate to additions, fixes, removals, or security updates.

**Table 1.** Definitions of changelog terms

Term	Definition
<i>Update</i>	<i>A modification to software or firmware that can correct, enhance, or otherwise modify functionality and features</i>
<i>Changelog</i>	<i>A document listing developer changes (updates) made to a product or system</i>
<i>Changelog entry</i>	<i>A section about each version of software/firmware update/s.</i>
<i>Changelog item</i>	<i>A component of an entry that refers to a change.</i>

<sup>1</sup> The NIH US National Library of Medicine ClinicaTrials.gov database includes 929 clinical trials records that indicate 'fitbit' of which 596 refer to 'fitbit' in the intervention field record (searched 23/04/2023).

Changelogs are used by developers to keep track of changes made to their codebase and, for users, changelogs can communicate changes that have been made in software updates (Rigby and Storey, 2011). For commercial products, we might expect that the level of detail in externally communicated changelogs will be limited compared to internal documentation. Examples of different wearable tracker changelog entries from different manufacturers are illustrated in Figure 1.

The term ‘release notes’ is sometimes used interchangeably with changelogs and also sometimes used to refer to user-oriented communications about specific version changes that are generally less technical and less comprehensive, and more focused on user-relevant changes (Amoeboids, n.d).

The visual, appealing, intuitive, and goal-incentivising dashboard interfaces to wearable data have contributed to the success of wearable trackers, but the interfaces to data about the devices themselves are limited and, like other system data interfaces, they contrast sharply with the very visual, appealing, and intuitive interfaces of the tracker dashboards. Perhaps it can be argued that, like Mark Weiser’s vision for ubiquitous computing (Weiser, 1996), wearable devices have succeeded as ‘quiet, invisible servants’ in helping users do the things they want to do. But, where there are stakeholder needs to access and report system-level data, observe aspects of system performance or track system changes over time, what should this interface be? What information and presentation would benefit users, researchers, health professionals or other stakeholders?

### 3. RELATED WORK

The research associated with this study was motivated by the ambition to design informative, easy-to-use interfaces to wearable system-related data for users, health researchers and other stakeholders. The observations presented in this paper contribute to the analysis component of a requirements elicitation process for a prototype health tracker system interface. The ambition is that the interface would include access to the system changelog.


There is limited reporting in the HCI literature about the design, usability and user experience relating to update communications, changelogs, and system-level information (Vitale et al., 2017; Woolley et al., 2019; Khattak, 2020). Woolley et al. (2019) investigated the nature and frequency of wearable tracker updates recorded in device changelogs. They reported on the chronology of updates and estimated the intervals where algorithm updates could impact device validations.

## What's changed in the latest Fitbit device update?

Update your Fitbit device to access the latest features and improvements. For instructions, see [How do I update my Fitbit device?](#)  
**Note:** We release updates to all customers in phases. If an update is available but you don't see it, check the app again later. We recommend plugging your Fitbit device into the charger before starting an update.

### VERSION 1.171.50

- Find new clock faces in the Fitbit Gallery in the Fitbit app. For more information, see [How do I change the clock face on my Fitbit device?](#)

- When you can't find your phone, use the Find Phone app  on your tracker to locate it. For more information, see [How do I set up and troubleshoot apps on my Fitbit device?](#)

- We fixed a battery drain issue some customers may have experienced with GPS-enabled exercises.

- This release includes bug fixes and improvements.

### VERSION 1.149.11

- Assess your heart for atrial fibrillation (AFib)—a heart rhythm irregularity—with the Fitbit ECG app. For more information, see [What is the Fitbit ECG app?](#)

- This release includes bug fixes and improvements.

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a)

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### Changes made from version 2.40 to 2.50:

- Added alert for when charging clip is not properly attached
- Pulse-Ox improvements
- Increased breathe timer duration
- Body battery improvement
- Added Vibe to Pulse Ox Reading
- Improved weather caching

### Changes made from version 2.00 to 2.40:

- Improved UI when selecting numbers
- Fixed issue clearing alarms when pairing to another account
- Fixed issue with Strength Training activity briefly showing count from previous set
- Improvements to scrolling text
- Fixed Toe to Toe activity sync issue
- Fixed issue with time becoming incorrect overnight
- Updated alarm and timer vibration patterns
- Pulse-Ox Sleep Tracking improvements
- Notification banners now repeat
- SW version now displayed after update
- Breathe timer improvements
- Improved double tap performance
- Fixed initial pairing issue when not selecting a language

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### Version 7041 - February 3rd, 2021

- Notifications fix
- Workout maximum duration modification: from 6h to 10h
- Security improvements

### Version 6981 - September 3rd, 2020

- Bug fixes and improvements

### Version 6971 - July 23th, 2020

- [Stopwatch and timer](#)

### Version 6701 - December 3rd, 2019

- [Workout pause](#)
- [Strava compatibility](#)

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### Version 6571 - November 3rd, 2019

- Bug fixes

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c)

**Figure 1:** Changelog extract examples from a) Fitbit Charge 3 (Fitbit, n.d), b) Garmin Vivosmart 4 (Garmin, n.d) and c) Withings Steel HR (Withings, n.d)

A study about improving software updating interfaces, by Mathur et al. (2016), reported that changelogs can also present information barriers for users if they are too technical or difficult to understand. The authors recommended that developers create clear and concise changelogs that are easy for users to understand. Other researchers, such as Vaniea and Rashidi (2016), have recommended that developers consider providing additional information about the purpose and consequences of updates to help users make informed decisions about whether or not to update their software.

Trust and transparency are important factors for any products, services, or businesses to succeed (Ribes et al, 2021). These traits are closely related to the HCI principles and are crucial parts of designing user interfaces that are effective, usable, and trustworthy (Rana, 2023). In a study exploring user experience and perception of smart home updates, Haney and Furman (2020), reported that users experienced inconsistency in update transparency and methods. The authors recommended that manufacturers: i) design update mechanisms that are consistent and easy for end-users to understand and implement, and ii) consider providing more information about updates, such as what changes will be made and how they will affect performance.

Documentation styles vary from developer to developer. Some use more technical and dry language while others adopt a more conversational tone. Google developer documentation style guide recommends use of the second person “Address the reader as you, and assume that the reader is the person who's doing the tasks that you're documenting.” (Google, n.d). Garmin suggests “We should sound knowledgeable and trusted but also have a personable, next-door neighbor vibe that makes consumers feel like we are talking “with” them, not “at” them.” (Garmin, 2017).

### 3. METHODOLOGY

Changelogs for consumer-grade wearable trackers were surveyed according to the following selection criteria (adapted from Woolley et al, 2019):

- Consumer-grade heart-rate sensing wrist-worn fitness trackers designed for adult use and not special edition issues.

- Device family currently available and manufacturer maintains a changelog.
- Changelog available between 1<sup>st</sup> January 2021 and 1<sup>st</sup> January 2023.

Changelogs for device models that satisfied the criteria were downloaded from manufacturer websites in January 2023. Each changelog was inspected for style, use of language, tone and consistency. MATLAB 2023a was used to create word frequency data with and without headers. The use of 2<sup>nd</sup> person pronouns (“you”, “your”, etc.) was observed and instances quantified. The number of entries (versions) per changelog were observed and the number of words per entry (version) and per item were recorded, and averages and standard deviations calculated.

### 4. RESULTS

Latest updates for wearable trackers were readily findable via Internet searches based on search strings for: (update/s OR changelog/s) AND <wearable manufacturer name>.

Seventeen consumer-grade tracker device models from five families (from four manufacturers) satisfied the selection criteria. These were the Fitbit Charge (device models: ‘HR’ and 1-5) and Inspire (‘HR’, 2 and 3), Garmin Vivosmart (‘HR’, 3 and 4), Polar Verity Sense and Withings Steel (‘HR’ and ‘HR Sports’) devices.

The top 10 changelog words in the collated changelogs for all devices satisfying the selection criteria are listed in Table 2. Tables 3 and 4 summarise the content and style of changelogs for each of the four manufacturers.

**Table 2.** Top 10 stem words in collated changelogs for all manufacturers (with headers included)

Rank	Word	Frequency (%)
1	<i>improve</i>	3.6
2	<i>version</i>	3.2
3	<i>fix</i>	2.7
4	<i>device</i>	2.5
5	<i>update</i>	2.3
6	<i>change</i>	1.9
7	<i>fitbit</i>	1.9
8	<i>your</i>	1.8
9	<i>bug</i>	1.7
10	<i>make</i>	1.6

**Table 3.** Manufacturer changelog content and style

Manufacturer	Version no.	Date	Style	Address user (2 <sup>nd</sup> person you/r vs user/s)	Words/entry	Words/item	Entries/changelog
<i>Fitbit</i>	✓	X	<i>Bullet points + prose</i>	✓	47.8	18.9	3.6
<i>Garmin</i>	✓	X	<i>Bullet points</i>	<i>Partial</i>	32.6	8.3	15.5
<i>Polar</i>	✓	✓	<i>Bullet points + prose</i>	<i>Partial</i>	114.0	17.5	2
<i>Withings</i>	✓	✓	<i>Bullet points</i>	X	8.3	4.6	13

**Table 4.** Wearable tracker model changelog composition (words, entries and items)

Model	Total no. words	No. entries (versions)	No. items	Items/entry	Words/item Average (SD)
<i>Fitbit Charge 5</i>	114	2	6	3.0	19.0 (11.2)
<i>Fitbit Charge 4</i>	398	6	19	3.2	20.0 (13.0)
<i>Fitbit Charge 3</i>	509	8	28	3.5	18.2 (11.3)
<i>Fitbit Charge 2</i>	7	1	1	1.0	7.0 (N/A)
<i>Fitbit Charge HR</i>	55	1	3	3.0	18.3 (9.3)
<i>Fitbit Charge</i>	55	1	3	3.0	18.3 (9.3)
<i>Fitbit Inspire 3</i>	7	1	1	1.0	7.0 (N/A)
<i>Fitbit Inspire 2</i>	235	3	7	2.3	33.6 (18.2)
<i>Fitbit Inspire HR</i>	173	7	12	1.7	14.4 (10.2)
<i>Fitbit Inspire</i>	166	6	11	1.8	15.1 (10.4)
<i>Garmin Vivosmart 4</i>	237	14	45	3.2	5.3 (2.7)
<i>Garmin Vivosmart 3</i>	449	19	67	3.5	6.7 (3.3)
<i>Garmin Vivosmart HR</i>	873	14	86	6.1	10.2 (6.1)
<i>Garmin Vivosmart</i>	460	15	45	3.0	10.2 (5.6)
<i>Polar Verity Sense</i>	228	2	13	6.5	17.5 (23.9)
<i>Withings Steel HR</i>	137	16	29	1.8	4.7 (4.1)
<i>Withings Steel HR Sports</i>	79	10	18	1.8	4.4 (3.3)

## 5. DISCUSSION

The emphasis on communicating device improvements and fixes is demonstrated by the relatively high frequencies of stem words “improve” and “fix” shown in Table 2 for the collated corpus of changelog documentation. However, as shown in Tables 3 and 4, manufacturer changelogs have markedly different styles. The extent of this variation was somewhat surprising given the similar nature of the devices.

With minor variations in semantic style, all manufacturers included version numbers for changelog entries. Polar and Withings also supplemented entries with dates. Garmin and Withings used bullet points to itemise updates, whereas Fitbit and Polar used a combination of bullet points and prose. Within manufacturer changelogs the styles were consistent except for a few deviations. For example, occasional mentions of “you”, “your”, “user” and “users” in Garmin items such as “*Added fireworks and text when you hit 2x/3x/etc. your daily goal*” and “*User can respond to notifications if phone allows*”. In terms of supplementary sources of information, changes in practice and alternative update communication approaches, it was observed that i) the Fitbit web interface to tracker updates was itself updated after the study data collection phase so that only the latest version of updates are now reported to visitors, ii) most manufacturers supplement changelogs or user release notes with discussion and support fora for users and iii) Huawei’s ‘Band’ heart-rate sensing wearable while not having a manufacturer-maintained changelog, does receive conversationally-styled promotional update web articles from the website, ‘huaweicentral.com’.

## 6. CONCLUSIONS AND FUTURE WORK

Manufacturer changelogs were observed to be markedly different in presentation, tone and content, for example, from terse bullet points (Withings) to a more conversational prose style addressing the user in 2<sup>nd</sup> person (Fitbit) with “you”/“your”.

Future research will elicit and analyse requirements and preferences of different stakeholder groups with the aim of exploring and evaluating alternative interfaces to changelog data tailored to stakeholder needs and interests. This will encompass both changelog interactions and information visualizations with the aim of affording and styling interactive interfaces according to different stakeholder needs and preferences. For example, stakeholder groups such as clinical or sports researchers using devices in clinical trials or research studies; athletes, coaches or sports professionals; or individuals with interests focused on their own personal activity data and their own device functionality.

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