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Smart Sport Watch Usage: The Dominant Role of Technology Readiness over Exercise Motivation and Sensation Seeking

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Abstract: The study examines the link between technology readiness/acceptance, motivation for exercising, and sensation seeking and using or avoiding Smart Sport Watches (SSW). A sample of 315 adolescents, *Mage* = 29.6 (SD = 11.01) and healthy male (*n* = 95, 30.2%) and female (*n* = 179, 56.85%), completed all the measures of these variables' dimensions via the internet. Multiple followed by univariate analyses of variance (MANOVA, ANOVA) were performed for each of the study's psychological dimensions and single variables. The two categorical factors (e.g., BS factors) were the use of SSW (yes/no) and walk/run (yes/no). Results revealed that adolescents using SSW rated themselves significantly ($p < 0.05$) and substantially higher than their non-SSW users on positive readiness for technology ($d = 0.47$), and specifically on optimism ($d = 0.34$) and innovation ($d = 0.51$). Moreover, users of SSW reported significantly ($p < 0.05$) and substantially lower negative readiness for technology than their non-SSW users' counterparts ($d = -0.49$), and specifically on discomfort ($d = -0.38$) and distrust ($d = -50$), but neither on the overall motivation for exercise dimensions nor on sensation-seeking. Moreover, adolescents who walk/run reported being more internally motivated ($d = 0.38$), integrated ($d = 0.61$), and identified ($d = 0.34$) than their sedentary counterparts. Discussion centers on the important role of readiness/acceptance in using technological devices and the need to use technology-specific motivation and personality measures to further explore this phenomenon.

Keywords: digital; watches; acceptance; readiness; motivation; exercise; personality

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1. Purpose for Using Smart Sport Watches (SSW)

SSW are designed to monitor the physical effort invested in exercising. SSW translate effort output into quantitative measures which are useful for monitoring the person's unfolding physical and health-related activities. In addition, SSW data enable the user to design and monitor his/her exercise regimen and maintain it for some time. SSW users primarily use wearables to guide their training decisions and optimize exercise programming, emphasizing a focus on personal adaptation to their readiness states [1]. The SSW provides information which is useful for both motivational and physical outcomes [2]. The use of wearables in the exercise and health domains has gained a significant momentum in recent years [3]. However, the psychological factors associated with its use are not entirely clear. To capture the underlying motives of SSW use, we consider the person's technology readiness/acceptance, general motivation for exercising, and sensation seeking as predictors of SSW use.

1.1. Technology Readiness/Acceptance

Along with the development and promotion of exercise and health-related technologies, some people experience a threat when using them (i.e., technophobia). Technophobia (i.e., fear of using technology) is prevalent in 30% of the general population, depending on gender, age, education, personality, culture, and ideology [4]. An internet survey among young adults supported the notion that technology readiness moderates the relationships between performance expectancy and attitudes toward wearables [5]. Seifert [6] examined the use of SSW among older adults aged fifty and above and concluded that education, age, technological affinity, and the use of mobile information and communication technology (ICT) devices (e.g., SSW, tablets, radio, TV, computers, and fitness trackers) in particular distinguished SSW users from non-users. However, Wu and Lim [7] identified several key factors influencing older adults' willingness to adopt smart wearable devices. These factors include performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and digital health literacy, all of which significantly affect their acceptance.

Technology readiness (TR) is an attitude which pertains to the user's belief towards a technology. It is the user's inclination to engage with a novel technology [8]. TR is a multifaceted concept, dependent on individuals' prominent personality traits relating to technology use. For example, users demonstrate a high level of positive technology readiness, heavily influenced by perceived ease of use, underscoring the importance of ease of operation as a critical factor in their willingness to adopt these technologies [9]. Parasuraman [10] distinguished between positive technology readiness (PTR) and negative technology readiness (NTR). Specifically, PTR comprises factors that motivate acceptance of a new technology such as optimism, control, flexibility, efficiency in peoples' lives, and innovativeness—a tendency to be a technological pioneer and thought leader. In contrast, NTR includes two factors that inhibit acceptance of new technology: (a) discomfort—a perceived lack of control over technology and a feeling of being overwhelmed by it—and (b) insecurity—distrust of technology, stemming from skepticism about its ability to work properly and concerns about its potential harmful consequences [10].

A technology acceptance model was derived from Ajzen and Fishbein's [11] theory of reasoned action (TRA). The TRA model was fundamentally used to predict the degree of acceptance of any new technology [12]. Accordingly, two main antecedents influence the user's intention to adopt a novel technology: (a) perceived usefulness (PU)—"the degree to which a person believes that using a particular system would enhance his or her job performance", and (b) perceived ease of use—"the degree to which a person believes that using a particular system would be free of effort" ([12] p. 32). Yet, according to Ramen and Aashish [13], some of the researchers have indicated that TAM must be broadened and enhanced with supplemental constructs to improve its interpretations and predictive capabilities [14]. Lin et al. [15], for example, included TR in the existing TAM model to better capture the person's intention to use a novel technology. With this integration, the TRAM (technology readiness and acceptance model) emerged. The model simplifies the process by which one adopts a novel technology by considering his/her experience and awareness about using any technology at large. The role of TR in TRAM is to measure a user's perspective regarding any generic technology.

Most of the current work on TR has viewed it as a variable which affects motivation in the domain of information technology [16–18]. Moreover, user's motivation and behavioral intentions depend on technology readiness because utilitarian and hedonic motivations vary in people with different personality dispositions [19,20]. According to Chang and Chen [21], only a few studies have examined the moderating effect of TR on the relationships between motivations and behavioral intentions, and thus, our aim is to further explore its role in determining the use of smart sport watches in people who recreationally walk and/or run.

1.2. Motivation and Sensation-Seeking Related to Using Technologies and SSW

We postulate that people varying in motivational characteristics and approach to exercise will also vary in SSW usage. To operationalize this conceptualization, the self-determination theory (SDT; [22,23]) was used. The SDT classifies people's motivation on a continuum ranging from a complete lack of motivation to be involved in a task through three stages of external motivation. i.e., (identified, introjected, integrated) and finally to internal motivation. The state of motivation depends on satisfying three basic needs—autonomy, competence, and relatedness [24]. Under the regulation of autonomy, people regulate their behaviors according to their values, attitudes, and beliefs and reject external control over their actions [25]. Achieving competence is required to efficiently monitor the actions people are engaged in [26,27], and the need for relatedness regulates people to be in close relations to others as a source of social networks of people with similar interests [28].

According to the SDT, people are completely unmotivated to a task or a mission because they do not value its immediate benefit, do not perceive the outcomes as imperative for them, and feel they lack the self-efficacy which is required to accomplish the task [23]. Pertaining to exercise and wearing SSW, people may wish to be engaged in exercise but not to use SSW. Accordingly, people who walk/run but refrain from wearing SSW may value the psychological and physical health benefits of the exercise but not necessarily value the use of SSW. We test herein the notion that the motivational stages set by the SDT determine the use of SSW and its functions during and outside the realm of walking/running.

According to the SDT, when people are externally motivated, their involvement in the task is governed by an external control which is associated with a lack of personal autonomy. Under such a motivational state, people expect to receive materialistic, monitory, or psychological rewards for their direct involvement in the task. Coercion, fear of failure, not being rewarded, and materialistic passion are associated with this state of mind [22]. Thus, according to our view, people who walk/run may use SSW to overcome negative consequences associated with physical activity and not use it to its full potential because of their lack of autonomy. In contrast, they may use SSW because they wish to relate to others who use SSW and develop competence in the exercise they are engaged in.

It must be noted that the SDT distinguishes among three types of external regulation of motivation. Introjected regulation is a motivation state where the person strives to comprehend the value of his/her involvement in the task but his/her efforts are regulated by the wish to avoid negative consequences such as guilt, rejection, shame, and embarrassment, along with perceived pressure to feel pride, self-confidence, and feel loved and evaluated by others. Identified regulation is evident when the person internalizes the value of his/her actions toward the goal he/she is striving to achieve. Integrated regulation represents the most autonomous state of mind within the external motivation construct. Within this motivational state, one feels a complete integration between one's goals, values, and actions. This motivational state is not yet internalized because it is not yet fully associated with one's desires and self-accomplishment, but shame and guilt feeling are not experienced because of not satisfying other controlling sources. In the current concept, the person may exercise with SSW because he/she identifies with the potential of the technology to accomplish the exercise regimen [27]. When people are regulated by internal motivation, they act to achieve their own goals and do so because it is part of their identity [29]. In the current conceptualization, exercisers use or do not use SSW because of their autonomous state of mind, along with the need to develop physical competence and social relations. They lack the need to satisfy external sources by using SSW when exercising [22].

Motivation to exercise is likely to increase when the runner uses SSW [30]. Using SSW increases the running velocity and its associated heart rate [2,30]. Moreover, motivation was found to positively influence goal orientation, with curiosity and trend-driven motivations sig-

nificantly enhancing exercise involvement. This suggests that the underlying reasons for using the technology can shape users' goals and increase their engagement in physical activities [31]. In contrast, this technology, and similar ones, may prevent people from directly attending to their body that would be otherwise attended to when running without SSW [32]. It may well be that such devices lead people to depend on technological-biological sensors and prevent them from self-regulating and self-monitoring their physical efforts. Thus, using or avoiding SSW while exercising may be accounted for by different states of motivation by people who exercise.

In addition to the SDT motivational framework, sensation-seeking may also determine the use of or refraining from technology use. Sensation seekers are people searching for exciting, novel, and rich experiences, which sometimes involve significant risk-taking [33]. Such people are likely to feel frustrated when their stimulation is underestimated or not fulfilled. Sensation seeking was related to choosing a high-risk sport [34], to a personal history of sport-related concussion [35], and to sport-related concussion in adolescent and young adult athletes [36]. Thus, it seems that people high on sensation seeking may perceive the SSW as a technology that limits their freedom and are not likely to use it.

2. The Purpose of the Study

Our aim is to study how readiness/acceptance of technology, motivation to exercise, and sensation seeking account for using SSW and its main functions. It is evident that technological attraction and the practical use of other technological devices, such as tablets and smartphone, are related to the technology readiness and acceptance tendency [6]. We therefore predict that the more positive the approach to use technology (i.e., lower technophobia), the more prevalence the use of SSW and its features will be. We also hypothesize that people motivated internally will make greater use of SSW because of feeling more autonomous and competent. Along this line of thought, we hypothesize that users of SSW will be lower on sensation-seeking than non-users of SSW. Specifically, people high in sensation seeking will tend to refrain from using SSW features which provide information about their training program and features which provide information about their bodily information. In contrast, people low in sensation seeking are likely to have less objection to the SSW.

3. Method

3.1. Participants

A sample of 315 was used for this study. Of these, 276 were students and 39 were not engaged academically. They were healthy young males (n = 95, 30.2%) and females (n = 179, 56.85%), *Mage* = 29.6 (*SD* = 11.01), who studied in various colleges in Israel. On average, the participant reported being engaged in walk/run activities for 2.60 h (*SD* = 1.41) per week, exercised for 57.81 min (*SD* = 48.42) each time, and covered 6.23 km (*SD* = 3.89) in each practice. They were approached via social media networks such as Instagram, Facebook, Twitter (X), and TikTok and were assured anonymity and confidentiality through the provision of codes rather than names.

3.2. Measures

Demographic Questionnaire. The questionnaire includes the following items: age, gender, occupation, familial status, exercise habits, and details about using a smartwatch.

Exercise Motivation Scale (EMS-SMS-II; [37]). The SMS-II scale was designed to assess the individuals' level of motivation towards sport in adult athletes, relying on the self-determination theory framework. The term "sport" was replaced by the term "exercise" without losing its motivational orientation and semantic meaning. The motivation questionnaire consists of 17 items that are divided into 6 scales: intrinsic (k = 3), integrated, (k = 3), identified (k = 3), introjected (k = 3), external (k = 3), and amotivation (k = 2). Each item is rated

on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). The mean of the items' ratings on each scale is considered the score on the respective dimension. Cronbach α reliability coefficients reported by the authors ranged between 0.70 and 0.88. Furthermore, a six-factor CFA model was fitted to the model, χ^2 (120, N = 290) = 258.14, $p < 0.001$, *RMSEA* = 0.07, *CFI* = 0.94, *NFI* = 0.90, *TLI* = 0.92. Item-factor loadings ranged between 0.47 and 0.95. The Cronbach Alpha in the current study ranged between 0.64 and 0.82. The SMS-II was translated into Hebrew and then back to English by five scholars well-versed in both languages. The final questionnaire was set upon full agreement among the researchers.

Brief Sensation Seeking Scale (BSSS; [38]). The BSSS was designed to assess the individuals' level of a biosocial dimension of personality characterized by "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences" ([39] p. 10). The BSSS was created by adapting items from the SSS-V [39] and a set of items derived from the SSS-V which was tailored for adolescents [40]. The questionnaire consists of a single-factor model of 8 items that are divided into 4 scales (2 questions each): experience seeking, boredom susceptibility, thrill and adventure seeking, and disinhibition. Responses are made on a 5-point Likert-type scale labeled, "strongly disagree", "disagree", "neither disagree nor agree", "agree", and "strongly agree". The coefficient alpha was 0.74, and the model fit to the data was χ^2 (18, n = 281) = 215.75, $p < 0.001$, *RMSEA* = 0.042, *CFI* = 0.98. The BSSS was translated into Hebrew and followed similar procedures to those used for the SMS-II. The Cronbach Alphas Coefficients ranged between 0.73 and 0.80 and under 0.70 for "boredom susceptibility" and "Thrill and adventure seeking".

Technology Readiness and Technology Acceptance Questionnaire (TR; [41]) and **Technology Acceptance Measure** (TAM; [12]). The TR operationalizes the model of Lin et al. [15] using the conceptual framework of Parasuraman [10] and Devis [12]. The TRAM Model relates to individuals' beliefs about and propensity for using innovative technology-based products or services [10]. The TRAM is a theoretical framework that explains the process of using and adopting a technological innovation across a variety of contexts [8]. It was established to explain consumers' intentions to use new technology, and understanding people's technology acceptance behaviors [15]. The Technology Readiness (TR) consists of 14 items that are divided into four dimensions: two positive—optimism (k = 4) and innovativeness, (k = 3)—and two negative—discomfort (k = 4) and insecurity (k = 3). Items are rated on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach α reliability coefficients reported by the authors were 0.82, 0.82, 0.70, and 0.79, respectively. The technology acceptance measure (TAM) consists of 12 items divided into three dimensions: perceived usefulness (k = 4), perceived ease of use (k = 4), and intention to use (k = 4). Cronbach α reliability coefficients of the scales reported by the authors were 0.87, 0.91, and 0.83, respectively. The factor loadings for the items ranged between 0.66 and 0.91. Convergent validity using Average variance Extracted (AVE) values were well above the required level of 0.50 for all measures. Discriminant validity values using the HeteroTrait-MonoTrait (HTMT) procedure were between two reflective constructs of below 0.90. The Cronbach Alpha Reliability Coefficients in the current Hebrew version ranged between 0.70 and 0.90, with most above 0.85 and only one dimension, "distrust", under 0.70. The TR and TAM were translated into Hebrew and followed identical translation and verification processes as the BSSS and the SMS-II.

3.3. Procedure

At first, permission to approach the students was obtained from the university's IRB. The questionnaire was designed in a quartics format which allowed a quick and identical administration format to all the participants. Following the IRB research proposal approval, informed consent and all the questionnaires were sent electronically to the participants

via Qualtrics Software (https://www.qualtrics.com/). Confidentiality was assured prior to data collection. Specifically, participants were informed that only the researchers have access to their responses. The participants were asked to complete the demographics form first followed by a battery of questionnaires including the SMS-II, BSSS, NFC, and TRAM. A counter-balanced order was used to eliminate order effects. At the end of the administration, the participants were thanked.

4. Results

4.1. Preliminary Analyses Testing the Normality Assumption

Along with verifying the Alpha Internal Consistency Reliability Coefficients (ICRC) for each questionnaire and its respective dimension (see method chapter; $\alpha > 0.70$), we tested the normality assumption using the Skewness and Kurtosis coefficients. The analyses revealed that all the variables used in the study were normally distributed, ranging between −2.00 and 2.00 for both coefficients, respectively.

4.2. Multi-Variate and Univariate Analyses of Variance

Multiple followed by univariate analyses of variance (MANOVA, ANOVA) were performed for each of the study's psychological cluster and single variables. The two categorical factors (e.g., BS factors) were the use of SSW (yes/no) and walk/run (yes/no). The analyses revealed no significant effect for gender. Thus, gender was not considered for further analysis. The main and interactional effects of BS factors on the study's variables are presented in Table 1.

Table 1. Two-way ANOVA main and interactional effects for sensation-seeking, motivation, and readiness for technology by using SSW (yes/no) and walk/run (yes/no) for the entire sample, and readiness for SSW for the adolescents who walk/run but refrain from using SSW (*F*—the statistical effect, *p*—significance level, λ^2—accounted variance of the effect).

Variable	A. Smart Watch (Yes/No)			B. Walk/Run (Yes/No)			A by B		
	F	***p***	λ^2	***F***	***p***	λ^2	***F***	***p***	λ^2
Sensation Seeking Total (*n* = 242)	0.49	0.49	0.00	0.04	0.85	0.00	0.240	0.63	0.00
Experience seeking	1.15	0.28	0.01	0.11	0.74	0.00	0.010	0.91	0.00
Boredom susceptibility	0.030	0.87	0.00	81	0.37	0.00	0.250	0.62	0.00
Thrill and adventure seeking	0.22	0.64	0.00	0.01	0.92	0.00	0.430	0.51	0.00
Disinhibition	3.78	0.05	0.02	0.64	0.43	0.00	0.050	0.82	0.00
Motivation-SMS-II (*n* = 236)									
Internal	0.160	0.69	0.00	6.34	0.01	0.03	0.770	0.38	0.00
Integrated	0.22	0.64	0.00	20.18	0.00	0.08	3.21	0.07	0.01
Identified	1.27	0.26	0.01	7.93	0.01	0.03	1.17	0.28	0.01
Introjected	3.58	0.06	0.02	0.01	0.94	0.00	3.56	0.06	0.02
External	1.70	0.19	0.01	0.59	0.44	0.00	0.600	0.44	0.00
Amotivation	0.420	0.52	0.00	0.02	0.89	0.00	0.750	0.39	0.00
Readiness for Technology (TR) (*n* = 240)									
Positive Readiness	7.19	0.01	0.03	0.18	0.69	0.00	0.460	0.50	0.00
Optimism	4.35	0.04	0.02	0.02	0.90	0.00	0.270	0.60	0.00
Innovation	7.89	0.01	0.03	0.84	0.36	0.00	0.510	0.48	0.00
Negative Readiness	12.84	0.00	0.05	1.38	0.24	0.01	0.00	0.96	0.00
Discomfort	12.19	0.00	0.05	4.58	0.03	0.02	0.670	0.41	0.00
Distrust	7.18	0.01	0.03	0.28	0.60	0.00	1.12	0.29	0.01

Table 1. *Cont.*

Variable	A. Smart Watch (Yes/No)			B. Walk/Run (Yes/No)			A by B		
	F	*p*	λ^2	*F*	*p*	λ^2	*F*	*p*	λ^2
Readiness for Smart Watch (TAM) (*n* = 121)									
Total	-	-	-	17.19	0.00	0.12	-	-	-
Perceived usefulness				34.01	0.00	0.22	-	-	-
Perceived ease of use	-	-	-	2.78	0.10	0.02	-	-	-
Intention to use	-	-	-	3.73	0.06	0.03	-	-	-

4.3. Readiness for Technology

The MANOVA pertaining to Positive Readiness for Technology resulted in a significant overall SSW use effect, Wilk's λ = 0.96, $F(2,239)$= 3.79, $p < 0.02$, $\eta_p^2 = 0.03$, but neither walk/run nor their interaction showed a significant effect ($p > 0.05$). A similar significant SSW use effect was revealed for Negative Readiness for Technology, Wilk's λ = 0.05, $F(2,239) = 6.52$, $p < 0.002$, $\eta^2 = 0.95$. The follow-up ANOVAs revealed significant univariate effects for the four Readiness for Technology dimensions ($p < 0.05$). Figure 1 presents these effects descriptively (means and SDs) along with Cohen's d coefficients.

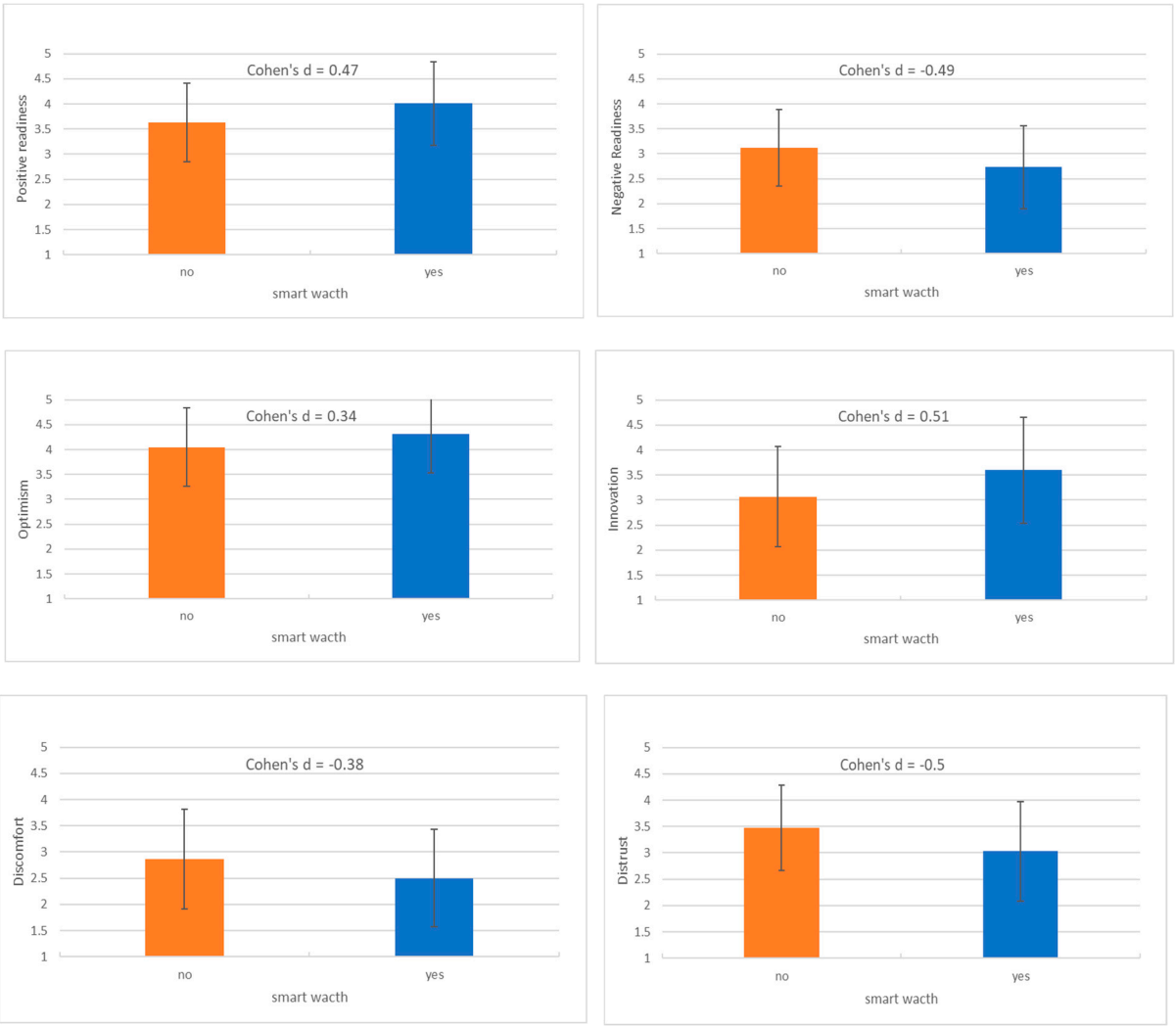


Figure 1. Means and SDs for positive and negative readiness for technology dimensions and total scores in adolescents who use and avoid using SSW.

People using SSW rated themselves significantly ($p < 0.05$) and substantially higher than their non-SSW users on positive readiness for technology ($d = 0.47$), and specifically on optimism ($d = 0.34$) and innovation ($d = 0.51$). Moreover, users of SSW reported significantly ($p < 0.05$) and substantially lower negative readiness for technology than their non-SSW users' counterparts ($d = -0.49$), and specifically on discomfort ($d = -0.38$) and distrust ($d = -50$).

4.4. Motivation for Exercise

The MANOVA performed for the six dimensions of Motivation to Exercise resulted in an overall non-significant effect of SSW use, Wilk's $\lambda = 0.97$, $F(6,229) = 0.52$, $p < 0.87$, $\eta^2 = 0.03$. Despite the non-significant effect, we performed six follow-up ANOVAs. Only one tendency for significance of the SSW use effect ($p < 0.06$) emerged for introjected motivation. Adolescents who use SSW reported being lower on introjected motivation than their non-SSW users ($d = -0.35$) (see Figure 2, bottom panel). However, the mean values for both SSW users and non-users were low.

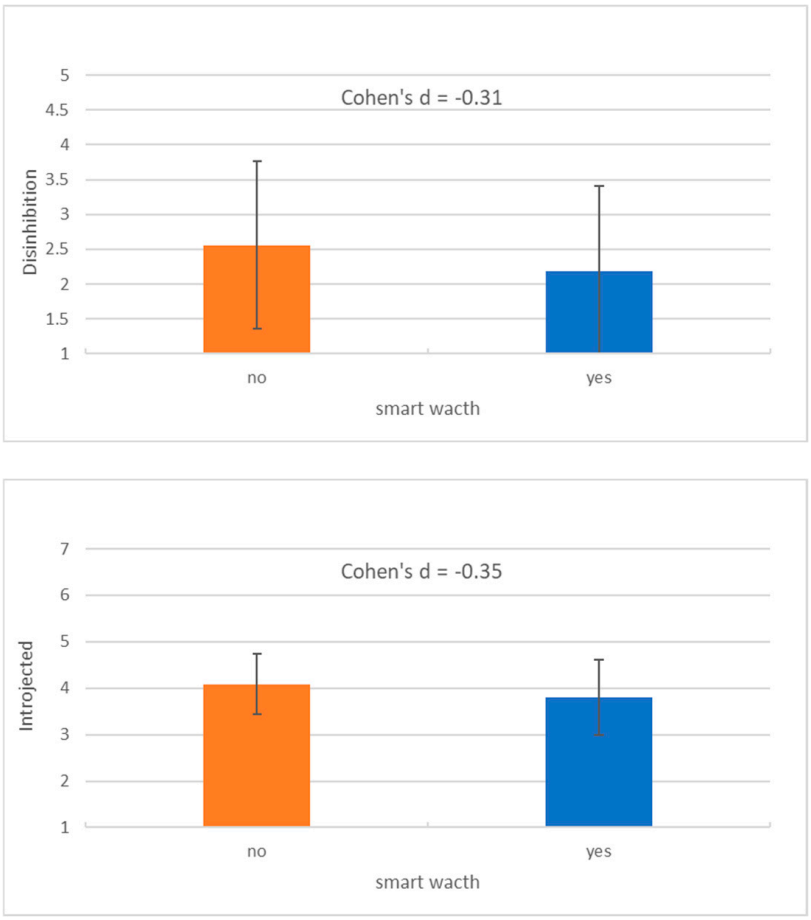


Figure 2. Means and SDs for sensation-seeking disinhibition and for introjected motivation in adolescents who use and avoid using SSW.

The MANOVA also revealed a significant multivariate walk/run effect on the motivation to exercise dimensions, Wilk's $\lambda = 0.92$, $F(6,229) = 2.93$, $p < 0.006$, $\eta^2 = 0.08$, and consequently on internal, integrated, and identified motivations (see Table 1 and Figure 3). Adolescents who walk/run reported being more internally motivated ($d = 0.38$), integrated ($d = 0.61$), and identified ($d = 0.34$) than their sedentary counterparts. The mean values of these motivational dimensions were low for both active and sedentary people.

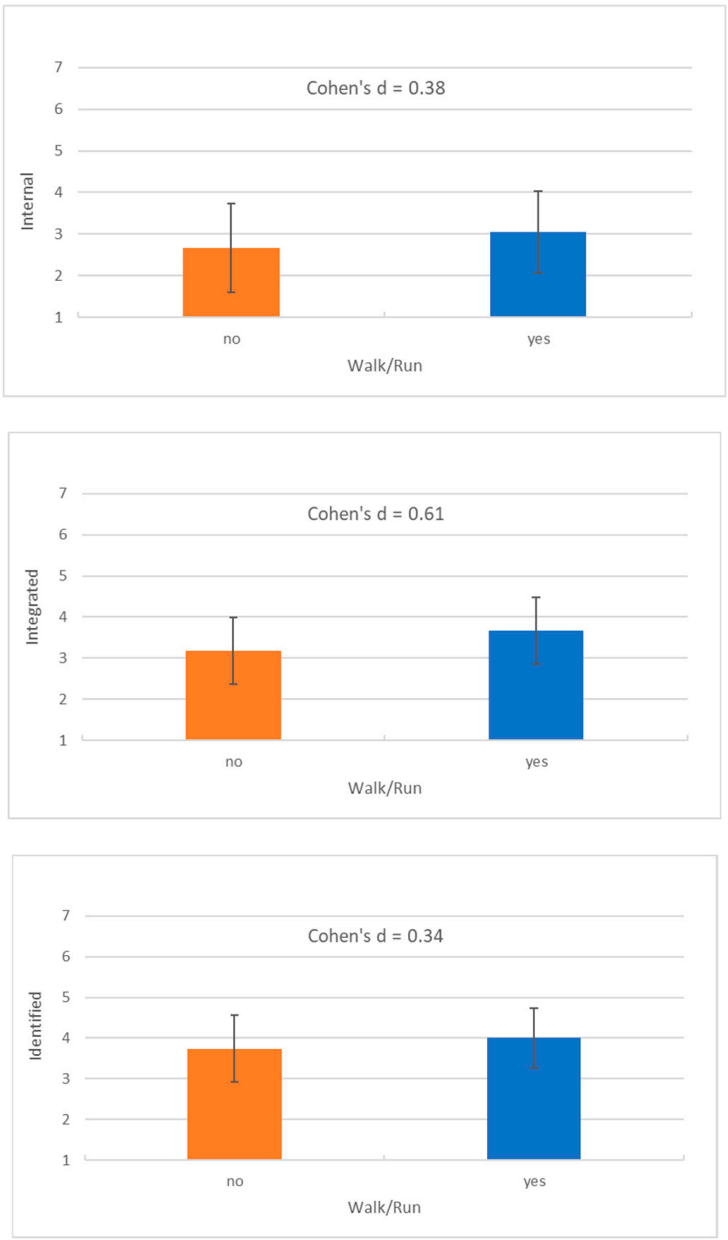


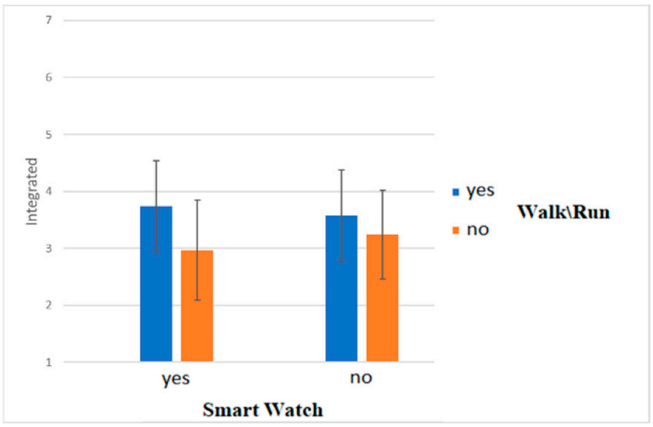
Figure 3. Means and SDs for internal, integrated, and identified motivation dimensions in adolescents who walk/run and adolescents who refrain from walking/running.

4.5. Sensation Seeking

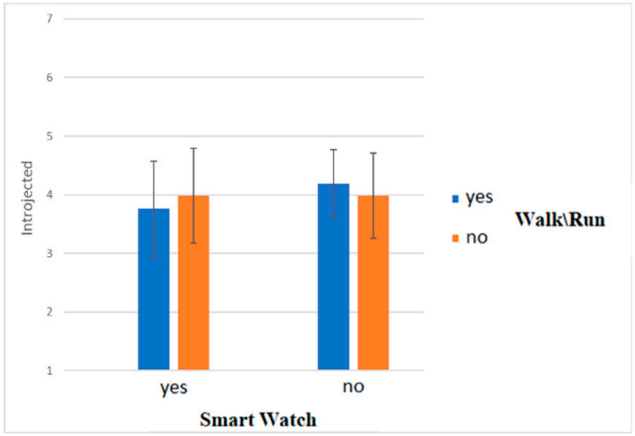
The MANOVA pertaining to sensation-seeking revealed an overall non-significant SSW use effect, Wilk's $\lambda = 0.97$, $F(4,239) = 1.69$, $p < 0.15$, $\eta^2 = 0.03$, and follow-up ANOVAs revealed a significant SSW effect ($p < 0.05$) only for disinhibition of the four dimensions. People using SSW reported being lower on disinhibition than people not using SSW ($d = -0.31$, see Figure 2 upper panel). However, the means for disinhibition were low for both SSW users and avoiders.

4.6. SSW and Walk/Run Interaction Effects

Two significant interaction effects of SSW and walk/run emerged (see Table 1); one for integrated motivation and the other for introjected motivation. These two interactions are shown in Figure 4a,b.



(**a**) Integrated Motivation



(**b**) Intojected Motivation

Figure 4. Mean and SDs for integrated and introjected motivation dimensions in adolescents using and avoiding SSW and walking/running or not.

The first interactional effect is presented in Figure 4a and is assigned to the observation that people using SSW and walking/running reported much higher integrated motivation than those who were sedentary (d = 0.88). Among those who refrained from SSW, this difference was reduced (d = 0.41). As one can notice, walkers/runners reported higher integrated motivation than sedentary adolescents. Different results were obtained for introjected motivation. Users of SSW who refrained from walking/running reported higher introjected motivation than those who walk/run (d = −0.30), but the opposite was true for those who refrain from SSW use. Among them, those who walk/run reported higher introjected motivation than the sedentary (d = 0.29).

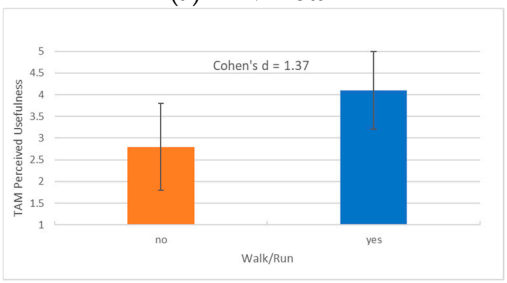
4.7. Analyses Pertained to Users of SSW

Additional MANOVA and ANOVA procedures were applied only to users of SSW and pertained to readiness for smart phone use (TAM; in contrast to readiness for technology in general). The MANOVA resulted in a significant main effect for walking/running, Wilk's λ = 0.75, F(3,119), = 13.30, $p < 0.001$, η^2 = 0.25. The follow-up ANOVAs resulted in three main significant ($p < 0.05$) walk/run effects: total readiness for smart phones, perceived usefulness, and a strong tendency toward intention to use them ($p < 0.06$). The descriptive data pertaining to these effects are presented in Figure 5a–c.

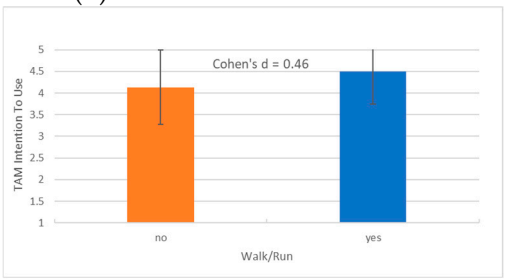
Walkers and runners were significantly and substantially higher than those who refrained from walking and running in readiness to use smart phones (total TAM; d = 0.98), showed higher usefulness of them (d = 1.37), and intended to use them (d = 0.46).



(**a**) TAM Total



(**b**) Tam Preceived Usefullness



(**c**) TAM Intention to Use

Figure 5. Means and SDs for TAM total, perceived usefulness of SSW use, and intention to use SSW for adolescents who walk/run and those who refrain from it.

5. Discussion

Several of the critical factors involved in the adoption of wearable devices, especially watches, have been overlooked in the published research. The current study offers empirical evidence for promoting exploration of the psychological processes involved in the value people hold for technology in general and for SSWs in particular. The study consists of the original Technology Acceptance Model (TAM), extends the profundity of the literature on wearable technologies, and provides applied research references. TAM has been widely opined as a solid base theory for examining users' intentions of using wearable devices. Nevertheless, some scholars critique TAM for insufficiently explaining the users' technology adoption behaviors [15]. Thus, our study was design to explore the psychological determinants, i.e., disposition of readiness/acceptance of technology, motivation for exercise, and sensation seeking, in using SSWs.

By administering both the Technology Readiness and Technology Acceptance Questionnaire (TR; [41]) and the Technology Acceptance Measure (TAM; [12]), we examined our projections that the more positive the approach to using technology is, the more prevalent the use of SSWs and their accompanying features will be. Previous studies demonstrated this link (e.g., [5,6]), and others indicated that young adults' technology readiness moderates the relationships between performance expectancy and attitudes toward wearables [5]. In line with these postulations, our findings indicate that healthy adolescents who are more ready to accept technology are more likely to use SSWs. They were more optimistic and innovative and less negative about, distrustful of, and discomfortable with technology than their non-SSW users.

Positive technology readiness is an attitude which motivates acceptance of a new technology along with optimism, control, flexibility, and efficiency in peoples' lives [10]. In contrast, negative technology readiness results in feelings of discomfort, being overwhelmed by it, and feeling of insecurity and distrust of technology, stemming from skepticism about its ability to work properly and concerns about its potential harmful consequences [10]. We observed that high positive readiness for technology attitude of the study's SSW users (see Figure 1) was reflected by stronger perceived usefulness and higher ease of use than their non-users' counterparts [12]. In previous studies, technology readiness attitude was found to vary in people varying in utilitarian and hedonic motivations ([19,20,42]), which strengthens our assumption that motivation to exercise will be a valuable component in determining the use or avoidance of SSW use. Thus, we assumed that, in line with [22], those motivated internally to exercise will make greater use of their SSWs due to feeling more autonomous and competent and that users of SSWs will score lower on sensation-seeking than non-users.

The findings indicate that adolescents who use SSW reported being regulated by less introjected motivation for exercising than the non-SSW users, though introjected motivation was reported to be low in both cohorts. Specifically, people holding an introjected motivation orientation were more likely to be seeking affirmation from their surroundings or fearing embarrassment by peers. Introjected regulation is a motivation state where the efforts are regulated by the wish to avoid negative consequences such as guilt, rejection, shame, and embarrassment along with perceived pressure to feel pride, self-confidence, and loved and evaluated by others [22]. Refraining from using SSWs was associated with relatively more external, but still low, regulated actions related to exercise. In contrast, adolescents who use SSW were less regulated by external factors and doing it more for their own benefit rather than by conscious effort to impress others and improve their social status. However, we must note that the low ratings given by the SSW user and non-user adolescents to the introjected and other motivation dimensions make these conclusions doubtful.

Our study extended this view by contrasting exercise motivation regulation of users and non-users of SSW who walk/run or refrain from these activities (see Figure 4). Indeed, people may wish to exercise but not use SSW. Accordingly, people who walk/run but refrain from wearing SSW may value the psychological and physical health benefits of the exercise but not necessarily value the use of SSW. We tested herein the notion that the motivational stages set by the SDT [22] determine the use of SSW and its functions during and outside the realm of walking/running. It may well be that people who walk/run may use SSW to overcome negative consequences associated with physical activity and not use it to its full potential because of their lack of autonomy. In contrast, they may use SSW because they wish to relate to others who use SSW and develop competence in the exercise they are engaged in.

The findings also showed that SSW users who walk/run scored higher on integrated motivation than those who refrained from exercising, but both were low on this motivational dimension. A similar, but smaller, difference was noted among non-SSW users. It is therefore clear that it is the exercise which is more associated with the integrated motivational dimension. In other words, integrated motivation for exercising was more related to the mere act of exercising rather than to the SSW use. Relying on Ryan and Deci's [22] SDT, the mean values of the integrated motivation show that people who walk/run feel more integration between their goals, values, and actions than their non-exercise counterparts. This motivational state is not yet internalized, but walkers and runners felt accomplishment of the goals and values more than sedentary exercisers regardless of wearing SSWs. The significant effect of walking/running on the internal, integrated, and identified motivation

dimensions where walkers/runners rated themselves higher than those who refrained from exercising (see Figure 3), indicating that motivation for exercise is independent of motivation to use the SSW technology. The low mean values assigned by all the adolescents to these dimensions call for the use of other motivation frameworks to study motivation related to technology use.

Our findings also showed that adolescents who walk/run and use SSW scored the lowest on the introjected motivational dimension. Thus, avoidance of negative feeling is less of a motivated factor for these activities. In sum, the motivation to exercise and use SSW must be further studied using an alternative motivation conceptual framework to better capture the motives which underly the use of SSW alone and without SSW.

We also assumed that the sensation seeking disposition will distinguish between SSW users and avoiders. Specifically, we assumed that adolescents high on sensation seeking will perceive the SSW as a technology that limits their freedom and would not be likely to use it. The findings of this study failed to confirm this view. The sample of adolescents in the current study reported very low ratings of sensation seeking on the four dimensions including disinhibition, which tended to distinguish between SSW users and non-users. Accordingly, SSW users were lower on disinhibition than non-users, meaning they tended to make more decisions free of external constraints than their counterparts, in contrast to our initial assumption. However, the small differences and the low ratings given to sensation seeking by all adolescents makes this psychological concept less valuable to the use of SSW technology.

6. Future Directions

Although the TRAM provides significant data regarding users' intentions for using SSWs, scholars increasingly realize that the focus has shifted from revealing determinants of smartwatch adoption to capturing the factors which cause their long-term usage [43]. On this point, and like Gopinath et al. [44], we argue that perceived ease of use and self-efficacy are undeniably significant. Developers must make concerted efforts to create user-friendly platforms that enhance confidence among users to fully utilize the technological devices. Developers ought to leverage design principles to build a simple watch and mobile interface. They can also introduce tutorials and videos to promote wearable technologies [45], as well as giving importance to specific cultural factors in their creation of apps and manuals. Subsequently, we join Kim and Chiu's [41] recommendation that forthcoming analyses incorporate additional variables in the TRAM, such as perceived trust and enjoyment, to more comprehensively capture the psychological processes involved in the sports wearable technology eco-system. Furthermore, as sports wearables are relatively expensive, users' perceptions of value and quality must be further examined.

Additionally, more research is essential for capturing and tracking the increasing number of wearable technology users. Most wearable technologies are still in their infancy. Challenges including user acceptance, security, ethics, and big data issues must be addressed to enhance the usability and functionality of these devices for practical utilization. The users' preferences must be considered when creating wearable sensing systems. For example, due to the low weight and miniaturization of wearable devices, they are worn close to the body and can be remotely controlled or even bio transplanted, which increases the level of 'interaction' with consumers [46,47]. Furthermore, a combination of heart rate monitoring and positioning can be used to detect whether the user is in a sedentary state. Another possible direction for future studies is to explore whether the usage of SSWs directly influences individuals' physical conditions and active lifestyles [19].

7. Limitations

Our study has three limitations. Firstly, it is based on self-reporting questionnaires, which may create a demand characteristics effect whereby participants in the study do not accurately reflect their real approach to the use of SSW. For example, we can assume that those who bought an expensive SSW but rarely, if ever, use it to measure and improve their exercise activity may feel uncomfortable or guilty about this fact and therefore are more likely to report dishonestly. Secondly, we refrained from measuring people's personality to better capture the intentions for using and benefiting from the use of SSWs. Finally, the study's conclusions refer to a relatively young age cohort (mostly 20–40 years old). Thus, we suggest that younger and older cohorts should also be examined.

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