Acceptance Model in Designing for Extreme Users: Extreme Athletes Using Activity Trackers

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***Abstract*—'Extreme Users' (EU) is a design method in Human Computer Interaction, which allows user-centered design in design groups. 'Acceptance Models' is a theory in Information Systems, which models how users accept and use technology. We conducted a study to explore the relationships of the factors influencing Extreme Athletes in the acceptance and use of Activity Trackers (AT). The data was collected from a cross-sectional survey conducted using a self-selected convenience sample of 206. The research rendered an exploration and an examination of the factors affecting trail-running athletes. The results were analyzed using several statistical techniques including Structural Equation Analysis. Our goal was to observe to what extent the Health Information Technology Acceptance Model patterns and outlines EU use of AT. This contribution, to the best of our knowledge, is new given that the obtained model can be an initial quantitative working primary tool for designers using the EU design method.**

***Index Terms*—extreme users, user centered design, ubiquitous systems, personal data tracking, sports/exercise, health information technology acceptance model**

I. Introduction

Models may be very helpful in the design and evaluation of interactive applications, even though some researchers who think of them as too theoretical criticize these types of approaches. Indeed, researchers working with interfaces of applications who had frequently been skeptical began to admit that such approaches could be helpful [1].

Unsurprisingly, if one considers that in fact, we as people actual make models to comprehend reality and conduct our interactions with reality. In the design of interactive systems, the variety of imaginable design alternatives is extensive and numerous aspects need to be contemplated. Model-based approaches can help to cope with this level of complexity. The objective of model-based design is to find high-level models that allow designers to analyze and detail interactive applications with additional semantic-oriented levels instead of immediately beginning to tackle these at the implementation level.

Models have tried to force their way into three major socio-technical communities: Human Factor and Ergonomics that was developed to correct engineering production problems [2]; Human Computer Interaction (HCI) that contributed to the shift from corrective ergonomics to interaction design; Human Systems Integration that combined Systems Engineering and Human Centered Design [3].

For our research path an influential paradigm was followed which was the Health Information Technology Acceptance Model (HITAM) by Jeongeun Kim and Hyeoun-Ae Park who built a model characterizing the mechanism of acceptance and use for health management by users of Health Information Technology (HIT) [4].

HITAM leaned on the Technology Acceptance Model (TAM) developed in a Ph.D. thesis by Fred Davis in 1985 [5]. HITAM also leaned on the Health Belief Model (HBM) that predicts general health behavior. This model has been evolving since Godfrey Hochbaum initially developed it in 1958 [6]. TAM is a broadly adopted technology acceptance theory used to elucidate why people are more or less prone to adopting and using a particular technology [7].

Wearable devices as Activity Trackers are becoming increasingly important in monitoring health behavior, socialization, and recreation, and thus constitute a viable and significant research topic. Activity Trackers generate multi-million dollar returns each year and materialize in the form of mobile or wearable technologies. Estimates show that wearable personal-tracking technologies will reach $70 billion by 2024 [8].

Knowing the success and attractiveness of Activity Trackers, researchers are yet to fully enlighten what drives Activity Trackers use, Activity Trackers acceptance, and how Activity Trackers can influence human actions. Additional research can increment Activity Tracker's design iterations by reinforcing previous or identifying new strengths and weaknesses that need to be addressed.

However, despite the commercial success stated earlier, a survey [9] exposed that 34% of users of commercially accessible Activity Trackers stopped using them over one to two semesters after acquisition. Ruben Gouveia *et al.* [10] tackled this issue and came up with three design directions: "designing for different levels of 'readiness', designing for multilayered and playful goal setting, and designing for sustained engagement."

A global design and consultancy company, IDEO, based in Palo Alto, California, with more than 700 employees [11], has a design tool 'Method Cards' with

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51 methods to inspire User Centered Design. The Method Card named Extreme Users explores the frequent selection and observation of users at the extreme ends of a distribution, instead of the average or typical user [12].

Our intended first stage of this work is based on HITAM, to establish an initial extrapolative model that has its focus exclusively on 206 Activity Trackers' extreme users. Extreme users, in this case, are users who use the devices in extreme conditions like ultra-trail running. This model tries to provide a view of these devices based on physical Health Information search. The proposed model can be used to broaden the designing for the Extreme Users iterative method by showing shortcomings that need to be tackled in order to enhance user acceptance. To the best of our knowledge, this is the first study to employ a TAM like model based on a design method.

In the following sections, we portray HITAM, and express the designing for Extreme Users method. We describe the methodology, and the validation process for the model. Lastly, we discuss the results, we conclude, and envision possible options for future work.

II. Literature Review

Among models present in Human Centered Design (HCD), we highlight three that offer suitable concepts and relationships between systems and humans. The SFAC model (Structure/Function - Abstract/Concrete) offers articulation among declarative knowledge, procedural knowledge, static objects, and dynamic processes. The NAIR model (Natural/Artificial versus Cognitive/Physical) rationalizes natural or artificial systems with their cognitive or physical features [13]. Finally, the AUTOS model (Artifact, User, Task, Organization and Situation), which is a framework, that supports structuring HCD and engineering [14]. Modeling and simulation in HCD make observation and analysis feasible, allowing the development of complex, design systems.

The use of models captures semantically significant properties, and so designers can further clearly cope with the rising intricacy of interactive applications and analyze these throughout the whole process. Numerous notations for model-based design of interactive systems have been proposed. Model-based approaches in HCI promote the illustration of interaction solutions that allow designers to reflect on and take adequate design decisions. Several models can help in the design process, including: Interaction, Interface, User, Presentation, Application, Context, and Dialog among other models [15], [16]. Most widely used are: Domain Models that represent the information and nature of the work performed; Application Models that represent the utility, advantages, activities, and options [17]; Task Models that represent utility, reasoning, and hierarchies [18].

Models led to model-based user interface development like Mobi-D which is a model-based integrated development environment that connects numerous models, helps the user interface designers with the conception of these models, and also with the decisions that have to be made during the design of the user interface [16]. Another is ArtStudio, which is a model-based design tool that helps the visual specification of task, abstract presentation, and domain models [17].

The rationale considered in this work is closely tied up with the context of the Health Information Technology Acceptance Model (HITAM). HITAM constructs and the constructs' questions asked in the survey come from many models and are described below. In Information Systems HITAM is an important model that is based on the Technology Acceptance Model (TAM), Theory of Planned Behavior, and Health Belief Model. TAM in turn is based on Martin Fishbein and Icek Ajzen's Theory of Reasoned Action, a theory from social psychology that illustrates the behavior of a human being based on their intentions [19]. In their work, Subjective Norm is defined as "person's perception that most people who are important to the user think he should or should not perform the behavior in question."

TAM specifically focuses on computer control by featuring two constructs: Perceived Ease-of-Use (PEoU) and Perceived Usefulness (PU) that determine Intention to Use (IU) via Attitude [20]. PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and PEoU is defined as "the degree to which a person believes that using a particular system would be free of effort" [5]. Perceived Ease of Use is the construct that in the model looks at the aspects of Usability.

Theory of Reasoned Action was improved by the Theory of Planned Behavior which is a psychology theory regarding the relationship connecting attitude and behavior [21]. So, there are several theoretical models, rooted in psychology, sociology, and information systems. Faced with a choice amongst a plethora of models, Venkatesh and his colleagues, saw the need to formulate the Unified Theory of Acceptance and Use of Technology (UTAUT) a unified view of user acceptance, from a review and integration of eight models [7]. They posit four constructs: Expectancy (Performance, and Effort), Social Influence, and Facilitating Conditions. These take substantial part as direct determinants of the constructs representing Behavior Intention and Use Behavior.

Albert Bandura shaped one of the most predominant theories of human behavior, the Social Cognitive Theory [22], where ahead of Outcome Expectations (Performance, and Personal), Affect and Anxiety, he created Self-Efficacy (SE) defined as "the judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task" [23].

The evolution of the Health Belief Model (HBM) over time brought the following constructs: Perceived Severity of Disease, Perceived Susceptibility of Disease, and Health Threat. Perceived Severity of Disease is defined as "the beliefs a person holds concerning the effects a given disease or condition would have on one's state of affairs." Perceived Susceptibility of Disease is defined as "the perception of the likelihood of experiencing a condition that would adversely affect one's health." Health Threat is defined as "abstract assessing the susceptibility and the severity, of disease-specificity" [24].

HITAM [4] has a construct equivalent to one in HBM, that is Health Consciousness, defined as "the degree to which health concerns are integrated into a person's daily activities" [25]. The mentioned models are too general and are not specific enough for a particular application.

In the HITAM study with 728 users, Kim and Park categorized the leading factors that have an impact on the behavioral intention to quantify, save, and handle health data into three domains namely technology zone, information zone, and the health zone. They suggest that users enjoying the use of Health Information Technology (HIT) and gaining confidence in their skill to use HIT increase their likelihood of continuing to use HIT. Particularly, if Self-Efficacy improves then the PEoU also improves.

HITAM is a concise and robust model, that had its internal consistency and understandability of the items tested. HITAM rearranges and revises prior results in the field, by pinpointing the central factors that have the biggest influence. The predicting factors identified in the three zones are: HIT Reliability, and Subjective Norm in the information zone; Health Beliefs, and Health Status and concerns in the Health Zone; and HIT Self-efficacy in the technology zone.

Kim and Park study showed that, even though TAM has broadened and extended its usefulness in numerous areas and has been effectively applied, its application in the HIT field has been minimal and limited. In light of this, with the rapid development of information technology and its consequent influence on health management, a model that foresees and seizes a variety of nuances of the users' acceptance was missing.

Later, Kim complemented their study by interviewing 18 female college students to qualitatively abstract the constructs that sustain the user experience of self-trackers for activity, diet, and sleep [26]. This complemented the initial work in developing HITAM, as well as enhancing it with more thorough analysis of user experience. Kim used a hybrid approach called methodological triangulation that provides detail and abductive inspiration. Interviews with users can adjust the research to the suitable elements. Moreover, qualitative research can also put in order quantitative data that has been previously collected or insinuate new possibilities with regards to the observable facts. It also brings clarification to seemingly incoherent findings established by the quantitative results. Hence, the impact of her qualitative study is in performing a relatively innovative research methodology that backs up a research question by finding an undisclosed event in an earlier investigation.

Sol and Baras gave steps towards the establishment of an Activity Trackers acceptance model [27]. From their hypothesized model with 21 constructs they obtained a final model with only 11 constructs. Interestingly, it should be noticed that 7 of those final constructs are also included in HITAM.

When it comes to design, in literature one can find a plethora of design methods and practices. IDEO's design practice is an iterative loop that follows from understanding, to observing, visualizing, evaluating, refining and implementing. The Extreme Users method represents the far end of the usability requirements range, not its average reaches. This method supports the line of thought that starting the design process with relatively limited type of users is advantageous [28]. The experience of the extreme users acts like a provocation that tends to enrich the process of the designer who engages with these users. This gives the designer a keener understanding of a design breakdown and gives him the skill to articulate both the extreme users' peculiar response to it, and also the problem [29]. The irreplaceable research, specially the one based on extreme users is more likely to offer memorable insights that keep all stakeholders focusing on the user [30] Also Pullin and Newell suggested the concept of designing for "extra-ordinary" users and enumerated the benefits not only for extra-ordinary users but also for "ordinary" users in "extra-ordinary environments" [31].

As designers, computer and social scientists we have the responsibility to look critically at the integration of such methods and models. Of particular interest is the work of Consolvo *et al.*, who suggest that designers should design in order that the AT gives credit to the user, creates awareness, foment social interaction, and is aware of lifestyle constrains [32]. Shih *et al.*, suggests the use of reminders, looking into gender differences, fomenting social interaction, and insists on the devices accuracy [33]. Lazar *et al.* suggest appealing to the user's identity and motivation, to have proactive feedback, and that the AT should provide motivation to the user [34]. Klasnja *et al.* suggest the use of behavior change strategies [35]. Rooksby *et al.* noticed that the users do not use only one technology, that there is a need to attend to the physicality, and to look into the user's emotionality [36]. However, none of these researchers look into the user's health beliefs.

In this paper we look at a specific perspective in a novel application of these models within methods of design. We considered the method not simply instinctively, but also calculably. Going beyond technology related constructs this model also gives importance to the user's health beliefs by having related constructs. This is because we are interested in modeling quantitatively the patterns of acceptance and usage of extreme users of Activity Trackers.

III. Method

Our target population was the ultra-trail runners using Activity Trackers. We recruited them via the mailing list of the participants of a competition that is part of the Ultra Trail World Tour [37]. Analogously to Pullin and Newell [31] we define these users as Extreme Users because of their use of the devices in extreme competitions. We collected the data through an online survey sent by email. The survey questions of the Health Information Technology Acceptance Model were adapted to focus specifically on physical condition. For example, one item of Perceived Ease of Use was "It takes less effort to use Activity Trackers than other means for physical condition information and management." One item of HIT Reliability was "Activity Tracker findings for provision of physical condition information and management are of acceptable quality."

All the scales were adapted from the Health Information Technology Acceptance Model constructs by Kim and Park [4]. The constructs were measured with 5 items for Health Belief & Concerns, 5 items for Subjective Norm, 3 items for Perceived Susceptibility, 4 items for Perceived Seriousness, 6 items for HIT Self-Efficacy, 5 items for HIT Reliability, 5 items for Perceived Ease of Use, 5 items for Perceived Usefulness, 3 items for Attitude, and 3 items for Behavioral Intention. In the diagram of a TAM like model as HITAM there are arrows pointing between constructs. Each of these arrows represents a hypothesis. HITAM has 12 different hypotheses. For example, for Self-Efficacy, Hypothesis 1a is: Self-Efficacy will have a direct effect on Perceived Ease of Use. Hypothesis 1b is: Self-Efficacy will have a direct effect on Perceived Usefulness. For Attitude, Hypothesis 9a is: Perceived Usefulness will have a direct effect on Attitude. Hypothesis 9b is: Perceived Ease of Use will have a direct effect on Attitude.

The items were considered using a seven-point Likert scale, between "Strongly Disagree" and "Strongly Agree." Age was considered in years. Gender was coded using 1 and 2, where 1 stood for women.

We attempted to reach 2050 athletes from 40 countries mainly from Western Europe and obtained an overall response acceptance rate of 10.2 percent. From a total of 209 returned responses, 3 were invalid and were eliminated before the data analysis. Consequently, 206 users successfully completed the survey, of which 168 were male (81.6 percent) and 38 were female (18.4 percent), being the average age 38.5 years (standard deviation: 7.7). Regarding education levels, 3 users had Mid School or lower (1.5 percent), 40 had High School (19.4 percent), 42 had Bachelor's degrees (20.4 percent), 88 had Master's degrees (42.7 percent), and 19 had PhD degrees (9.2 percent).

IV. Analysis

We analyzed the proposed model using maximum likelihood parameter estimation. Descriptive statistics, and Exploratory Factor Analysis were conducted using IBM SPSS version 22. The structural equation model was built-in with maximum likelihood estimation routines in IBM SPSS Amos 24.

Cronbach alphas were higher than 0.7, except for Perceived Susceptibility (0.644). This indicates that there was construct reliability, meaning that the questions of each construct were related to each other. The Kurtosis analysis did not find normality issues.

The Exploratory Factor Analysis trimmed the initial model using Maximum Likelihood analysis with Promax Rotation. All loadings were above 0.420, except for HIT Self-Efficacy's items 3 and 4 with 0.370 and 0.380 respectively, which is bearable for our sample size [38]. Item 2 of the construct Health Belief, item 1 of Subjective Norm, item 1 of Perceived Seriousness, items 5 and 6 of HIT Self-Efficacy, items 1 and 3 of HIT Reliability, items 4 and 5 of Perceived Usefulness, item 3 of Intention to Use, and all items of Attitude had to be discarded for the integrity of the model. Item 3 of HIT Self-Efficacy loaded prominently with the HIT Reliability construct. The remaining 3 items of Perceived Usefulness loaded with the 5 items of Perceived Ease of Use, creating a more UTAUT like dependent variable construct that was named as Perceived Ease of Use & Perceived Usefulness. The total variance explained was 56.1 percent.

In Table I, one can observe the correlation coefficients for the measured variables, which vary from 0.000093 to 0.669, all are below the 0.7 threshold. For example, the coefficient -0.05 between HIT Reliability and Health Belief signifies that the questions of one construct are not needed to explain the other.

In Table II one can observe the tests for the convergent and discriminant validity of the scales. The Average Variance Extracted (AVE) that is the average quantity of variance in variables that a construct is able to explain is always close to or exceeding 0.50, and Composite Reliability exceeds 0.73. These values for Composite Reliability imply that the questions of each construct are still holding together in the Confirmatory Factor Analysis. In this table, the Maximum Reliability (MaxR(H)) is also reported. Common Methods Bias was tested during the Confirmatory Factor Analysis, where we compared the unconstrained and the fully zero constrained common method factor models that was significant with chi-square difference of 72.4, and a degrees of freedom difference of 25.

Nevertheless, we removed the common latent factor for the sake of the maximum interactions of the model. A Cook's distance test was done regarding multivariate assumption and no abnormalities were found.

TABLE I. Correlation Coefficients between Measured Variable

Factors	1	2	3	4	5	6	7
Health Belief & Concerns	1						
Subjective Norm	.322	1					
Perceived Seriousness	.537	.497	1				
HIT Self-Efficacy	.407	.201	.285	1			
HIT Reliability	-.005	.115	.134	.073	1		
Perceived Ease of Use & Perceived Usefulness	.597	.325	.443	.251	.000	1	
Intention to Use	.597	.432	.599	.379	-.011	.699	1

TABLE II. RESULTS FOR THE CONVERGENT AND DISCRIMINANT VALIDITY OF THE SCALES

Regular	1	2	3	4	5	6	7
CR	.790	.905	.793	.873	.738	.757	.874
AVE	.542	.576	.495	.696	.485	.509	.776
MaxR(H)	.781	.930	.948	.962	.966	.969	.975
Perceived Seriousness	.736	.073	.067	.047	.177	.140	-.007
Perceived Ease of Use & Perceived Usefulness		.759	.470	.814	.221	.653	.877
Health Belief & Concerns			.704	.419	.673	.606	.559

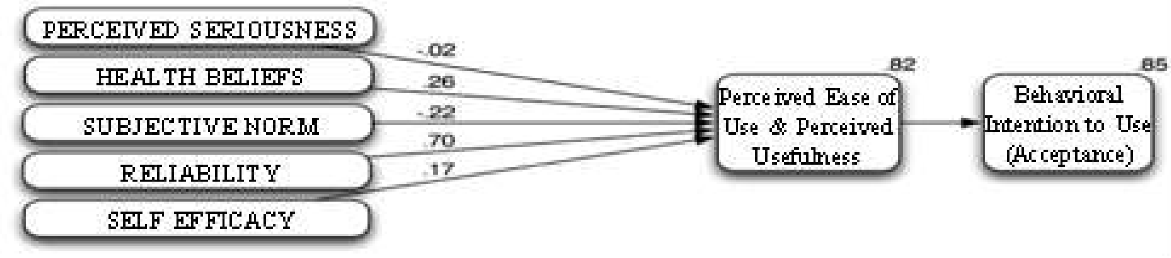

Figure 1. Finalized model.

The finalized model in respect to multicollinearity had a Variance Inflation Factors (VIF) showing that apart from Perceived Seriousness (1.088) all other independent variables have some redundancy, varying from 3.192 to 5.552, while explaining the dependent variable: Intention to Use. The finalized model exhibited the fit to the data with a Chi-square of 11.514, with 3 degrees of freedom, and $P < 0.01$. The goodness of fit index was 0.994. A root mean square error of approximation of 0.118 with a p of close fit (PCLOSE) of 0.047 is bearable due to the low degrees of freedom [39]. All paths in Fig. 1 are influencing Perceived Ease of Use & Perceived Usefulness, except Perceived Seriousness. The model accounts for 85 percent of the variance in Intention to Use, and 82 percent of the variance in Perceived Ease of Use & Perceived Usefulness.

V. DISCUSSION

Through an online survey we assessed the use of Activity Trackers, we assessed HITAM, which could explain this use. We submitted the constructs of HITAM for statistical analysis and obtained the resulting final model. As expected from an exploratory assessment like this one, the majority of our hypotheses did not prevail. Although the complete HITAM model did not prevail [4], the trimmed valid final model that was derived from the results had a higher level of prevision than the original TAM [5].

The other statistical results while mediocre, are not necessarily surprising given that we are dealing with extreme users who, by definition, are at the extreme end of a distribution.

The study is limited in a number of ways: its sample is biased, as 81.6 percent were males, however this is common in extreme sports. A few items have statistical limitations in their loadings. There is shared variance between Perceived Ease of Use & Perceived Usefulness with Intention to Use, and with HIT Reliability. Furthermore, there is shared variance between HIT Self-Efficacy with Intention to Use. This in turn is in line with the fact that the independent variables have some redundancy when explaining the dependent variables.

This study supports the notion that Subjective Norm has a negative influence on Perceived Ease of Use & Perceived Usefulness giving AT a utilitarian value to these users. Since Subjective Norm has this effect in the acceptance of these devices, thus other users or social counterparts do not induce Activity Tracker use by extreme users, we question if this should be considered when thinking about the marketability of these devices. Previous studies, which looked at the social aspect of the uses, found it to be important [17], [32], [40]. Our results narrow the broadness of social influence, quantifying its competitive and comparative aspects found by other authors [36]. It seems that extreme athletes do not give importance to the social aspect of the use, even though we suspect that the comparisons with their counterparts are important as previously found [41].

As expected, HIT Self-Efficacy has an influence on the model, supporting previous findings on features such as giving credit and awareness to users [31], widening the variety of adjustable goals [20] or a tailored efficacy evaluation [35].

The described study supports the hypothesis that Perceived Usefulness & Perceived Ease of Use is a stronger determinant of the Behavioral Intention to use Activity Trackers than Health Threat. A major difference regarding the original HITAM is that we saw that the Health Information, in this case is not an important condition for the validity of ATs acceptance and use by extreme users. Specifically, Health Threat loses its prevailing value in favor of Perceived Ease of Use & Perceived Usefulness, given that, Perceived Susceptibility was initially trimmed, and later Perceived Seriousness was found not to be an influencer. In the light of this, we suspect that it is because extreme athletes' physical condition is above the average. This level of physical condition might reflect that the extreme athletes have a minimum perception of the likelihood of experiencing a condition that would be unfavorable to their health. Therefore, this lack of impact of Susceptibility, and

Seriousness found in this study may be because some extreme users considered the issue of Susceptibility and Seriousness to be unimportant, due to their good health. This is backed by the finding of the strong influence of Health Belief in the model, meaning that these users have a strong belief in their good health. Another reason might be that Perceived Susceptibility and Perceived Seriousness focus on disease, but perceived usefulness focus on usefulness of HIT in health support. These are important findings that add to the increasing body of knowledge in the intersection of HCI, Information Systems, and Health Sciences [35].

The deeper repercussion of our work for further research is that health threat is exhausted by the important role of Reliability, supporting previous findings regarding the need for accuracy in AT [33], [41]. The obtained model clearly shows Reliability as the most influential construct. This finding advocates that development in Activity Trackers should be made by focusing more on the effective response of the system and not so much in the search for secondary determinants. From this, we can suggest that designers of AT will need to be the ones to perfect and evolve the intricate details of wearable devices when the engineers do not fulfill nor anticipate results of the devices.

For extreme users, the effect of Perceived Ease of Use on Perceived Usefulness is so strong that the two constructs load as one. Nevertheless, it supports previous findings such as the need of the user to create routines, need for low maintenance of the devices, devices that speak the user’s language, the need to coach the user [34], the dealing with the interweaving among systems, the need to have meaning to the context, and the fact that the user is not a data scientist needing the data to be processed [36]. These loading as one are stimulated by the fact that a significant correlation between Perceived Ease of Use and Perceived Usefulness is precisely the pattern foreseen if Usefulness is mediated between Ease of Use and Intention to Use [5]. This brings into question if for an extreme user a device that it is not easy to use immediately becomes useless. This result was unexpected, as it conflicts with the basic idea of the Technology Acceptance Model. This also raises questions about the use of a TAM like model for predicting and explaining the adoption of emergent information technologies [42]. While surprising, it is necessarily interesting given that we dealt with extreme users, and to our knowledge this is the first acceptance model that looks at these specific users.

It is worth mentioning that the resulting model of this paper has similarities with the UTAUT Model and that line of research should be pursued [7]. This is because the UTAUT constructs: Performance expectancy, effort expectancy, and social influence are conjectured to influence the behavioral intention to use a technology, while behavioral intention and facilitating conditions determine technology use.

The quantitative results from this paper partly reflect that we are working with Ultra Trail athletes who are ‘extra-ordinary users in extra-ordinary situations.’ These users do not represent the average users, however they are an important market niche and are also used for marketing purposes.

The resulting model fulfills the objectives of model-based design, stated in the introduction. The theoretical bases of models allow the designers to select the accurate model for the design problem. However, designers need to realize and understand when the design problem encompasses matters and features not tackled by the models. Since this contribution, to the best of our knowledge, is new given the obtained dedicated model, designers using the EU design method can utilize this model or a more generic one.

VI. Conclusion

Research and design opportunities abound in the Activity Trackers sphere, and our goal was to obtain a preliminary understanding of Activity Trackers use by ultra trail runners. Not only because these users represent a niche market, but also, mainly because they are taken into consideration in a design method.

The main contributions of this article are of two levels. At the first level in the Information Systems field this article presented a unique quantitative acceptance model that although statistically mediocre, models how extreme users accept and use Activity Trackers. At the second level in the Human Computer Interaction field this article presented a unique quantitative instrument that can support the work of the designers using the Extreme Users method while designing Activity Trackers. These contributions together are significant as they show more opportunities for the intersection of these two fields.

In this study, the HITAM model has been examined to explain and predict factors affecting extreme users of Activity Trackers. Health Belief and Concerns, Subjective Norm and Health Knowledge, HIT Self-Efficacy, HIT and Reliability included as antecedents in this model were found to influence extreme users' beliefs and indirectly influencing Activity Trackers use. The resulting model improves on existing models, due to its reinforced specialization in predicting Activity Trackers use by extreme users. Therefore, this study can help Activity Trackers’ designers, especially those who work with the Extreme Users method, because it reinforces and unveils more of what makes extreme users use these devices. Such knowledge adds to the improvement of Activity Trackers, through an enhanced aptitude in order to evaluate users beliefs.

One of the long-term aims of this research path is a qualitative evaluation of the performance of Acceptance Models’ use with the Extreme Users design method. The next steps are to evaluate Extreme Users with the UTAUT Model, and to evaluate HITAM with an alternative type of extreme users of Activity Trackers, such as the morbid obese.

Conflict of Interest

Funded by LARSyS (Projeto-UIDB/50009/2020). The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Ricardo Sol conducted the research, analyzed the data, wrote the paper; Karolina Baras supervised all steps; all authors had approved the final version.

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