Log my dog

Perceived impact of dog activity tracking

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ABSTRACT. The billion dollars' worth pet industry is catching up on the wearables market, as pet activity and location trackers are increasingly worn by our furry friends. Despite the growing body of work on user perceptions of human wearables, very few works have addressed canine activity trackers and their impact on pet owners' lifestyles and the human-animal bond. In this paper we report on an empirical study investigating perceptions of 81 users of a popular dog activity tracker. The results show that dog activity trackers are perceived to have positive impact on owners' motivation to increase their mutual physical activities with their dogs. The human-dog bond is perceived to be further reinforced by the use of activity trackers, increasing human awareness to animals' needs by giving them a "digital voice," and potentially improving the quality of human caregiving.

Introduction

> *You become responsible, forever, for what you have tamed. - A. de Saint-Exupérie, The Little Prince.*

Out of the huge variety of IoT devices available on the market, activity and fitness trackers are among the most prevalent ones. Such devices help us to monitor our daily activities, giving us insight into how many steps we have taken, how many calories we have burned, how well we have slept, and more, generating actionable recommendations for us by which to improve our lives. The number of available devices, and subsequently their users, have grown significantly over the last decade. This is mainly due to the great promise these devices hold towards improving motivation for increasing physical activity, leading to healthier lifestyle. While the use of such devices in clinical settings remains quite modest, due to concerns related to accuracy and reliability [1], there is some evidence supporting their efficacy, such as studies showing the potential of activity trackers to increase physical activity [2].

The billion-dollar pet industry is currently catching up on the hype and getting involved in the wearables market. The global pet-wearables market is expected to grow at a CAGR of 13.5% before 2025, with exponentially growing demand from Asian countries following initial popularity in the West. Canine activity and fitness trackers such as FitBark, PetPace, and Whistle constitute the main typical wearable on the market (exemplified in Fig. 1), using different sensors such as accelerometers, GPS, and vitality sensors to measure the activity and sleep patterns of pets.

Figure 1. Becky trying on an activity tracker investigated in this study.

While there is a growing body of research on the challenges and opportunities of regular 'human' wearables, as well as users' perceptions thereof [3], much less is known on those topics for pet wearables. In the current study we aim to deepen the understanding of the impact of quantified technologies on the human-animal bond and the lifestyles of owners and pets, by studying the perceptions of 81 users of a widely available and popular commercial canine activity tracker. We focus in particular on the following research questions:

1. Why and how are commercial canine activity trackers used by pet owners?
2. What effect, if any, does their use have on the lifestyle of pets and their owners?
3. What aspects of commercial canine activity trackers are perceived as important by pet owners?

Activity trackers: new facilitators of the human-dog bond?

The *human-animal bond*, initially coined in the 1980s, is used to refer to a mutually beneficial relationship between people and animals and has been acknowledged to contribute to the health and well-being of both. There is evidence that contact with animals can influence psychological and physiological parameters of human health [8] through e.g., animal-assisted therapy. Human bonding with dogs in particular is the strongest and most well-studied of all human-animal bonds. Our history with dogs goes back over 13,000 years, and the title of 'man's best friend' is well-deserved given the impact and contribution that dogs have had to early human society. There is evidence that pet ownership can contribute to human health and feelings of happiness [9] by increasing physical activity. A critical review of literature [10] similarly showed that "dog ownership produces considerable health benefit and provides an important form of social support that encourages dog owners to walk." Coleman et al. provided further support that pet ownership promotes physical activity and contributes to weight control [11].

Canine activity trackers mediate in this human-dog bond, with the potential to impact the lifestyles of dogs and their owners in several ways, including increasing physical activity, and affecting the quality of care-giving, thereby improving the quality of attachment between human and dog. Human-dog bonding has been explained using Bowlby's attachment theory, which suggests that infants of many mammalian species are born with a behavioral system intended to protect them from danger and maximize safe exploration by regulating proximity to a caregiver. Infants tend to seek the proximity of their caregiver, become anxious when separating from them,

use their attachment figure as a safe base for exploration, and turn to them for reassurance and comfort.

There is an increasing amount of works on wearable technologies for quantifying pet activity (see, e.g., [4]). Such technologies have the potential to affect the human-dog relationship in a tangible way — by giving detailed input to improve the quality of their care-giving. Several works have recently addressed the impact of technologies on the human-animal bond. Nelson and Shih [7] study the CompanionViz system, an information visualization prototype designed to inform pet owners on their dogs' caloric inputs/outputs, as well as exercise and movement habits. After evaluating initial interest in the system in a survey with 12 participants, CompanionViz was evaluated in a field study with three actual users. Themes emerging from users' feedback were increased awareness, motivation and curiosity with respect to their pets' needs. Alcaidinho et al. [5] investigated the use of canine trackers combined with a smartphone application in the context of sheltered dog adoption. Their pilot study discovered promising results indicating that providing dog quantimetric data to adopters through the use of a smartphone application could yield reduced rates of re-relinquishment. Additionally, respondents indicated that they felt that using the smartphone application helped them to better meet the activity needs of their dog and increased the bond between themselves and their newly adopted dog. Lawson et al. [6] draw on critical practice and speculative design to question the ultimate consequences of applying technology for quantification of companion animals. The authors developed a series of speculative prototypes on the theme of quantified cats and dogs, and invited users to reflect on the product designs, their potential value and long-term implications through a series of semi-structured focus groups, which included both pet owners and animal experts. Their findings suggest that there is a strong desire among owners to better understand the needs of their pets, and a wish for improved information about their pets' physiological condition, in order to guide positive action towards e.g. minimizing suffering and seeking medical attention in a timelier manner. Yet the authors draw on critical practice and propose their interpretation of the findings that quantified technologies might not be the answer and may even undermine the human-animal relationship by "requiring owners to engage in gamified actions to fulfil algorithmically determined needs."

Previous works have critically analyzed the promise of pet wearables [6] and explored the impact of prototypes [7]. In this study, we aim to take another step forward by investigating how devices on the market are being used by actual consumers. To this end, we investigate the perceptions of 81 actual users of a commercially available and widely used commercial canine tracker.

Empirical study

Object of study. We investigate user perceptions with regard to FitBark canine activity tracker. We chose this specific device because of its widespread use, and the availability of an active Facebook group of FitBark users, which provided us access to users that would otherwise not be available to us. The FitBark, similar to most other canine activity trackers, consists of a physical device based on accelerometer sensors worn by the dog, and a mobile application that provides the owner with a user interface for the activity and sleep patterns of the dog. The users are able to set up a desired activity level for their dogs, which is measured in FitBark points, an analog of activity counts in human wearables based on accelerometers.

Participants. Eighty-one FitBark users were recruited via an invitation to participate in our study posted on an active international Facebook group. This medium is used by FitBark users to discuss their experiences and questions regarding the use of FitBark devices for tracking their dog's activity. We used this purposive sampling to only include users of a specific device to avoid the threat of the sample describing attitudes towards functionally distinct devices, marketed in different ways to their users. No personal details were recorded, as we did not intend to correlate specific perceptions to demographic subgroups. All participated voluntarily and received no compensation for their participation.

Procedure. The study was designed as a questionnaire incorporating both Likert scale and open-ended questions. We iteratively designed the study with feedback from a behavioral veterinarian

whose patients have used such devices. Feedback received from participants indicated it took around ten minutes to complete, depending on the level of detail provided to the open questions. The questionnaire elicited the following data.

(1) Canine demographics. We first allowed participants to share information about their dog: its name, breed, age, and activity level.
(2) Obtaining and using the canine activity tracker. We asked several open questions to understand for what reason (if any) participants purchased the device, how its use has affected their lifestyle, and to what extent they were happy with using it:
- What was the main reason you purchased a FitBark?
- Can you give examples of decisions you make based on outputs of FitBark?
- In what way, if at all, has FitBark affected your and your dog's lifestyle?

(3) Importance of different aspects. We presented a rating task, asking participants to rate "how important the following aspects of FitBark are for you" on a 5-point Likert scale from "not important at all" to "very important." To ensure a common understanding of these concepts, we presented the aspects with explanations, as detailed below:
- Consistency: e.g., if a dog walks 1 km in the same pace every day, FitBark will always show the same number.
- Accuracy: e.g., if FitBark app shows 100 calories were burnt, this is the exact number of calories burnt in reality.
- Look and feel: appearance of the device and the app,
- Security: prevention of information leakage about your dog or about you.
- Usability: ease of use of the device and app.
- Maintainability: ease of maintenance of the device (e.g., charging battery).
- Scalability: ease of use with multiple dogs.

(4) Accuracy and consistency. Because these two aspects are a major concern in human wearables [12], we asked participants to first rate on the same Likert scale presented above:
- How accurate is FitBark for YOUR dog?
- How consistent is FitBark for YOUR dog?
  Finally, we elicited further detailed comments on the above by asking:
- Please provide your opinion on issues of accuracy and consistency of FitBark, and their importance and impact.

Data analysis. A total of 86 results received were first analyzed for any duplicate records or erroneous entries. Five repeating entries were found, and removed from the dataset, resulting in 81 participants. The results of the rating task were quantified and visualized in Fig. 3. We used thematic analysis to analyze the results of the open questions. Each question was coded individually by all authors over two iterations. Resulting codebooks were compared, and repeating codes established as an initial classification framework. This framework was then applied to the data in a similar iterative fashion with any disagreements resolved by the authors. The codebook used for the final classification was as follows, giving three core topics and several codes for each topic:
- Reason for acquisition: tracking of activity, tracking of activity at a specific location/time, increasing activity, improving health, increasing activity of owner, fun
- Effect on lifestyle: increased activity, more informed caregiving, improved health of pet
- Effect on decision-making: more control of diet, more control of activity, motivation to initiate specific activity, healthcare/behavioral interventions

Findings

In terms of canine demographics, the dogs owned by the study participants were on average 4 years old (± 3 years, oldest 13, youngest 4 months). Breeds were very diverse - including purebred, crossbreed and mixed-breed dogs, ranging from small breeds such as chihuahua and dachshund to larger breeds such as shepherds and retrievers. The majority were quite active: 16% of the participants reported on more than 2 hours of daily walk, 48% 1-2 hours of daily walk, 25% 0-1 hours of daily walk, and only 10% described their dog as a "couch potato."

Why and how are canine activity trackers used?

In total, 79 participants responded to this question, with their answers sometimes encoding more than one effect. The most prevalent reason for using a canine activity tracker was, expectedly, to perform some extent of [tracking of activity], with 39 responses. For [fun] was found in 18 responses. The remaining use cases were close in terms of response counts, with [increasing activity] having 13 responses, [tracking of activity at a specific location/time] 11 responses, and [improving health] 10 responses. Trailing far behind, were 2 sole responses who indicated having purchased the device for [increasing activity of owners]. In descending order of prevalence (as per Fig. 2, exemplary data for each code are discussed below.
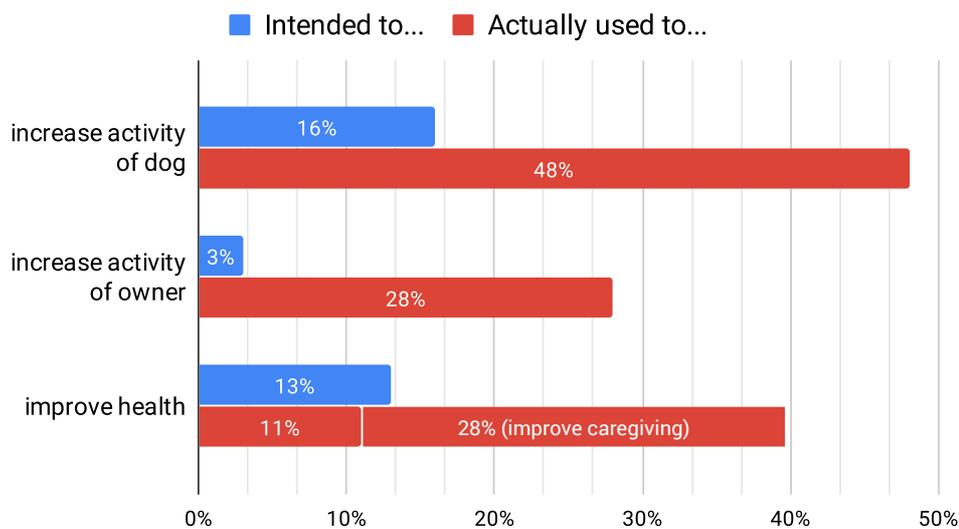

Figure 2. Comparison of what participants intended to use the activity tracker for, and how they actually used. Shown are the three themes found in both cases, indicating that increasing activity of their dog, themselves, and improving their dog's health (via improving their caregiving) all were used more than originally intended to. The percentages do not express a representative quantification of these themes and should be considered as a preliminary impression based on this qualitative study.

[Tracking of activity] was the main anticipated use case, with participants primarily driven by gaining insights into their dogs by "learn[ing] more about his daily activity," "check[ing] her energy level and how much she walks." Moreover, tracking of activity to compare and contrast from one moment to another was noted by several participants, such as determining "how much exercise she was getting each day," and being driven by "curiosity about whether his activity really is way above average."

Many participants indicated simply purchasing a device for [fun]. This includes curiosity similar to the prior code, but less targeted at wanting to specifically understand their dog, such as e.g., one participant noting "I like statistics/being able to measure things. I have a Fitbit for myself which I enjoy so it made sense getting my dog a FitBark." Moreover, several participants noted that they purchased the device without seeing a specific use case for it, but later on realizing its value: "at first it was on sale and then I realized what a great tool it was."

Several participants noted wanting a priori for [increasing activity] of their dogs. This seems driven primarily by motivating the dog to stay active, such as a participant noting "to observe whether or not he is getting the exercise he needs. He loves to walk but can be quite lazy and would rather not go out on wet days!" Similar to humans, ensuring that their dogs remained active during typically lesser active seasons was indicated by several participants, such as e.g., "keep[ing]

up the summer activity level during the winter months."

A subtly different use case than the personal monitoring to which we are used from personal fitness devices, was people's intention to use their dog's activity trackers for [tracking of activity at a specific location/time]. This was both driven by a desire to understand the dog's behavior when left alone, with several participants noting wanting to "find out what she does at home when we are out," or "I especially wanted to know if he is calm when I am at work." More unorthodox was the use to indirectly (in)validate other's claims about their dog's behavior: "Neighbours were telling me Reggie was barking during the day, now I can see how active he is when I am out at work - sleeps 55 mins during most hours."

[Improving health] was noted as an interest by several participants. This primarily seemed to be related to weight management, e.g., "I want to help them lose weight," and wanting insight into "how many calories he burns so I could feed him the correct amount." Moreover, participants noted wanting to use the data to assess their own capability as owners, wanting to "judge how I'm taking care of her."

Finally, two participants indicated purchasing the device for [increasing activity of owners]. This was both noted as an indirect motivator, "to encourage my husband to keep fit," and as direct, personal motivator: "it's an indirect motivator to get myself off the couch, more than if I wear my own Fitbit or similar device. I'm more likely to make the effort if my dog is short some points than if I'm a thousand steps short!"

What effect, if any, does the use of an activity tracker have on the lifestyle of pets and their owners?

In total, 75 participants responded to this question, with their answers sometimes encoding more than one effect. The largest effect on lifestyle was, expectedly, [increased activity], with 36 responses, followed by a [more informed caregiving] with 21 responses. Less expected, however, and specifically not expected from the reasons why participants purchased the device, are the 21 responses indicating that it [increased activity of owner]. Finally, 15 responses indicated [none] specific effect on lifestyle, and 8 responses indicated concrete [improved health] of the pet. In descending order of prevalence (as per Fig. 2, exemplary data for each code are discussed below.

Much more participants noted that the device led to [increased activity] of their pet than originally intended (see the comparison in Fig. 2). Participants noted increased activity because of the device, "we try to meet her goal every day, even if we don't want to go for a walk." Moreover, some responses indicate the linked effect between pet and owner activity levels: "it's a bit of fun tracking his exercise, does make me take him out for another walk if he hasn't done enough that day." Similarly, [more informed caregiving] was quite prevalent. Participants noted being "aware of how much or how little he moves some days," and being "much more conscientious about making sure [my dog] gets exercise." Some participants indicate even more clearly to the next finding, namely that owners gain an increased understanding of the need for them to become more active for their pets: "we are more aware of how active we need to be." This manifested as guilt in some participants: "[it is] a bit shaming to see how active she could be if I wasn't working so much," and noting "Although I will work out in the gym, he will not. I'm more mindful about his needs now."

As indicated above, a rather unexpected 28% of all responses indicated that use of the device led to [increased activity of owner]. Participants noted such success stories as "[going] from sedentary to walking at least 13,000 steps a day with my dog! I thank Fitbark and Fitbit for that." A common thread in such responses is the dyadic relation indicating a feeling of shared impact between dog and owner for the dog's exercise, leading to increased exercise of the owner: "it makes me more motivated to go out and do my runs because I don't want him to miss his mark. So, he gets out for runs more frequently."

On the other hand, several participants did note there was [none] effect on their lifestyle. This primarily concerned participants who were already active, and mostly interested in validating their activity levels: "[my dog] was always active, didn't need to lose weight either. I wanted it to measure her activity."

Finally, several participants indicated the device (in)directly led to [improved health] of their pet. This seems primarily linked to diet and weight management, allowing for more tailored feeding according to the energy used: "made me more vigilant in ensuring he is active enough every day. I can adjust his food according to the amount he's done."

What aspects are important in a canine activity tracker?

Figure 3 presents the relative importance of the quality aspects as perceived by the user. Usability and maintainability were found as the most important, while scalability (being able to use the wearable with multiple dogs) is perceived as less important. The self-reported accuracy and consistency of the device for an owner's dog was comparable (median= 4, ±0.6 for accuracy, ±0.8 for consistency), but the perceived *importance* of these aspects varied more. While both are perceived of as important, consistency seems so to a higher extent. This is interesting because we expect that users would find it important to trust the correctness of the data they receive from the device, data on which they evidently base their caregiving decisions. The relatively higher importance they allocate to consistency may provide some explanation: they trust the data if it is consistent, namely if they can trust that the data show trends (e.g., yesterday the dog was more active than today) and do not insist for its absolute value to be accurate.
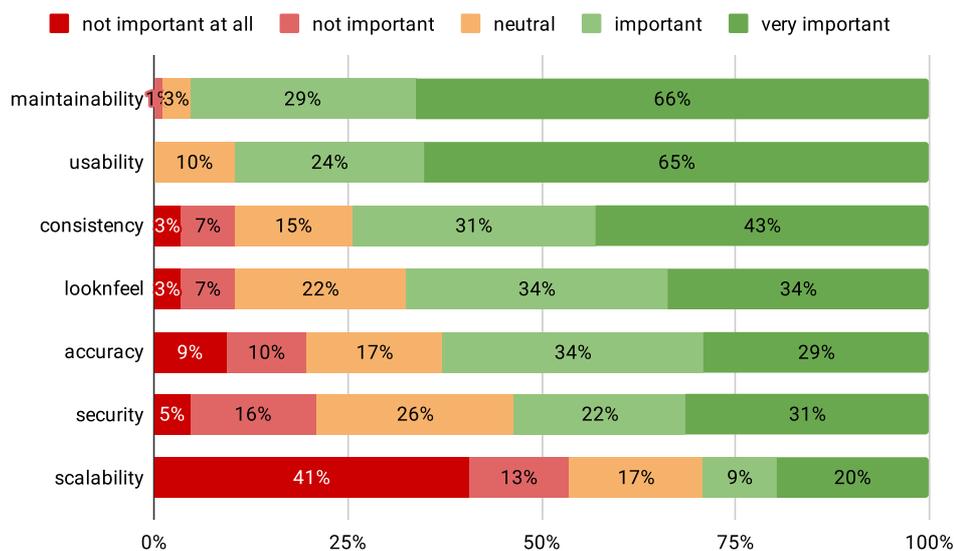

Figure 3. Perceived importance of quality aspects (n=81)

Implications for design & use

Healthier together

As Fig. 2 shows, while only ~2.5% of the participants noted purchasing the activity tracker to increase their own level of fitness, ~28% of participants indicated that the activity tracker led to an increase in their own activity. This result highlights a side benefit of canine activity trackers: increased motivation of their owners to exercise more. Researchers are increasingly focused on whether human activity trackers have continuing health benefits, and motivate us to exercise on the long-term [1,2].

We also noted the repeating occurrence of participants talking of their dogs and themselves as one, when it comes to exercise and activity. For example, with emphasis added, participants noted that "[the canine activity tracker] definitely encouraged *us* both to be more active. I take my dog on multiple bike rides most days now in order to reach his goal," and that "it's made *us* more active because now if he's been super lazy all day I can see that and *we* either change that or *we* work hard the next day. All in all I think it's been great for *us*."

Canine activity trackers may add a new dimension to our understanding of human motivation to increase physical activity

not only for one's own good, but for the sake of one's beloved pet.

A particularly promising direction for further research is the synchronization between human and dog tracking devices, which several participants highlighted as important to them: "[I am] more conscious of exercise with connection with Fitbit."

Improving caregiving
Looking at canine activity trackers through the lens of attachment theory may provide new insights into the human-dog bond. Several participants reported an improvement of the quality of their caregiving, as well as increased awareness of their responsibility for their pet's wellbeing, using terms such as 'accountability', 'sense of guilt', 'conscientiousness', 'being more aware of his needs'. For example, participants noted that "[the canine activity tracker] made me more aware of his activity or lack thereof," "[the canine activity tracker] made us more aware of what he needs in terms of his physical wellbeing", and "I am much more conscientious about making sure [my dog] gets exercise."

The device in a sense provides animals a digital voice to express their needs more clearly. The question is whether that voice will continue to be heard in the long run.

Thus, an interesting direction for future research is further studying whether there is a quantifiable change in the quality of caregiving resulting from using tracking devices.

Accuracy vs. consistency
Accuracy and consistency (or reliability) are two important aspects of data quality, which have been extensively studied in the context of human wearables [12]. Issues of accuracy and consistency are major barriers in the adoption of human wearables in clinical settings [1].

While participants reported overall good accuracy and consistency, and found both aspects important, between the two they found consistency more important than accuracy. Using the Mann-Whitney test, the importance of consistency (mean=4.03) was found greater than the importance of accuracy (mean=3.62), U =3015.5, p=0.036. This is consistent with the findings in [12] concerning human wearables. This can be explained by looking at the main ways of usage which emerged from our study. The main actual use (see Fig. 2) is for increasing activity. Achieving such an increase is a gradual process, where pet owners tend to compare and contrast the activity of their pets over days and weeks, not caring too strongly about the individual measurements. One participant noted: "I generally don't concern myself a whole lot about accuracy because there are a lot of variables that need calibrating, it's difficult to be precise, and at some point absolute values correct to how many ever significant digits aren't that important. But having consistent numbers to compare and work with over time, that's more interesting and useful."

Consistency, indeed, is instrumental for detecting improvement in activity levels. But also a number of participants highlighted its importance for detecting sudden changes in activity patterns which may indicate health problems such as restlessness or high inhibition. As another participant noted: "[consistency is] very important for daily and monthly comparisons. They let us know if something is up."

Notwithstanding the pragmatic use owners reported of these devices (relying on *changes* in pet data rather than the pet data itself), there is an inherent risk that comes with accuracy being perceived of as less important. As Fig. 2 shows, increased activity of pet and owner together with improved caregiving are the main actual uses of these devices. For example, a device could, whether due to mis-calibration or malfunction consistently underreport a dog's physical activity levels. Owners may then be motivated to take it out on more, or longer walks, potentially leading to

over-exercise and physiological stress. Thus, it is important for pet owners to see these devices and the advice they generate as *complementary,* rather than replacing their own interaction with their pet, as well as expert advice from their veterinarian.

Conclusion

This paper presented the results of an empirical study with 81 users of a canine activity tracker, focusing on their perceptions of canine activity trackers and the impact these devices have on their lifestyles and the human-animal bond. To the best of our knowledge, this is the first empirical study to address perceptions of active users of an existing, widely available, commercial tracker, who have actual daily experience with using the device.

Our study reveals that activity trackers meant for canines are reported to increase the motivation of humans to exercise as well. They are also perceived as a novel technological mediation in the human-animal bond, giving animals "a digital voice" for expressing their needs, which has the potential to complement pet-owner interaction and improve caregiving. This aspect, however, needs to be further investigated using quantifiable means to assess caregiving (e.g., measuring the dog's levels of cortisol or oxytocin, which are related to stress and social behavior), in addition to owners' perceptions as this study has shown.

It is our hope that this study demonstrates the usefulness of future empirical studies on the impact of technologies for monitoring animal activity and wellness. We believe that our findings and their relation to the human-dog bond provide indications for the importance of the design and development of future devices being guided by multi-disciplinary research efforts, providing insights into animal behavior, welfare and the human-animal bond.

References

1. Lukasz Piwek, David A Ellis, Sally Andrews, and Adam Joinson. The rise of consumer health wearables: promises and barriers. PLoS Medicine, 13(2):e1001953, 2016.

2. Tess Harris, Sally M Kerry, Christina R Victor, Ulf Ekelund, Alison Woodcock, Steve Iliffe, Peter H Whincup, Carole Beighton, Michael Ussher, Elizabeth S Limb, et al. A primary care nurse-delivered walking intervention in older adults: Pace (pedometer accelerometer consultation evaluation)-lift cluster randomised controlled trial. PLoS medicine, 12(2):e1001783, 2015.

3. S. Seneviratne, Y. Hu, T. Nguyen, G. Lan, S. Khalifa, K. Thilakarathna, M. Hassan, and A. Seneviratne. A survey of wearable devices and challenges. IEEE Communications Surveys Tutorials, 19(4):2573–2620, Fourthquarter 2017

4. Cassim Ladha, Nils Hammerla, Emma Hughes, Patrick Olivier, and Thomas Ploetz. Dog's life: wearable activity recognition for dogs. In Proceedings of the 2013 ACM international joint conference on Pervasive and ubiquitous computing, pages 415–418. ACM, 2013.

5. Joelle Alcaidinho, Giancarlo Valentin, Stephanie Tai, Brian Nguyen, Krista Sanders, Melody Jackson, Eric Gilbert, and Thad Starner. Leveraging mobile technology to increase the permanent adoption of shelter dogs. In Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services, pages 463–469. ACM, 2015.

6. Shaun Lawson, Ben Kirman, Conor Linehan, Tom Feltwell, and Lisa Hopkins. Problematising upstream technology through speculative design: the case of quantified cats and dogs. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, pages 2663–2672. ACM, 2015.

7. Jonathan K Nelson and Patrick C Shih. Companionviz: Mediated platform for gauging canine health and enhancing human–pet interactions. International Journal of Human-Computer Studies, 98:169–178, 2017.

8. Alan M Beck and Aaron H Katcher. Future directions in human-animal bond research. American Behavioral Scientist, 47(1):79–93, 2003.

9. Carri Westgarth, Robert M Christley, Garry Marvin, and Elizabeth Perkins. I walk my dog because it makes

me happy: a qualitative study to understand why dogs motivate walking and improved health. International journal of environmental research and public health, 14(8):936, 2017.

10. Hayley Cutt, Billie Giles-Corti, Matthew Knuiman, and Valerie Burke. Dog ownership, health and physical activity: A critical review of the literature. Health & place, 13(1):261–272, 2007.

11. Karen J Coleman, Dori E Rosenberg, Terry L Conway, James F Sallis, Brian E Saelens, Lawrence D Frank, and Kelli Cain. Physical activity, weight status, and neighborhood characteristics of dog walkers. Preventive medicine, 47(3):309–312, 2008.

12. Rayoung Yang, Eunice Shin, Mark W. Newman, and Mark S. Ackerman. When fitness trackers don't 'fit': End-user difficulties in the assessment of personal tracking device accuracy. In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing, UbiComp '15, pages 623–634, New York, NY, USA, 2015. ACM.

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