ASSESSMENT OF ETHICAL ON THE INTENTION TO USE OF WEARABLES

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INTRODUCTION

The human body has become a support for intelligent technologies as wearables (externally-worn intelligent devices, such as watches, bracelets, clothing, glasses and headphones) that has opened an ethical debate about their development, commercialisation, and use in modern society. Wearables represent an expanding market and forecasts for the use indicate that the world market will reach 279 million units in 2023, with a compound annual growth rate of 8.9%, being the health field a large market (IDC, 2019).

In the literature, this scenario poses ethical dilemmas about wearable in a variety of areas, including the social, economic, environmental, educational, moral and philosophical (e.g. Shipp et al., 2014; Li, 2015; Mok et al., 2015; Ferenbok et al., 2016; Hofmann et al., 2017; Segura Anaya et al., 2017; McCall et al., 2019; Kostick et al., 2019; Kreitmair, 2019; Olarte-Pascual, 2021). Although the ethical issues have been approached from institutional and organisational perspectives, fundamentally using discourse methodology, few studies have taken a demand perspective about the influence of ethics on the acceptance and intention of using wearables (e.g. Hofmann et al., 2017; Segura Anaya et al., 2017).

The present study addresses this research gap by modelling the acceptance of capacity-enhancing wearable ITDs, using "ethical judgment" as an antecedent of intention to use. Ethical judgment has been defined as a cognitive process in which the individual must "judge which course of action is morally right" (Nguyen & Biderman, 2008, p. 628).

The results of this work advance the theoretical development of ethics as applied to the acceptance of new technologies: ethical judgment is key for the acceptance of wearables? At the same time, the demand approach will establish operational implications that can help, while taking account of users' ethical judgments, guide the development and commercialisation of capacity-enhancing wearables.

THE INFLUENCE OF ETHICS ON THE ACCEPTANCE OF WEARABLE

As previously noted, a fundamental criterion for the acceptance of wearable is the ethical assessment of these technologies. In discussing, Ferenbok et al. (2016, p. 95) stated that *"wearable devices represent more than just a potential economic disruption, but, in a broader sense, a disruption of the ethics by which we live"*. Disruptive technologies, through a process of refinement, improvement and innovation, create new standards (Christensen et al., 2018). Ethics allow the controversy between the potential benefits that can be achieved through technological progress, and the duty not to endanger this progress, to be addressed.

In the framework of ethical judgment, ethical evaluations of actions have been conceptualised as individual cognitive processes (Nguyen & Biderman, 2008). In turn, *psychological contract theory* conceptualises decision-making subjectively (Thompson & Hart, 2006). This theoretical basis can be used to address similar decisions made by individuals in the absence of absolute rules of what one can and cannot do (Goel et al., 2016). Decisions and actions are often guided by applied ethical perceptions, rather than a complete understanding of what can or should be done (LaFollette, 2002; Cohen & Wellman, 2005). In the sphere of circular evolutionary ethics, what an individual considers ethical influences his/her behaviour and, over time, the behaviours they observe influence what they believe to be ethical (Goel et al., 2016). In the present study, we believe it is appropriate to analyse the impact of ethics on intention to use wearables on the basis of individuals' perceptions of what behaviours, from an applied ethical viewpoint, are appropriate (Thompson & Hart, 2006).

Reidenbach and Robin (1990) argued that individuals use more than one reason to make ethical judgments, and thus they established the multidimensional ethics scale (MES) used in the literature to explain the influence of ethical judgment on people's behavior. Shawver and Sennetti (2009) proposed a new scale, which they called the Composite MES; this has five dimensions, "moral equity", "relativism", "utilitarianism", "egoism" and "contractualism" (deontology). The Composite MES has been widely used to explain the impact of ethical judgments on behaviour (e.g. Mudrack & Mason, 2013; Manly et al., 2015; Kara et al., 2016). To a lesser extent, the MES has been used in the context of consumption behaviour (e.g. Nguyen & Biderman, 2008; Jones & Leonard, 2016; Leonard & Jones, 2017); however, in the field of wereables acceptance, the influence of ethical judgments and the Composite MES dimensions have been discussed only by Olarte-Pascual (2021):

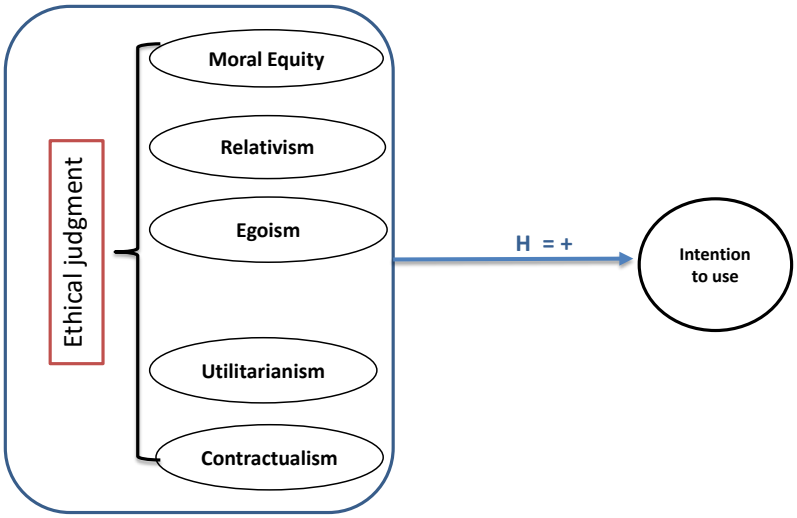
- The "moral equity" dimension refers to the "*individual perception of fairness and justice as well as what is right and wrong in its broadest sense*" (Nguyen & Biderman, 2008, p. 628). According to Leonard et al. (2017), this dimension encompasses fairness, justice, rightness, and goodness. Hofmann et al. (2017) concluded that, in relation to smart glasses, justice appears to be crucial for the successful development, evaluation, decision-making, implementation, use, and formation of knowledge and norms**.** Weber and Zink (2014) found that the use of smart glasses and other intelligent devices increases the digital divide and, in the sports field, Bozyer (2015) showed that these devices create unfair advantages for those who have access to the technologies because they can, in consequence, train more effectively. Wearables can have negative consequences, such as the creation of a social divide between those who can afford the latest innovative technology and those who cannot.
- "Relativism" refers to the perception that what is correct is based on guidelines/parameters embedded in social/cultural systems, rather than on individual considerations (Reidenbach & Robin, 1990; Nguyen & Biderman, 2008). Ferenbok et al. (2016) found that the most modern wearable computers, such as smart glasses, offer unprecedented portability and ability to capture images, and thus can go where no digital eye has gone before, which represents a departure from established social norms.
- "Utilitarianism" has been defined as "*an action based on cost and benefit analyses, such that the action will bring about the greatest good for the greatest number*" (Nguyen & Biderman, 2008, p. 628). It must be kept in mind that capacity-enhancing technologies might help in societal advancement and that impeding them could be considered unethical (Berger et al., 2008). Wearables improve the quality of life of their users, promote lifestyle changes and save time and money (Segura Anaya et al., 2017). These authors also found that, while wearables have considerable benefits, device dependency, and privacy and security concerns, are major

challenges. In light of these potential problems, the balance between the costs and the societal benefits of technology must be analysed from a utilitarian perspective.

- "Egoism'" has been defined as acting in a manner that promotes only one's own long-term self-interest (Nguyen & Biderman, 2008). This dimension focuses on the consequences for the individual (Reidenbach & Robin, 1990), and Leonard et al. (2017) concluded that the individual's intention to behave ethically is driven by the benefits that the behaviour will bring to him/her. Wearable technologies have been developed to improve, increase, and empower individuals. For example, smart glasses empower and improve their users' cognitive capacities, although this may provoke negative reactions in others (Hofmann et al., 2017).
- "Contractualism" (deontology) refers to the "*individual perception of what is right versus wrong based on notions of an implied contract that exists between business and society*" (Nguyen & Biderman, 2008, p. 633). Reidenbach and Robin (1990) argued that this dimension reflects the deontological concept and encompasses notions of implicit obligations, contracts, duties and rules. Shipp et al. (2014) and Mok et al. (2015) examined the role of wearable cameras in the research field and evaluated the amount of data they provided to researchers and the related ethical concerns in regard to respect for personal autonomy, common well-being, trust in third parties, anonymity, confidentiality, privacy, beneficence (responsibility to do good) and non-maleficence (responsibility to avoid doing harm). According to Thierer (2015), societal and individual adaptation play key roles in the acceptance of wearables. Although great privacy and security challenges await, individuals and institutions will adjust in an evolutionary, resilient fashion, just as they have to earlier disruptive technologies.

Based on this theoretical background, the authors propose to advance the knowledge of the impact of ethical judgment and its dimensions on digital natives' intention to use wearable. Few researchers have discussed its influence on the acceptance of wearable. Thus, a working hypothesis is proposed: *H. Ethical judgment (moral equity, relativism, egoism, utilitarianism, contractualism) positively affects intention to use wearable.*

Figure 1. Structural model.



METHOD

To test the proposed hypotheses an online survey was undertaken with an international sample of 1,563 digital-native higher education students who assessed levels of technological competence from America, Asia and Europe. The characteristics of the sample are: Men 47.1% and Women 52.9%; Average 21.5 years and 19.39% wearing a wearable (e.g. bracelet, watch, glasses, or intelligent clothes).

The scale used to measure Ethical judgement have been adapted from Composite MES by Shawver & Sennetti (2009) with a semantic differential - 5 to +5 and intention to use with a 11-point Likert scale adapted from Venkatesh & Davis (2000).

The collected data were analysed through structural equation modelling (SEM), specifically, using the Consistent Partial Least Square (PLSc) technique.

To test the proposed hypotheses a sequential 3-step statistical process was followed: 1) Assessment of the measurement model. The measurement model was assessed by verifying the reliability and validity of the measurement scales; 2) Assessment of the structural model. For the model the R^2, path coefficients, and their significance were estimated.

RESULTS

Assessment of the measurement model

The results of the PLSc SEM analyses indicated that in the model, the standardised loadings of the observable variable "self-promoting for me" were lower than 0.7. This variable belongs to the egoism factor. Furthermore, in the analysis of the discriminant validity of the egoism and utilitarianism factors, it was observed that the heterotrait-monotrait ratio (HTMT) criterion was higher than 0.9. This led us to eliminate the observable variable “self-promoting for me” from the model. The results, without this variable, are presented below. All standardised loadings are higher than .7 and all t-values are higher than 1.96 (Hair et al., 2013), so the reliability of the indicator is verified (see Table 1). To check for common method bias the partialling out “marker” variable method recommended by Podsakoff et al. (2003) was used, following the process suggested by Tehseen et al. (2017). A marker variable was introduced as a predictor for the endogenous constructs of the wearable model. Subsequently, the R^2 values of the endogenous constructs before and after adding the marker variable were examined. The results showed similar R^2 values before and after introducing the marker variable. This result establishes that there is no substantial common method bias.

Table 1. Standardised loading values (t-values) of the dimensions of ethical judgement and intention to use wearables.

Moral Equity (ME)	
Unjust/Just	0.85 (33.1)
Unfair/Fair	0.87 (32.9)
Not morally right/Morally right	0.85 (35.3)
Relativism (REL)	
Not acceptable to my family/Acceptable to my family	0.89 (29.4)
Culturally unacceptable/Culturally acceptable	0.75 (22.2)
Traditionally unacceptable/Traditionally acceptable	0.79 (22.0)
Egoism (EGO)	
Not self-promoting for me/Self-promoting for me	single item

Utilitarianism (UTI)	
Produces the least utility/Produces the greatest utility	0.85 (36.5)
Minimise benefits and maximise hurt/ Maximise benefits and minimise hurt	0.76 (34.2)
Contractualism (CON)	
Violates/does not violate an unwritten contract	0.96 (51.8)
Violates/does not violate an unspoken promise	0.91 (45.5)
Intention to use wearables (IU)	
Intention to use	0.92 (76.9)
Use prediction	0.91 (71.3)

Table 2 shows that the reliability was adequate: Cronbach's *alpha* and composite reliability returned values greater than 0.7. Convergent validity is also verified as the average variance extracted (AVE) was greater than 0.5. Similarly, the discriminant validity criterion was met: the HTMT values were correct in all cases and the square root of the AVEs was greater than the inter-construct correlations (Roldán & Sánchez-Franco, 2012).

Table 2. Composite reliability, Cronbach's *alpha*, AVE (convergent validity) and discriminant validity.

Construct	**Composite reliability > 0.7**	**Cronbach's *alpha***	**AVE > 0.5**	**ME**	**REL**	**EGO**	**UTI**	**CON**	**IU**
ME	0.89	0.89	0.73	**0.86**	0.86	0.67	0.79	0.73	0.49
REL	0.85	0.85	0.66	0.86	**0.81**	0.62	0.79	0.77	0.45
EGO	1.00	1.00	1.00	0.67	0.62	**1.00**	0.80	0.60	0.57
UTI	0.79	0.79	0.65	0.79	0.78	0.79	**0.81**	0.78	0.64
CON	0.93	0.93	0.87	0.73	0.76	0.60	0.77	**0.93**	0.41
IU	0.90	0.90	0.83	0.49	0.45	0.57	0.64	0.41	**0.91**

Note: The diagonal elements (in bold) are the square root of the AVEs. The off-diagonal elements are the inter-construct correlations. The elements above the diagonal (in bold) are the HTMT values.

Assessment of the structural model

Table 3 shows the R^2 and Q^2 values, the path coefficients (direct effects), the path coefficients (direct effect), the Student´s t-test values and p-values for each antecedent variable of intention to use wearables, from which the influence of ethical judgment on intention to use can be extracted.

The R^2 for the intention to use wearables model is 0.44. The Q^2 provided by PLS Predict was greater than 0. This indicates that the exogenous variables, indeed, predict the endogenous variable. The results confirm that the model have predictive relevance.

Table 3. Effect on the endogenous variables.

	R^2	**Q^2**	**Path coefficient**	**Student's *t*-test**	***p*-value**
IUW	44.4%	0.18			
ME=> (+) IUW			0.10	1332	0.18
REL=>(+) IUW			-0.13	1652	0.10
EGO=>(+) IUW			0.15	2240	0.03
UTI=>(+) IUW			0.70	5960	0.00
CON=>(+) IUW			-0.19	3437	0.00

Note: Based on one-tailed Student's t-distribution (4.99).

The ethical judgment dimensions “egoism” and “utilitarianism” significantly influenced intention to use warables devices. "Moral equity" and “relativism” did not influence intention to use wearables. “Contractualism” affected significantly but negatively.

CONCLUSIONS

In the framework of new technology acceptance, the principal conclusion to be drawn from this work is that the ethical judgment construct has high explanatory power for digital natives’ intention to use new capacity-enhancing wearable technologies (R^2 = 44.4%; Q^2 = 0.184).

“Utilitarianism” is the most important dimension for wearables. We argue that that when more is known about new devices, such as wearables, ethical judgments focus more on whether they are useful to society in terms of their benefits (improved quality of life, lifestyle changes, time and money savings) vs their associated costs and inconvenience (device dependency, privacy and security concerns, among others) (Segura Anaya et al., 2017), leaving other ethical aspects in the background, as the devices have already been assimilated and the objections overcome in the framework of circular evolutionary ethics.

The effect of “relativism” is negative, although not significant (-13.3%) for intention to use wearables. "Relativism" is based on the idea that "social and cultural systems are important in helping us define our ethical beliefs" (Reidenbach & Robin, 1990, p. 646). In this sense, for a known product, which has been socially accepted, and is not perceived as bodily invasive, such as wearables, this spread of opinion is not observed in digital natives (Pelegrín-Borondo et al., 2017).

The "moral equity" ethical judgment dimension had a positive influence on intention to use of wearables. However, was not significant probably because digital natives’ ethical judgment is almost all explained by the “utilitarianism” dimension. This result contrasts with those of Hofmann et al. (2017) and Weber and Zink (2014), which showed that smart glasses and other intelligent devices widen the digital divide, which raises the issue about whether such a gap is morally fair.

The influence of “contractualism” on intention to use wearables is negative and significant. In other words, contrary to expectations, "contractualism", the implicit contract that exists between the individual and society, inversely influences intention to use wereables. We can say that, although wearables are a known quantity, and that their use is expected to increase significantly in the coming years (Hayward, 2018; IDC, 2019), there is no defined social norm in favour of, or against, these devices, so the related social pressure might be positive or negative.

The results of this study allow us to establish a series of operational implications to guide and design the responsible development and commercialisation of wearables.

Ethical aspects are key in explaining digital natives’ acceptance of wearables. The first implication is that any organisation that wishes to participate and compete in this sector must develop an ethical strategy based on the ethical judgments of these users.

It is also important for organisations to know how intention to use can be strengthened by addressing the dimensions of ethical judgment. The intensity and the direction of the effects of the five ethical judgment dimensions on intention to use wearables suggest the following practical implications will help promote their acceptance, and prevent their rejection, by digital natives:

Companies should focus their efforts on the “utilitarianism” dimension, which explains most of intention to use wearables, due to its high explanatory power. To promote the use of wearables, the marketing community must continue to emphasise their utility for society, in line, for example, with

the benefits reported by Segura Anaya et al. (2017), in terms of improved quality of life, and the optimisation of productivity and economic and time resources. On the other hand, to prevent rejection, the marketing axis must focus on reducing or eliminating societal perceptions of privacy and security problems related to the use of these devices. In addition, due to the importance of the "utilitarianism" dimension, public powers must guarantee the rights of individuals in this matter. Kreitmair (2019) evaluated the ethical dimensions of wearable technologies based on their contribution to the "good life" of the user, in accordance with the Aristotelian "human flourishing" concept, and argued that, as a criterion of consumption ethics, that the momentum of utilitarianism should not be arrested. However, McCall et al. (2019) noted the widespread marketing claims promoting the use of wearables, promising health, personal cognitive and well-being benefits, absent of any warnings about possible risks and side effects. We believe it is necessary that, in line with the ethical considerations of Kostick et al. (2019) about the effects of these type of claims, to guarantee informed choice the commercial exploitation of the "utility" dimension be supported by scientific evidence.

The study of the key variables of the acceptance of wearables is an insufficiently studied field, which is related to a high growth potential and a high impact on job creation and economic activity. A future research line could identify new variables that should expand the models of acceptance of wearables and analyse whether the specific applications of wearables and the contexts of use moderate the explanatory power of the ethical judgment model and how.

KEYWORDS: Wearables, Technology acceptance, Ethical judgment, Composite MES.

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