Shut Up and Run: the Never-ending Quest for Social Fitness

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ABSTRACT

In this paper we explore possible negative drawbacks in the use of wearable sensors, i.e., wearable devices used to detect different kinds of activity, e.g., from step and calories counting to heart rate and sleep monitoring. These technologies, which in the latter years witnessed a rapid development in terms of accuracy and diffusion, are now available on different platforms at reasonable prices and can lead to an healthier behavior in people using them. Nevertheless, we will try to investigate possibly harming behaviors related to these devices. We will provide different scenarios in which wearable sensors, in connection with social media, data mining, or other technologies, could prove harmful for their users.

CCS CONCEPTS

• **Security and privacy** → **Social aspects of security and privacy**; *Social network security and privacy*; • **Social and professional topics** → *Surveillance*; *Medical information policy*;

KEYWORDS

Wearable devices, Fitness devices, Social Media, Black Mirror, Privacy, Health, Fitness

1 INTRODUCTION

In the last years a shift occurred in the context of health-care, which changed its focus from the treatment of diseases to their *prevention*, promoting better awareness of health in the general public. New technologies evolved accordingly, developing devices which claim to improve the quality of life, by helping people to modify unhealthy behaviors and aiding them to quantify their activities, gaining awareness of their life-style.

Body sensors, fitness trackers, smart watches and smart phones are light, easy to use and available at affordable prices, thus users can wear them (or simply bring them into their pocket) and start monitoring their daily activities.

Wearable activity monitors and their companion applications –e.g., Fitbit, Apple Watch, Garmin, Samsung Gear Fit, to cite some of them– not only measure physical activity, but also can provide

personalized feedbacks on other aspects of health, i.e., heart rate, calories intake and consumption, weight, and sleep patterns [15], and they translate this data into health information; new devices often include multiple charts, *social comparisons*, and indicators of progress towards individual goals [11]. The collected data are then analyzed, providing instantaneous and predictive insights to users [1] which are now able to quantify their actions and adjust them accordingly. For example, nowadays many worldwide public health problems (e.g., obesity) may occur due to the lack of physical activity. Small increases in activity could lead to positive impacts on noncommunicable conditions, i.e., type 2 diabetes, cardiovascular diseases and several cancers [14]. Thus, an healthy diet and exercising regularly can be considered modifiable risk factors, and the new wearable technologies can help (or at least, motivate) their users to keep an healthy life-style, reducing the global burden of noncommunicable diseases [1]. For the aforementioned reasons, wearable activity monitors are generally seen in a positive way, both from the scientific community and by the general public. Some issues related to the privacy of the shared data may arise, but the positive social impact of these new technologies blurs them quickly.

Nevertheless, in this work we want to highlight some negative aspects that may arise from the misuse of wearable activity trackers and their combination with social media. We want to stress the social and ethical impact that these technologies can have, in particular regarding their potential abuse. As Bauman suggested, in fact, nowadays the terms "health" and "fitness" are used synonymously, but while being *healthy* is something objective and measurable, "fitness stays permanently open on the side of 'more': it does not refer to any particular standard of bodily capacity, but to its (preferably unlimited) potential of expansion." [4]

The paper is structured as follows. Section 2 introduces the context of wearable technologies for health monitoring and highlights the related social and ethical issues which have been already addresses by scholars. Section 3 presents three Black Mirror inspired dystopian scenarios of application, while Section 4 ends the paper and proposes some actions that could help to prevent the aforementioned scenarios.

2 RELATED WORK

Wearable sensors play an important role in the medical research community, where they are already used in several fields, as e.g. patient tracking, rehabilitation, telemonitoring and surveillance of patients, assisted living, and so on [7, 8]. These sensors can classify activities performed by the person who's wearing them with a very fine granularity: in fact, sensors can recognize not only physical activities, e.g. running, climbing stairs, or swimming, but also very mundane activities as well, e.g., reading, brushing teeth, writing, and so on [7].

At the same time, the commercial fitness device market is flourishing, and such devices have been received positively by the research community as a medium which could drive better health and lifestyle habits [11], even if they are less powerful or precise as the ones that health care professionals use. For example, personalized suggestions generated by fitness applications are effective in improving their users habits, e.g., by encouraging them to exercise more or to eat healthier [13].

The challenges perceived by the research community, however, seem to be more technical than ethical. For example, when deploying wearable sensors one must enforce their security, that their battery lasts long enough, that there is enough bandwidth to reliably transfer data, or simply that the sensor is easy and unobtrusive to wear [8].

Nevertheless, wearable sensors pose significant ethical concerns. First, privacy of the users is at risk, since a huge body of sensitive data could be continuously collected and transmitted over the Internet. Second, fitness devices could undermine free, individual choices and independence, for example by producing "dependent, learning behavior" in their users [12]. Finally, it's worth addressing the cost of personal fitness or health devices. Allen and Christie [1] warn that "populations who stand to benefit the most from these technologies are unable to afford, access, or use them", so the emergence of this market could lead to greater inequalities between people who can afford to buy wearable fitness devices, and people who can not.

3 THE FITNESS DYSTOPIA

In this Section we present three different scenarios that, in true Black Mirror spirit, push the fitness request of our society at its limits. We want to stress that the technologies that could enable their realization are already available. Hence, the dystopian future we describe is definitely *possible*.

The three scenarios are presented as narrations, followed by a short comment about the available technologies that could lead to their realization.

3.1 Scenario 1: Alice's Insurance

Let us imagine Alice as a woman in her middle 20s living in a suburban area in a Western country. Alice is not a wealthy woman; she comes from a low income family, so she did not have the possibility to attend top tier universities, because she had to pay for her studies herself; she even had to resort to students loans. Alice has just found her first job. However, she lives in a country where there is no national health care, so she must buy a health insurance, and in order to obtain it, she must pass a screening by insurance companies. She requires price quotations from three insurance companies: *A inc.*, *B ltd.*, and *C&co*.

The first company, called *A inc.*, used an automatic web crawler that scanned Alice's social media. Even if Alice seldom uses them, the company was able to identify the social accounts of her relatives. This allowed *A inc.* to find out that her mother has diabetes. Hence, the company required that Alice answers a questionnaire with various answers about her medical record. The company analyzed such answers with an automatic system, which predicts if she will be diagnosed with certain conditions within the next year.

Unfortunately, the system predicted that she may be diagnosed with diabetes with an high probability. For this reason, the plan offered by *A inc.* is very costly, thus not affordable for Alice.

The second company, *B ltd.*, uses automatic social media crawlers as well, but in a different manner. *B*'s scientists divided the country in small areas of 2500 square kilometers. Then, they scanned social networks for *geotagged* posts, i.e. posts containing the GPS position of the author. Using this data, they were able to build a statistical model of the country used to make certain assumptions. For example, they counted the appearance of the word *cancer* in posts, and they (arguably) correlated it with the incidence of actual cancer incidence in the area; i.e., if in an area many users spoke about cancer, *B* requires a premium assuming (arbitrarily) that in this area its customers where at higher risk of cancer. Moreover, *B* scans social media using *sentiment analysis* as well. In Alice's area, unfortunately, the higher than average aggressiveness of the population on social media suggests that there is an high risk of developing heart diseases. Again, this information is used by the insurance company to justify a very high quotation. Alice can't afford *B*'s insurance plan as well, so she is forced to resort to the last company's questionable practices.

C&co insurance plan is, in fact, quite affordable for Alice. However, in order to obtain and maintain such a low price, *C&co* enforces their customers to wear a wearable fitness device to track them, much like a plane's "black box". If Alice subscribes to this plan, she is forced to exercise daily for at least 30 minutes, twice a day, in order to stay fit and avoid the emergence of illnesses related to a sedentary lifestyle. Moreover, she is forced to compile an eating diary. In fact, *C&co*'s social crawlers revealed her familiarity with diabetes, much like *A inc.*'s systems did. However, *C*'s approach is different: if Alice follows a diet suggested by the company, which supposedly should help her to avoid the emergence of the illness, they will let her pay less. However, the company does not blindly trust Alice: in fact, they will continue to scan her and her friends' social media, in order to find eventual discrepancies between Alice's reported diet and her actual behavior. For example, a friend of Alice's tagging her at an ice cream parlor would be considered as a breach of contract, and in turn it will lead to an insurance price increase for the next year.

Alice's choice is pretty limited. She can not afford *A inc.* and *B ltd.* plans. *C&co*'s plan, while cheap, would require her a huge sacrifice, since she already spends over an hour and a half a day in commuting; so, she would have to subtract the time required to stay fit to her already scarce social activities. If she gets ill, she has the burden to demonstrate to *C&co* that she's unable to exercise, by paying a company approved doctor to certify her condition. Moreover, the supposedly healthier diet required by the insurance company is a bit pricier than her usual diet.

Still, convinced that at the end of the game the lower price and the exercise should make her fitter and less poor, she surrenders her privacy, her free time, and her free will to *C&co*.

3.1.1 Comment. The reader could think that many of the technologies described in this Scenario are impossible or too futuristic, but this is not the case. The system that predicts the emergence of diabetes within one year already exists [5]. Eichstaedt et al. [9] were

able to build a model based only on Twitter language predicting Artherosclerotic Hearth Diseases mortality with good results.

Putting a "black box" to humans may seem unlawful or at least unethical due to the privacy concerns that this may rise, as we already pointed out in Section 2. Nevertheless, the first patent related to the use of fitness devices in health insurances can be tracked down to the early 2000s [2]. More recently, fitness device makers like e.g., Fitbit, began to sign agreements with insurance companies in order to provide discounted plans for their users. Some media already expressed their concerns, fearing that giving access of the wearables' data to the insurance companies could allow them to exploit such data even to deny coverage e.g. if they found clues of a pre-existing condition [6].

3.2 Scenario 2: Bob's Mortgage

Bob is a thirty three years old man. He has a full time permanent job, which pays well enough to allow his wife to be a stay-at-home mom. He is healthy, fit, and his medical record shows no prior episodes nor any predisposition of hereditary or genetic disorders. Recently, Bob entered a pilot project, which aims at making fitness trackers become mandatory for all adults. This way, the NHS wants to monitor the health of the citizens and, by encouraging the sharing of personal achievements on social media, to put social pressure on people in order to stay fitter. Many of Bob's friends entered the program as well, and all the group started sharing and comparing their achievements on social media.

This puts a huge pressure on Bob. In fact, while he is a perfectly fit person, he is used to sleep just seven hours per night, while the fitness tracking program goal is of eight hours per night. He consulted a clinician, which analyzed his sleep patterns with professional instruments and concluded that Bob had no sleeping problems whatsoever. Still, Bob is unconvinced by the clinician's advice, because his friend easily manage to get eight hours of sleep, and they happily share their results on social media. Bob begins to stress himself, and develops irritability, tiredness, and attention and memory problems.

However, since its new permanent job provides to his family a good income, Bob decides to buy a new house closer to the city center. Hence, he contacts his bank, looking for information about mortgages. Surprisingly, his financial advisor communicates him that at the moment he's not eligible for a mortgage, due to potential health issues detected by his personal fitness tracker.

In fact, the pilot program he enrolled in is partially financed by private companies, which are happy to cover part of the costs of buying the fitness trackers in exchange of information about their customers, current or potential. The information provided by Bob's fitness tracker, both voluntarily (i.e., shared by Bob on social media) and involuntarily (i.e., as part of the deal between his bank and the NHS) reveal his sleep problems, which have deteriorated over time, and his now frequent anxious outbreaks. This can be potentially dangerous, since Bob's new home will be located quite far from his workplace. Bob drives to work every day, thus the risk of him having a (potentially fatal) car accident due to the lack of sleep is too high for the bank to lend him such a conspicuous amount of money.

As his stress levels increase, his wife manages to get Bob visited again by a professional. The clinician diagnoses Bob with orthosomnia, a recently discovered illness where patients, trying to match the sleep requirements of their personal trackers, develop stress and anxiety problems because they can't manage to match their expectations. Much to his dismay, Bob is forcibly removed from the pilot program (who continues nevertheless) and put on mandatory psychological support.

3.2.1 Comment. Orthosomnia is a psychological condition recently identified by Baron et al. [3], who analyzed the behavior of fitness trackers users who used these devices to track their sleep. The authors "chose this term because the perfectionist quest to achieve perfect sleep is similar to the unhealthy preoccupation with healthy eating, termed orthorexia": patients, in fact, were always unsatisfied with their sleep quality, just because they didn't meet the expectations of their fitness trackers. For example, a patient "felt pressure every night to ensure his tracker would display at least eight hours of sleep", and another patient was convinced that she was sleeping poorly even if medical evidence (e.g., polysomnogram) suggested that she had no sleep related problems, only because her Fitbit didn't say so. In Bob's case, orthosomnia is aggravated by the fact that not only his fitness trackers says he doesn't sleep enough, but also his friend share positive sleep records on social media, thus increasing his pressure on getting (and possibly sharing) good results.

3.3 Scenario 3: Charlie's Problem

Charlie is an eight years old child, of normal weight, who lives in an happy neighborhood, full of kids of the same age. Charlie comes from an average-income family, which always provided him care and affection. However, he doesn't have many friends: in fact, both Charlie's parents have a full-time job, and they had to put him in a school which provides afternoon lessons, more expensive than a usual *part-time* one. For this reason, Charlie usually spends a lot of time sit at his desk studying, attending lessons, and only during the intervals he can play with his schoolmates. When it is time to go home, Charlie's parents are too tired to make him attend other afternoon activities, such as a sport or a musical instrument lesson, making his *fitness/social* rank lower than expected in his neighborhood.

Charlie usually has lunch at school, which provides a complete and balanced diet, approved by a nutritionist and a medical équipe.

Charlie's parents' workplaces are located in the same block, thus they often take the chance to spend the lunch time together. Since they don't have enough time –and sometimes they are too lazy in the evening– to bring homemade food, they often rely on the local *fast food* restaurant near their offices, where they pay via credit card. It is cheaper than an healthier choice but, they think having a lighter and balanced meal in the evening will compensate the high calories, salt, and fat intake. They don't have time to make any activity other than job and family. Thus, their fitness rank is quite low, since their unhealthy habits are constantly analyzed by the social rank system connected to their bank account.

Charlie has been discovered with a kidney condition which remained silent for the majority of his life. Nevertheless, this year he had two episodes and the physician told his parents that he

needs a surgery to avoid a kidney failure. Contrary to his parents' expectations, Charlie is very low in the scheduled surgery list, due to his apparently unhealthy behavior. Indeed, like the rest of the people, every member of Charlie's family has been provided with an activity tracker –which is attached to the personal ID profile hosted on a public national website– able to *quantify* and *rank* the activity of each person. According to this device, Charlie does not exercise as often as he is expected, thus he is categorized as *lazy*, and he is suspected of not doing enough to maintain his health. Moreover, since these data are publicly visible, the other children parent's prevent their kids to spend time with Charlie, to avoid contamination from his perceived lazier attitude.

The second important factor in the surgery list positioning was played by Charlie's parents eating habits. They often eat at the local fast food restaurant, and, since Charlie can't be tracked (he obviously does not own a credit card), a statistical cross-check suggests the system that very often children has the same eating habits of their parents.

In the end Charlie's parents provided the proofs about the food, since the school signed a paper guaranteeing that the child had an healthier habit than his parents. In this way he was able to earn few position on the surgery list. However, people with the possibility of having an healthier and supposedly fitter health style are still *ranked* higher than him.

3.3.1 Comment. This scenario further pushes Bauman's definition of fitness: since there is not a clear limit, every time the expectation can be increased (we are never too fit, never too thin, never too smart, etc). However, in a world where big data analytics and social network analysis allow the constant monitoring of citizens, there are people who may not be able to comply with the constant request of being "better".

For example, the Chinese government is supposedly developing a "social rank" in order to classify people and distinguish a "reliable" person from an unreliable one [10]. The social rank, developed in cooperation with private companies, is used e.g. on dating sites in order to boost the dating possibilities of good "social ranked" users, i.e. people who have a good credit score and online behavior.

4 CONCLUSIONS

The scenarios we presented are inspired from Black Mirror episodes like "Shut Up and Run", where a man blackmails people using information recorded from the computers of its oblivious victims, and "Nosedive", where an entire society lives in the fear of a *social rating*, where a bad rating could ruin a person life. The theme of a continuous collection of personal, sensitive data is depicted in the episodes "The Entire History of You", "Arkangel", and "Crocodile". Finally, fat-shaming is tackled the first season episode "Fifteen Million Merits", where people must exercise in order to conquer the possibility of escaping from a dystopian, "Big Brother"-like world.

In the world we depicted, the blackmailer from "Shut Up and Run" is replaced by organizations like insurance companies or national health care systems, which impose the continuous, never ending fitness paradigm to their customers-patients. In this way, people are forced to renounce to their privacy and/or of their right of being *healthy* without the need of being overly *fit*. Moreover, such organizations could favor people who can *afford* to buy such

devices and neglect people who cannot, bringing to the extreme the (already grim) unequal world predicted by Allen and Christie [1]. Finally, organizations could also predict our lifestyle by using our social media data, like e.g., sharing locations of fast food restaurant, pictures of healthy dinners, or text mining, building a *social score* akin to the one presented in "Nosedive", which could affect their possibility of getting an insurance or a proper treatment.

In order to prevent these scenarios, governments which want to preserve the privacy and the free choice of their citizens should forbid the possibility of building or using social and fitness profiles to discriminate patients or customers in all health-related markets. Scholars who work in the fields of social media analysis, semantic web, and so on, and that believe - as the authors of the present work do - in the value of privacy should raise the awareness of a responsible use of social media, fitness devices, and of all kind of technologies which could be used to profile people without their explicit consent.

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