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CONFERENCE PAPER

Gone to the dogs. Canine activity step count, using technology designed for human movement

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ABSTRACT

Wearable technologies impact on human performance monitoring. Technology designed for human monitoring was used as a proof of concept study to determine the effectiveness of monitoring physical activity of two different sized dogs. The device found significant step count differences with the smaller dog having greater step count. This was confirmed from step counts taken from an associated video recording. Therefore the study showed that a wearable device could measure step counts of dogs. Meaning that users can monitor their own physical activity or that of their pet with the same device.

Keywords: Canine; Fitbit; Gait; Physical activity; Wearable technology.

INTRODUCTION

Technology is widely used in human movement for performance analysis and rehabilitation monitoring. To some degree technology has been successfully used for kinematic and kinetic analysis of dogs.[1] While data has been collected using canine specific activity trackers e.g. FitBark[2], there appears to be little published research on the application of wearable technology on these animals. Additionally, it is unknown whether this data has factored in differences between breeds.

Wearable technologies (wearables) have gained popularity to monitor human movement, from individual self monitoring through to high end research applications.[3,4] According to professional services firm, PWC, 20% of people use wearables, of this, 45% use fitness bands.[5] No published research was found in a review of the literature that reported a fitness band device to assess canine movement. Extrapolating PWC[5] and pet ownership data[6], approximately 400,000 people who own dogs also own fitness bands, giving these owners the ability to use a familiar device, and avoid the cost of buying a specific device for their pet.

Wearable technology data could be used by veterinary clinicians and owners to monitor orthopaedic conditions or post-operation rehabilitation, by assessing increased movement as an indication of improvement. Additionally, decreased movement is detrimental to injury recovery and musculoskeletal health[7], therefore wearables may provide a measure of motivation that could assist in rehabilitation. Moreover to injury, canine obesity is prevalent in Australia and overseas.[8] Use of activity monitors may motivate owners to increase their dog's activity, in the same way devices have successfully done so in humans.[9] Their use also presents an

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opportunity for research. Since specific recommended levels of canine activity have not been found in the literature, these devices have the potential to capture large amounts of data, establishing such information.

A concern of gait analysis in dogs are differences in temporospatial and kinetic data between different dog breeds, potentially due to differences in size.[10] Fitness bands used for assessment of dogs would be required to allow for size and shape differences that may influence gait. Furthermore, differences may be seen in data due to changes in gait and not from breed/size. This information may influence the clinician's conclusion from data. For example, inactivity as a result of dog size must be distinguished from inactivity due to pain. Therefore the aim of this report was to investigate the capability of a fitness band to detect between dogs with anthropological differences in step count. Furthermore, a secondary aim was to determine whether animal size impacted on data output.

METHODS

Animal ethical clearance was given prior to research (VETX220616N). Two dogs were used to display proof of concept. Both passed a veterinary exam confirming health and suitability for use in a locomotor study. The smaller dog was a female spayed 4 year old Terrier Cross, (14 kg). The larger dog was a male neutered 4 year old Border Collie, (17 Kg) (Figure 1). Each dog was walked a distance of 50 m (3 repeats) on a lead by their owner and on the same flat road surface. Data was collected using a Fitbit Flex® (FitBit Inc., San Francisco), fastened to the collar, and corresponding FitBit Android phone application. Video capture (iPhone, Apple Corporation, Cupertino) of each dog's gait during the walk was taken. A Student's T-test was used to determine whether there were significant differences between datasets. An alpha level of p=0.05 was used to determine significance between the data.

Figure 1. The two participating dogs in the proof of concept trial. The dog on the left was the Terrier Cross. The dog on the right, the Border Collie.

RESULTS

The FitBit detected approximately 20% of the steps in both smaller and larger dog. The FitBit detected a mean value of 71 steps in the smaller dog and 53 steps in the larger dog (Standard Deviation 1 and 3 respectively) (Figure 2). Student's T-tests showed a significant difference between smaller and larger dog (p=0.005). This was verified by the video (p=0.003).

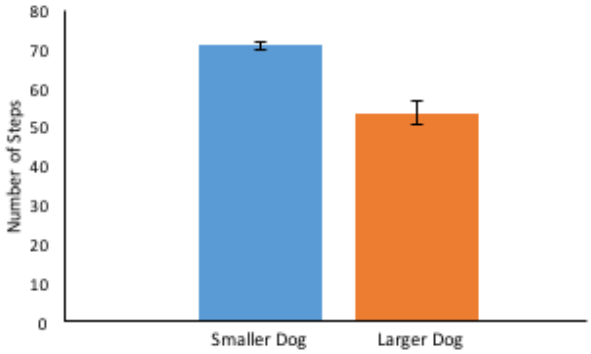

Figure 2. Total steps taken by both dogs in the trial. The smaller dog had a higher step count compared to the larger dog.

DISCUSSION

The FitBit detected 20% of steps in both breeds. It was speculated this inaccuracy was due to limited event detection of gait phases as a result of collar attachment. Future research may be required to determine the ideal sensor position to better measure step rates, e.g. on the leg, or close to the centre of mass. The research will also need to address new challenges such as change of gait due to device positioning. However, since the error was consistent in both dogs, owners could use this knowledge to calculate a specific step count manually. This would expand the potential of the FitBit to unsupervised monitoring. Many dogs spend time alone.

Unsupervised monitoring would allow for assessment for the need to take the dog for a walk, based on its activity while their owners were away.

Data collected showed that smaller dogs have a different (higher) step count to larger dogs. Wearable technology specifically designed for dogs has been used to collect data, providing information such as breed differences in activity levels, and changes in activity with osteoarthritis[2]. No published information was found for recommended levels of activity, step count or distance for dogs. This may be due to wide ranging dog sizes and morphologies, making it impractical to establish an average. The current study indicated there are significant differences between dogs. It is unknown if research[2] accommodated for the known differences. For example, many active listed dogs are smaller breeds, however, active larger breeds could be misrepresented due to their naturally lower step count. There is a need to establish a normal range for different sized dogs. This would provide a reference point enabling clinicians and owners to use data received more effectively. The potential for wearable technology to provide such data should be noted.

CONCLUSION.

A device designed for human exercise monitoring may be capable of monitoring activity in different sized dogs if error patterns are accommodated. This provides an opportunity for dog owners to measure their animal's movement with a device they may already own. Additionally, dogs of different size display significant differences in step count. These differences should be considered when drawing conclusions of a dog's health.

PRACTICAL APPLICATIONS

- Monitoring of canine activity in absence of humans
- Veterinary monitoring of activity during rehabilitation
- Possible motivator for human exercise.
- Baseline for in-depth monitoring research

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