Peppy Pole: An Anthropomorphic and Interactive Hiking Companion

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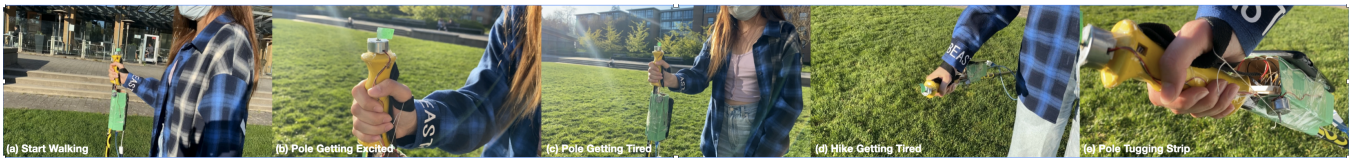

Figure 1: Peppy Pole prototype outdoor activities workflow example. (a) Hiker starts walking with Peppy Pole. (b) Peppy Pole gets excited at the beginning of the hike. (c) Peppy Pole expresses tiredness to hiker by tugging wrist bands and spinning motor. Hiker will need to have a rest with Peppy Pole until pole becomes excited again. (d) Hiker gets tired and expresses her tiredness by tilting Peppy Pole over an angle of 45°. (e) Peppy Pole comforts hiker after hiker expresses her tiredness by tugging the wrist bands so that user can receive the mechanical tugging motion from the wrist strap.

ABSTRACT

In this paper, we present the Peppy Pole, an anthropomorphic and interactive hiking pole prototype that merges life-like features with the innate functionality of a hiking pole to create rich and interactive experiences for hikers. Compared to regular or other forms of smart hiking poles, the Peppy Pole leverages the 'poleness' of a hiking pole in its character. Our prototype is made up of a smartphone collecting sensor data, sending the data to an Arduino Uno that actuates the expressions of the Pole with motors. Our findings in a two step user study evaluating the indoor function of the Pole partially supported the fact that the Peppy Pole's life-like features can motivate hikers to go on hikes more frequently by displaying its "own" wish to be taken out on hikes. We also found while evaluating the outdoor functions of the Peppy Pole that it helped hikers hike more distances compared to a regular pole.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

Human-Computer Interaction, Anthropomorphic Hiking Pole

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1 INTRODUCTION

Today, trekking and hiking are one of most popular outdoor recreation activities. Many technologies such as GPS devices, satellite phones, personal locator beams, and smartphones are influencing the experience of hiking and other outdoor recreations[5]. It can be observed that while there are many technologies created and proposed to enhance the hiking experience in terms of navigation, safety, and comfort, there is not much evidence of using technological devices and interfaces for improving the social and emotional aspects of these outdoor activities.

Research on anthropomorphic interfaces and designing products with lifelike traits suggests that these technologies can influence the emotional connection between the user and the product[7]. However, the potential for using these interfaces in outdoor activities and the effect of the mentioned emotional attachment on the hiking experience has not yet been explored.

To engage hikers in personal experiences stimulated by the physical, emotional and behavioral traits of the hiking pole, we propose to design an anthropomorphic hiking pole that communicates its feelings to the hiker and responds to the hiker's actions. This form of interaction can create and enhance the emotional attachment between the hiker and the hiking pole. We have made an attempt to explore whether this attachment can subsequently encourage and motivate the hiker to hike more frequently and for longer periods and/or distances.

Specifically, our user study aims to focus on addressing the following research questions:

- Will the Peppy Pole help the hiker to cover more distance, with its outdoor life-like features?
- Will the Peppy Pole motivate the hiker to go on hikes more often, by displaying its "own" wish to be taken out on hikes?

We made the following core contributions in this paper:

- An artifact prototype of an anthropomorphic and interactive hiking pole merging innate pole-like functions with life-like features.
- An empirical contribution in the form of a two-part user study assessing the motivation to hike more distances and more frequently, caused by our proposed pole compared to a regular hiking pole, the results of which shows the pole's effectiveness in these criteria.

2 BACKGROUND AND MOTIVATION

2.1 Introduction to Anthropomorphic Objects

Humans have a natural need for social connections which forms one of the strong motivation factors for the tendency to choose anthropomorphic gadgets[8]. Brown (2010) proposed that numerous anthropomorphic techniques have been increasingly applied nowadays, especially by marketing brands[6]. Beyond that, Mourey (2017) mentioned that the fast development of the Internet of Things has created items that appear to be "alive" through intuitiveness, interaction, responsiveness, and even personality[12]. The fact that individuals are engaged with anthropomorphic products consists with the belongings theory saying that people own a fundamental demand to belong and form social attachments with live being[12].

The manner in which anthropomorphic tendencies actualize differs based on different personal preferences. Previous research indicates that people who suffer chronic loneliness are more likely to assign human like traits to devices like an alarm clock, air purifier, battery charger, etc[4]. A study including 210 Australian participants, on effects of anthropomorphic tendency on destination attitude and travel intentions indicated that people with high levels of anthropomorphic tendency prefer to humanized destination, travel intentions and view a personified traveling advertisement[11].

2.2 Lifelike Characteristics in Anthropomorphic Objects

Adding lifelike characteristics to different products can influence the relationship between the user and the product. A study by Burneleit et al (2009) introduced a product prototype called the Impatient Toaster which presented lifelike traits to encourage people to use it more often. They showed that these traits help create an emotional bond between the user and the product[7]. Such an emotional attachment with everyday objects may be investigated further in all aspects of people's lives ranging from indoor activities to outdoor recreation such as hiking or trekking.

Row and Nam (2016) conducted a study on lifelike characteristics in interfaces. They found out that for the interfaces to feel more alive to the users, they must have certain features. Some important examples of these features are lively movement in the interface, behaving like an independent agent and acting autonomously without need for operation, and having an appearance resembling a living organism[13]. Features like these are included in the design of an anthropomorphic interface to make it feel more alive to the user.

2.3 Motivations to Design Anthropomorphic Hiking Poles

Even though there are many patents owned and papers published on multi-purpose smart hiking poles/canes, there is no evidence of research on the effects of augmented anthropomorphic features on hiking poles or walking sticks.

Karsten Hanlin (2020) invented a smart ski pole with integrated speaker that includes a display, a speaker, buttons and a controller all within the pole grip[9]. With a different set of features, Ahmad Alghazi (2018) has invented a multi-functional smart mobility aid device that includes sensors to collect biometric information and perform activity tracking[3]. Several versions of smart white canes for the visually impaired has also been designed and proposed[2][10][15]. These canes use ultrasonic or infrared sensors for recognizing obstacles and inform the user with haptic and/or audio feedback. Although these hiking poles are functional and have smart features, not much focus is directed on addressing how to create an emotional bonding with the hiking pole/cane and how that bonding will affect the user experience.

Anthropomorphism does not necessarily mean assigning superficial characteristics such as a human-like face or body, but rather to create objects with more significant human characteristics like the ability to think and feel emotions[14]. In the light of this definition, we observed there has not been much focus in existing literature on an anthropomorphic hiking pole for establishing emotional connection with the hiker that might improve the social and motivational aspects of the hiking experience. It is expected that this shall be a more intimate experience for the hiker than just a smart assistant on a smartphone, i.e., and in the design, the primary focus is on the pole's physically -"poleness".

3 METHODOLOGY & DESIGN

3.1 Features

The Peppy Pole, a hiking pole prototype has been built and designed so that it can display a number of anthropomorphic features in interaction with the hikers. To design the lifelike features for the Peppy Pole, the authors tried to observe and imagine how a living hiking pole would feel in different situations. The following sections cover the sets of augmented features of the Peppy Pole.

3.1.1 Outdoors features. We added features that are liekly to give a sense of "aliveness" when using the Peppy Pole. We used movement of the hiking pole's wrist straps to express the feelings of the pole because lively movement is considered to be a very effective anthropomorphic feature[13]. The Peppy Pole shows excitement at the beginning of the hikes. During the hikes, after a certain period of walking, the Peppy pole gets tired and lets the hiker know of its current fatigue. The Pole keeps expressing its tiredness until the user takes a break from hiking and lets it rest for some time. After being well rested, the Peppy pole will express its excitement and happiness again. This feature is allowing the hiker to acknowledge the feelings of the Peppy Pole as an independent entity and at the same time is expected to help the user have regular breaks during their hike.

The communication goes both ways. The hiker can also let the Pole know when he/she gets tired by holding the pole loosely and

with an angle, tilted towards the ground. This gesture was chosen because it corresponds well with the feeling of fatigue. The Peppy pole now responds to the hikers' feeling to create a sense of support and encouragement.

Our goal behind designing these features is to see if such living traits in a hiking pole or walking stick help the hiker be more motivated to finish their hike and hike for longer periods of time.

3.1.2 Indoors features. The Peppy Pole's general satisfaction grows with the number of steps it takes in a hike. The Peppy Pole's satisfaction decreases by the hours it sits idle at home when the hiker not walking. After a long hike with the Peppy Pole, based on how many steps it has walked, it will be content for a number of days and after that it will start to show signs of boredom and restlessness until the user takes it on another hike and walks with it some more. We were interested in how these expressions of boredom or requests to be taken out on another hike, can affect the users' motivation to hike more often and their hiking habits in general.

3.2 Prototype Design

Our prototype of the Peppy pole consists of 3 main parts : Arduino Uno, motors, and smartphone attached to a single hiking pole as shown in Figure 2.

3.2.1 Motors. We use two 3-6V DC motors to express the Peppy Pole's different feelings in the indoors and outdoors functions. The motors are supposed to move the two parts in the hiking pole's wrist band, marked part (a) and (b) in Figure 2. We chose different speeds and moving patterns for different situations by trial and error. When the pole is excited and happy to start the hike, the motor moving part A wiggles it around quickly. When the pole is tired and wants to stop for rest, part A moves slowly and the second motor tugs on the part B of the wrist band. When the user tells the pole that she is tired, the pole responds by tugging on the wrist band in a gesture of comfort.

3.2.2 Smartphone. We are using the sensor data from the smartphone (One Plus 5) to cue the actions of the Peppy Pole in different situations. We developed two android applications for the two sets of features (outdoors and indoors) explained in the previous section. The first application called the PeppyOutdoor uses the accelerometer data from the smartphone sensor to count the number of steps the pole is walking to determine when it should get tired. When the hiker want to express her tiredness to the pole she should hold the pole loosely and tilted towards the ground. It also uses the orientation sensor on the smartphone to sense when the user is tilting the pole more than the set threshold. The second Application PeppyIndoo keeps track of the number of steps the user takes and then sets a timer based on that count eventually giving a signal to the user via the Peppy Pole's movement that it is time to be taken out for a hike.

3.2.3 Arduino Uno. We use a serial connection using USB-C to USB cable to connect the smartphone to the Arduino Uno. The Arduino receives the signals from the smartphone through the serial connection and is programmed to control the movements of the motors. The working mechanism of Arduino Uno, Android Smartphone and Peppy Pole is shown in the Figure 4.

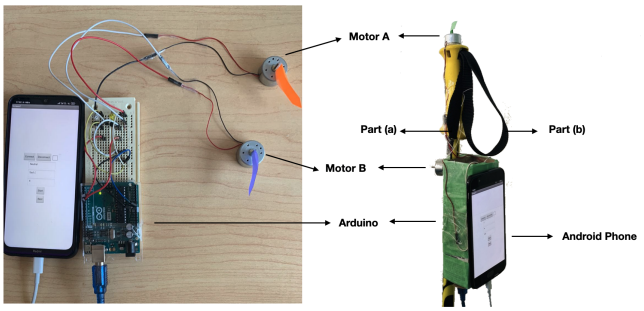

Figure 2: Peppy Pole Design Prototype

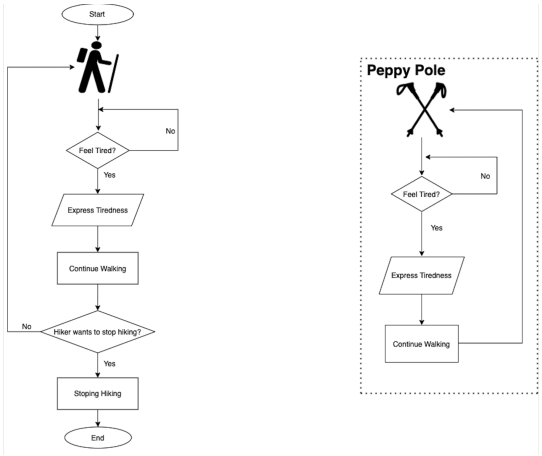

Figure 3: Flow Chart showing Hiker using Peppy Pole for Outdoor Activities

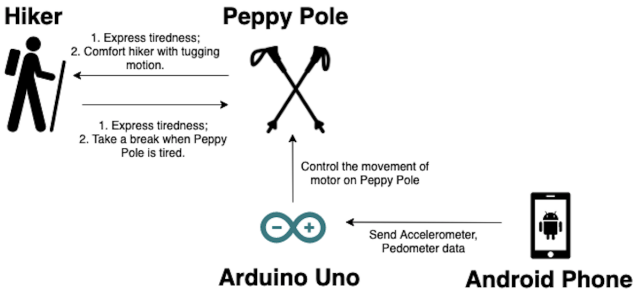

Figure 4: Peppy Pole Mechanism and Interaction with Hiker in Outdoor Activities. This figure illustrates the interaction between hiker and Peppy Pole while they get tired as shown in Figure 3. Hiker will express tiredness by tilting the hiking pole over 45°. Peppy Pole will express its tiredness by tugging wrist bands and spinning motor.

4 USER STUDY

4.1 Experimental Design

In order to test the indoors and outdoors features of the Pole the experiment was designed in two Phases. Before conducting the actual user study, we initially performed a pilot study with 2 participants (1 female and 1 male). Some questionnaire questions and prototype design were improved based on their feedback.

4.1.1 Phase A: Outdoors Experiment. In order to simulate the real conditions of a hiking trip and make our participants feel tired while addressing time limitation issues, we conducted our outdoors experiment in a set of 490 outdoors stairs leading to Wreck Beach in Vancouver, British Columbia.

After introducing the features of the Peppy Pole, the participants were asked to climb 100 stairs up and down once with the Peppy Pole and once with the a regular hiking pole. This was done to ensure that the participant becomes familiar with both a regular hiking pole and the augmented features of the Peppy Pole. The participants were again asked to climb the stairs with the Peppy Pole and the regular hiking pole, but this time they were asked to climb as many stairs as they felt like. The stair count, the time, and the number of times the Peppy Pole took a rest were recorded for each round and analyzed later. The participants were then interviewed and asked to fill a questionnaire. It is important to note that the participants were asked to rest and refresh between each round of climbing stairs. To reduce the confound effect caused by whether they are using the Peppy Pole or regular pole first, half of the participants were randomly assigned to climb with Peppy Pole first and the other half climbed with the regular hiking pole first. The proposed outdoor activities interaction between hikers and Peppy Pole is shown in the Figure 3.

4.1.2 Phase B: Indoors Experiment. In the indoors experiment the users spent 1.5 hours with the Peppy Pole at their homes or at study rooms. After explaining how the Pole works, they were asked to walk with the pole around the room for 20-30 steps and go back to what they planned to do, such as studying, cooking, reading, playing video games, etc. Meanwhile, when the pole gets bored and expresses its boredom the participant has to walk with it some more. Participants usually will repeat to get familiar with this functionality and avoid the novelty design resulting in influencing the experimental results. After 1.5 hours with the pole the participants were asked to fill a questionnaire and interviewed by the authors.

4.1.3 Covid-19 Safety Measures. Covid-19 safety measures were followed strictly during our user study. The participants were wearing face masks and practiced social distancing in both the indoor and outdoor experiments. The prototype was sanitized after each use and the interviews were either conducted outdoors or online.

4.2 Participants

For Phase A: outdoor experiment, six participants (3 male and 3 female) aged between 23-27 were recruited. Most (five) of them identify themselves as physically fit, while one doesn't. One participant hikes twice or more in a month, one hikes once a month, three hike once every 2-3 months, while one user has never hiked before. Also, three of them have experience in using hiking pole before.

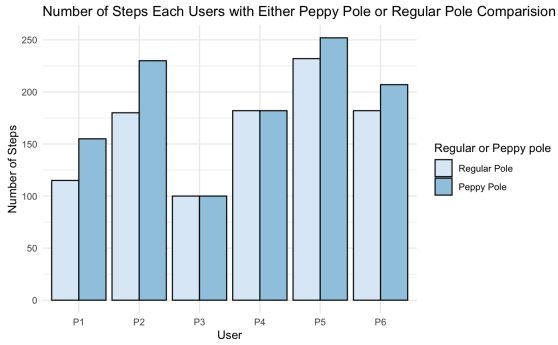

Figure 5: Comparison of the number of steps each user Walked with either Peppy Pole or regular Pole

For Phase B: indoor experiment, five participants (3 female and 2 male) with the age between 23-27 were recruited. All of them have experience in using regular hiking pole before.

All of the participants were UBC students. Three participants were common in Phase A and B experiments. Before beginning the experiments, participants were asked to sign consent forms for the investigators to use the questionnaire response and audio recording of the interview. The participants were requested to follow the Covid-19 protocols.

4.3 Hypothesis

We designed the following hypothesis to perform data analysis in our user study. Due to lack of sufficient data and time constraints, it was not possible to conduct a statistical analysis for our second research question. Hence, we only define one hypothesis for validating our first research question. Ideally, in a user study for Phase B with longer period of time, a similar hypothesis can be defined and explored in future work.

4.3.1 Hypothesis. 1:
$H0$: Users will not choose to climb longer distance when using the Peppy Pole with "poleness" life-like features compared to the regular hiking pole.
$H1$: Users will choose to climb longer distance when using the Peppy Pole with "poleness" life-like features compared to the regular hiking pole.

5 RESULTS

5.1 Outdoors Experiment: Quantitative Analysis

As mentioned before, participants are given the freedom to walk as long as they want. Thus, in order to compare among different users to analyze whether they prefer to cover longer distance with Peppy Pole, we first set the number of steps with regular pole for all users to the fixed value, 100 steps, and then scaled the number of steps with Peppy Pole correspondingly by following the formula:

$$\text{Number of Steps}_{(scaled)} = 100 \times \frac{\text{Steps with Peppy Pole}}{\text{Steps with Regular Pole}} \quad (1)$$

With R, a repeated measures ANOVA test on the dependent variable: number of steps, was conducted to investigate the data and validate them against our hypothesis. Specifically, we analyzed whether these additional anthropomorphic features of the Peppy Pole compared to regular pole make participants motivated to walk longer. As shown in the Figure 6 below, the analysis result turns out to be: $F_{(1,10)} = 5.764$, p = 0.0373 < 0.05, which supported hypothesis $H1$ that users would prefer to cover longer distance with the life-like features embedded in Peppy Pole compared with regular hiking pole.

```
                          Df Sum Sq Mean Sq F value Pr(>F)
Regular.or.Peppy..0.or.1.  1  600.9   600.9   5.764 0.0373 *
Residuals                 10 1042.6   104.3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 6: ANOVA Test Results

After completing the outdoors experiment, the participants were asked to fill a questionnaire designed with the five-point Likert scale. You can see their responses to some of the key questions of the questionnaire in the Figure 7. The participants gave an average response of 4 to the statement: the sound and movements of the Peppy Pole made it seems alive. Except one user (who chose disagree), the other 5 either strongly agreed or agreed to the statement: Compared to a regular pole, the Peppy Pole makes the user more motivated to finish the hike. This statement got an average of 4 from all 6 users. It was observed that the users were not enthusiastic about the feature of hiking pole responding to their tiredness and gave an average score of 3.34 to the statement: the Peppy Pole's response to my tiredness provided comfort for me. Based on the results, the overall enjoyability of the hike increases when using the Peppy Pole. The participants scored the statement: compared to when using a regular hiking pole, I enjoyed my hike more with the Peppy Pole, as 4.34 which is a good score relatively. Overall, the users agreed with a mean of 3.83 and a mode of 4 that they prefer to use the Peppy Pole instead of a regular pole in the future hikes.

5.2 Outdoors Experiment: Qualitative Analysis

Semi-structured interviews were conducted with each participant in both experiments during the user study. You can see the main findings of this analysis in terms of different features of the Peppy Pole grouped in the following subsections.

5.2.1 Augmented Features. Four out of six participants found the way the Peppy Pole expressed its feeling interesting and commented on the Pole's movements. Overall they found the way the pole moved and tugged the wrist bands 'cute' and 'likable'. It seemed like most of the participants preferred the tugging motion. One participant stated that "The tugging felt like a child. It was really intimate and likeable".

Four participants commented on how they liked the fact that the Pole got tired after some time and they needed to give it some rest before continuing the hike. They felt like it affects the quality of their hike positively and that it was helpful in letting them know when they should also take a break. One participant stated that "It is very good that it makes the hiker have rest in equal intervals because it is very important in hiking". It seemed like the participants were mostly interested in how the Pole's regular breaks will affect their rest management during hikes and they made suggestions to improve this feature in ways that benefit the hiker's experience. For example, one participant suggested that the pole should evolve with their hiking experience and match its stamina to the stamina of the hiker as they become more fit. They also made general suggestions about improving the resting feature such as suggesting to drink water or snacks. Another participant suggested that the Pole should take slope and conditions of the trail into consideration while computing when to get tired to match the hiker's condition better.

One feature that seemed to be not interesting in the users' point of view was the hiker's ability to communicate her/his tiredness to the pole. Two of the participants mentioned this features as a negative point. One said that "I personally didn't like telling the pole I am tired and felt like it was useless". While the other participants did not mention it explicitly, they did not seem to be very interested in that feature of the Peppy Pole as well. According to one of the participants, it is easy to forget to use this feature because it has to be initiated by the hiker.

5.2.2 Motivations and Loneliness. Three participants commented on how the Peppy Pole was effective in their motivation to finish the hike. One participant mentioned that the fact that the pole got excited to start walking after each break made them motivated. Another participant said that the pole was motivating them to hike more distance because "...the cue actually pushed me to go a little bit further every single time.". One participant however, felt that while the Peppy Pole affected the motivation to hike with better quality, it did not affect their motivation to finish the hike directly.

The Peppy Pole can also be effective in reducing the hiker's loneliness during hikes. Three participants mentioned how the life-like features of the Peppy Pole made them feel like they were not alone during the hike and "had a friend with them". One participants said "It makes the hike feel less lonely. As if the pole has a personality.". One of the participants believed that the pole was more effective and helpful when they were hiking solo or in trails with less traffic because when they are in a group they get to talk with others.

5.2.3 Limitations. Participants provided some constructive feedback and suggestions about the Peppy Pole. Two participants commented that the current Peppy Pole prototype is too big, and they preferred the design of the pole to be ideally slim. One of them also mentioned that the tugging feeling received from the pole was not strong and obvious enough sometimes. Another participant pointed out that Peppy Pole requested for rest too frequently, consequently he/she got enough rest and could not get a chance to interact with the pole while he/she felt tired.

5.3 Indoors Experiment: Quantitative Analysis

In the indoors experiment the 5 participants were asked to fill a questionnaire after spending 1.5 hours with the Peppy Pole. The answers for the questionnaire were in the 5 point Likert scale format and the collected results can be viewed in Figure 8. Based on the responses collected from those participants the following can be

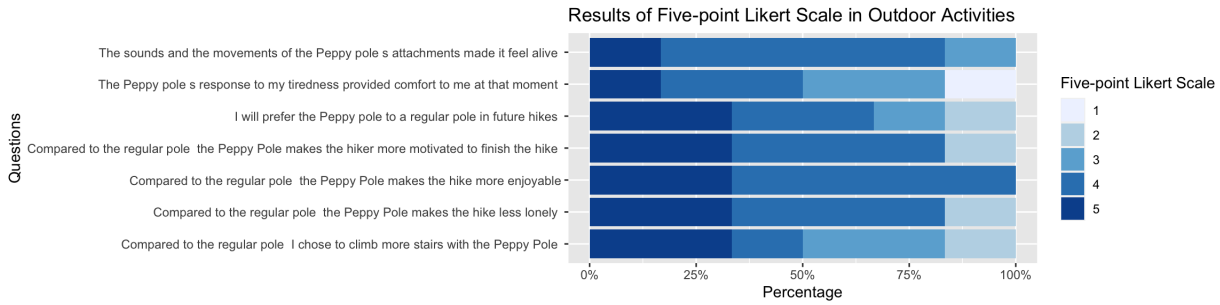

Figure 7: Percentage of Five-point Likert Scale in Outdoor Activities in Questionnaire. The questionnaire results show the Likert Scale with 5 strongly agree and 1 strongly disagree. Most participants ranked those proposed questions with scale 4 or 5. Especially, the questions "Compared to the regular pole, the Pepple Pole makes the hike more enjoyable." received 5 with 25% and 4 with 75% feedback.

deduced. With a mean response of 4 and a mode of 4 the majority of the participants agreed that the sounds and movements of the Peppy Pole made it feel alive. Except one person the other 4 either agreed or strongly agreed that the Peppy Pole's request to be taken out makes it more likely for them to go on a hike sooner and gave an average of 3.8 and a mode of 4. With an average of 3.8 and a mode of 4 the participants agreed that they prefer the Peppy Pole to the regular hiking pole in future hikes. Overall the majority of the participants expressed positive feedback regarding the effects of the Peppy Pole on hiking more often.

Due to the time limit, it is relatively tough to explore how frequently the users would go for a hike with either Peppy Pole or regular pole, through conducting a comparative user study. Therefore, we couldn't directly answer the second indoor-related research question by phrasing a hypothesis. However, since we intentionally recruited users in indoor experiments with previous experience in using hiking pole, their positive feedback would be relatively meaningful to partially support the research question about whether the Peppy Pole can motivate the hiker to go on hikes more often, by displaying its "own" wish to be taken out on hikes. An extension of our current study design with more participants for a longer duration may be effective in fully answering this question.

5.4 Indoors Experiment: Qualitative Analysis

Two out of five participants in the indoors experiment also suggested that the pole felt like it was alive and they believed that this sense of aliveness improves the motivational aspect of the Peppy Pole in this experiment setting.

One participant expressed how he thinks that the sounds and movements the pole makes is a great addition to the way it reminds the person to go on more hikes. Another participant also said that "It's definitely different from getting a notification from your cellphone!". One of the participants expressed delight in how it can even be a good reminder to walk more in an everyday setting like when sitting at the desk for too long.

Two out of five participants mentioned concerns about how this feature of the hiking pole may not be effective in long-term. They felt that after some time the feature might get repetitive and boring and the user will decided to ignore the signals.

The participants made recommendations on how the Pole can be smarter regarding when it gets bored. Two of them mentioned that if the pole gets bored in inconvenient times, it will not only be ineffective but also become irritating to the user. So it is better if it expresses its boredom on weekends or at times when the owner is more likely to be free.

Overall the reactions of the users to this feature of the Peppy Pole was positive and they mostly agreed that the Pole can act as a reminder and make them hike or walk more often. The participants made suggestions on how the prototype can be improved to increase the effectiveness of the Pole in increasing motivation to hike more often.

6 LIMITATIONS AND FUTURE WORKS

6.1 Prototype Limitations

We intended to use different parts of the pole as the means for its expression. The motors were originally designed to move the two parts of the wrist strap but in the current prototype Motor A is attached sepaately on the head of the Peppy Pole and is spinning an attached strap instead of part(a) of Pole's strap. This can be fixed in later versions to create a more consistent artifact.

Because of limited access to different electronic components, actions and movements of the motors could not be varied as well as it should and the pole's expressions were limited by this factor. The need for using the smartphone's sensors also added to the bulkiness of the prototype and created a negative impression for some of the users in the study.

6.2 Experimental Limitations

Due to the time limit, our experimental design for indoor activities was condensed into a less than two hours study, which are supposed to be tested in a longer time period, such as one week. Even though in the questionnaire and semi-structured interview, we asked participants to imagine if they conducted the user study in a longer period and answered the corresponding questions, some factors would still have a potential impact on user study results. In the future, the experiment should be conducted for a longer period to investigate the motivation caused by Peppy pole's "poleness" life-like indoors features more accurately.

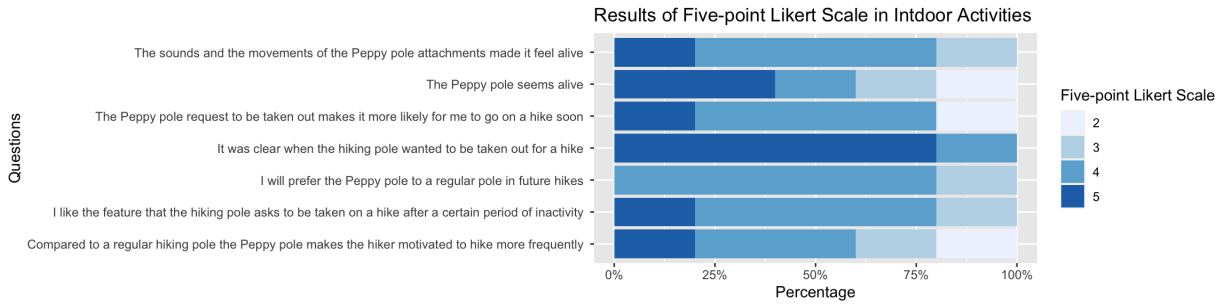

Figure 8: Percentage of Five-point Likert Scale in Indoor Activities in Questionnaire

Regarding the outdoor experiment, some participants misunderstood our initial purpose of asking them to walk as long as they want, and intentionally walked the same distance with both Peppy Pole and regular hiking pole for consistency. Also, the rest platforms alongside the stairs at the selected experimental position: Wreck Beach, is a big confound variable for some participants since they preferred to stop at those platform instead of a middle point of the stairs, about which we were notified while conducting the semi-structured interview.

To collaborate with more participants' schedule in a short time period, we chose climbing Wreck Beach stairs as our experimental activities instead of going for a real hike. The same issue about the condensed hiking time lied with the indoor user study as well - participants were asked to imagine they were hiking in a longer and real hiking trip. This would influence the collected data results, especially those users who didn't ever have an experience on hiking before.

Because of the Covid-19 Pandemic, the number of people allowed to gather together is extremely restricted. Recruiting more participants with diverse background to conduct the user study would make the results more persuasive and accurate.

6.3 Future Work

The possible improvement of the Peppy Pole is leveraging its "poleness" features instead of extra augmented features to accomplish our original "poleness" objectives and some aspects including portability and smartness.

The effectiveness of the artifact is definitely an important factor in the evaluation of the anthropomorphic features in a hiking pole. In future designs, without the mentioned limitations in the prototype, a more consistent artifact can be designed to better express the Pole's feelings and allow for better communication between the hiker and the pole. Exploring these new methods of communication and evaluating their effectiveness is a future direction in designing anthropomorphic interfaces in hiking poles.

Based on the feedback collected in the study, it is observed that while the life-like features made the Pole interesting to the users, they are mostly interested in those features that directly improve their hiking experience in terms of better performance. Therefore, we suggest more exploration in creating and features that benefit the hikers by being customized and taught based on the users' habits and tendencies.

Our user study design can be extended by recruiting more participants and more time in both the Phases A and B. Especially in Phase B, we can ask users to try out the regular pole and Peppy Pole as well and then analyze which one shall they prefer for motivation for hiking more. Getting more of this data, can help us frame a hypothesis regarding our second research question as well. Similarly, Phase A can include more extensive hiking trails and a longer study to gather more data that shall provide a strong support to our first hypothesis.

7 CONCLUSION

In this paper, we built an anthropomorphic and interactive hiking pole prototype called Peppy Pole, with life-like features that were built on existing features of a hiking pole. With the indoor and outdoor anthropomorphic features, we aimed to explore the potential implications in motivating hikers to go for a hike more frequently and help them walk longer distance during their trekking trips.

In addition to the normal functionality of a hiking pole, the Peppy pole gained two core functionalities in both indoor activities and outdoor activities by making some mechanical movements, sounds and tugging feelings. Through conducting the user study, the result supported the $H1$ in Hypothesis 1: User will prefer to climb longer distance when using the Peppy Pole with life-like features compared to the regular hiking pole. Therefore, we could concluded using ANOVA test on our study findings that the Peppy Pole's outdoor features can help the hiker to cover more distance. Our findings from experienced hiking pole users also partially showed that the indoor feature can effectively motivate hikers to go on hikes by displaying its "own" wish to be taken out on hikes.

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