Technology in Society 67 (2021) 101689

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

The influence of ethical judgements on acceptance and non-acceptance of wearables and insideables: Fuzzy set qualitative comparative analysis

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ARTICLE INFO

Keywords:
Ethical judgements
Multidimensional ethical scale
Intelligent technological devices
Intention to use
Intention to non-use
Qualitative comparative analysis
Fuzzy set qualitative comparative analysis

ABSTRACT

The rise of intelligent technological devices (ITDs)—*wearables* and *insideables*—provides the possibility of enhancing human capabilities and skills. This study contributes to the literature on the impact of ethical judgements on the acceptance of ITDs by using a multidimensional ethical scale (MES) proposed by Shwayer and Sennetti. The novelty of this study resides in using fuzzy set qualitative comparative analysis (fsQCA) instead of correlational methods to explain human behaviour (in this case, attitudes towards ITDs) from an ethical perspective. fsQCA evaluates the influence of ethical variables on the intention to use ITDs (and the non-use of these technologies). Positive ethical evaluations of technology do not always ensure ITD acceptance—unfavourable ethical perceptions may lead to its rejection. We find that for wearables: (1) positive perceptions from a utilitarian perspective are key in explaining their acceptance. Likewise, we identify configurations leading to acceptance where positive judgements on moral equity, egoism and contractualism are needed. Surprisingly, only the relativism dimension participates in configurations that cause acceptance when it is negated; (2) We found that a single unfavourable perception from a contractualism or relativism perspective causes non-use. Likewise, we found that coupling of negative judgements on moral equity, utilitarianism and egoism dimensions also produce resistance to wearables. For insideables, we notice that: (1) an MES has weak explanatory power for the intention to use ITDs but is effective in understanding resistance to use; (2) A negative perception of any ethical dimension leads to resistance towards insideables.

1. Introduction

Wearables and insideables are intelligent technologies that interact with the human body. Wearables are external (such as watches or glasses) and insideables are devices (such as microchips) that must be implanted. Ochsner et al. [1] noted that although wearables were considered too far removed from reality at the beginning of the 21st century, at present they are an expanding market. This led them to conclude that insideables would follow an identical trajectory. Two objectives drive the use of intelligent technological devices (ITDs): healthcare and the enhancement of standard capabilities. Healthcare is linked to the cure of diseases or disabilities whereas enhancement technologies imply an improvement in human skills or the creation of additional ones [2]. The most recent ITDs have generally been used for healthcare purposes [3], and even in the case of invasive technologies, there is no controversy on their use in healthcare [4]. However, some implantable ITDs go beyond health imperatives because their function is to enhance human capabilities [5]; Murata et al. [3] suggest that cyborgs are living among us, exemplified in real scenarios such as: Kevin Warwick was able to communicate with external devices from a chip implanted in his body; Neil Harbisson implanted an antenna in his body to detect a wider spectrum of colours than a standard eye; and Oscar Pistorius achieved athletic prowess using artificial legs. Medical Futurists [6] exposes the foremost enhancements that are possible in 2021.

Ethical arguments favouring improvements to human capabilities and skills through technological developments are rooted in transhumanism. This philosophic stream promotes the improvement of humans through the adoption of technological advances, including

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https://doi.org/10.1016/j.techsoc.2021.101689
Received 16 March 2021; Received in revised form 23 July 2021; Accepted 26 July 2021
Available online 3 August 2021

genetic engineering, information technology and molecular nanotechnology [7]. Transhumanism predicts that the progressive adoption of cyborg technologies by society (*cyborgization*) is inexorable [6,8,9] in fostering immense individual progress and enhancement.

The transhumanism perspective, however, has attracted certain criticisms. Several authors identify that using ITDs to improve standard human capabilities creates several ethical problems that are embedded in numerous spheres—social, economic, environmental and moral. Following Schermer [10]; Lai [11]; Park [12]; Reinares-Lara et al. [13] and Kapeller et al. [14]; we consider issues such as the loss of human essence, data protection, or problems with body control and autonomy.

From an organisational and institutional perspective, there is substantial literature discussing the ethical issues of integrating ITDs within the human body [15]. Likewise, the mainstream empirical literature on factors influencing the acceptance of ITDs is based on Davis et al.'s [16] technology acceptance model (TAM) and its extensions. However, there is a paucity of literature on the influence of ethics on the intention to use (IU) wearables and insideables. In their study on wearables, Hofmann et al. [17] identify several ethical issues related to smart glasses—privacy, safety, justice, change in human agency, accountability, responsibility, social interaction, power and ideology. Segura-Anaya et al. [18] analyse moral dilemmas arising from the use of health wearables, and especially the substantial amount of personal information that is accessible to third parties without user consent.

Reinares-Lara et al. [13] study on insideables finds that ethical judgements have a moderating role in influencing cognitive, affective and normative variables in perceptions of cyborg technology. Murata et al. [3] develop a cross-cultural study between Spain and Japan, finding that ethical perceptions are relevant in the adoption of insideables and found no differences between these countries. Arias-Oliva et al. [19] confirm that ethical perceptions are relevant in the segmentation of the cyborg products market. Gauttier [20] indicates that identifying the variables that facilitate the IU of cyborg technology is equally important as finding and measuring the reasons for its rejection.

Pelegrín-Borondo et al. [21] in their study on insideables and Olarte-Pascual et al. [15] exploring both wearables and insideables indicate that their acceptance can be explained by the antecedent *ethical judgment*—a subjective process whereby a person judges which action is morally correct [22]; p. 628). Their analysis uses the multidimensional ethical scale (MES [23]; revised in Shawver and Sennetti [24] and employing the following explanatory variables: moral equity, relativism, egoism, utilitarianism and contractualism. MES has proven useful in explaining human decision-making in situations with deep moral implications, including the acceptance of disruptive technologies in fields such as education [25] and electronic commerce [26]. Likewise, this focus has also been applied to measuring the influence of moral dilemmas in other fields, including business managers' decision-making [27]; tax practitioners' decisions [28] or students' behaviour in an academic setting [26]. In all these studies the evaluation of the explanatory capability of MES on behavioural issues is performed using correlational methods. Our study uses [15,21] who target 1563 individuals from several countries and continents that are digital natives for their analytical framework. Following [29]—whose population group is a key segment for non-medical insideables—we extend the results in Ref. [15] by applying fuzzy set qualitative comparative analysis (fsQCA) developed by Ragin [30,31] instead of partial least squares (PLS). Whereas Gauttier [20] uses a case study to evaluate ethical issues of microchip implants, all the other reviewed studies use conventional correlational techniques as PLS. Our study is methodologically novel by assessing human behaviours using multiple ethical scales and in particular for ITDs. The fsQCA approach has been applied in investigating the acceptance of new technologies, but by using TAM or similar theoretical frameworks [32–34].

The use of fsQCA provides a complementary and non-exclusionary approach to regression methods for assessing causality. fsQCA does not adjust the impact of a given variable over the output using a coefficient but rather captures combinatorial effects of input variables to generate the explained variable [35]. Likewise—contrary to correlational methods—fsQCA does not assume symmetrical relationships between variables despite being effective in that case [35].

Pelegrín-Borondo et al. [21] and Olarte-Pascual et al. [15] obtain a determination coefficient (R^2) of approximately 50 % in their assessment of the explanatory capability of MES on the acceptance of ITDs. Although this R^2 is acceptable, fsQCA is perhaps more useful in understanding the unknown variability (50 % in our case). Likewise, in their study, Pelegrín-Borondo et al. [21] report that moral equity, relativism, egoism and utilitarianism have a significant positive influence on the IU of insideables, whereas contractualism has a negative non-significant relationship. From their results, we cannot, however, state how ethical perceptions combine to produce a judgement about the use of insideables. They use correlation techniques and hence their results fail to reveal whether positive judgements on egoism are sufficient to induce a positive perception on insideables or whether this perception must be accompanied by a positive judgement on other ethical dimensions. Likewise, the statistical non-significance of contractualism may arise because that variable, effectively, does not influence IU wearables. Moreover, that judgement may need to be positive in some configurations to produce IU, but negative in others, thus rendering the average effect close to null. fsQCA enables the discovery of the combinatorial effects of input variables on output, thereby clarifying these issues.

The use of fsQCA clarifies how ethical perceptions combine to produce acceptance and non-acceptance of ITDs independently. This is relevant because combinations that produce acceptance and non-acceptance are possibly non-symmetrical. For example, a positive evaluation of insideables from a moral equity perspective may not be relevant in inducing their use, whereas a negative judgement may be decisive in rejecting them. Following Gauttier [20]; this question has special interest because the study of non-acceptance plays a key role in our context. In their study, it is argued that the ethical acceptability of technology results in its use; conversely, ethical unacceptability leads to resistance towards that technology. Thus, despite non-users traditionally being considered persons without access to technology, certain individuals, despite having access, simply do not want to use a given technology. We agree with Gauttier [20] that rejection of technology due to its perceived unacceptability—either for ethical or societal reasons—has been insufficiently researched. Our study contributes to bridging this gap because fsQCA can capture possible asymmetrical effects of ethical causes that foster acceptance or resistance to ITDs.

Although researchers infrequently distinguish between wearable and insideable devices when analysing ethical concerns must be revisited [4]. It seems reasonable that—whereas insideables technologies are invasive—most wearables are merely common items such as glasses, rendering them more akin to being ordinary than disruptive technologies (insideables). Following Olarte-Pascual et al. [15]; we feel this justifies studying the influence of ethical factors on both kinds of technology separately. Likewise, it is assumed that the objective of using ITDs is to enhance standard capabilities, thereby excluding any health reasons. These considerations inform the following research questions:

RQ1. Do ethical judgement factors influencing the *intention to use* indicate the same acceptance and consensus for wearables and insideables?

RQ2. How do ethical factors from MES influence the (intention to) use and non-use of wearables and insideables?

RQ3. How does MES explain the differences in the use and non-use of wearables and insideables?

For RQ1, multiple analysis of variance (MANOVA), combined with Wilcoxon and Levene tests, indicate that student's t for the difference of means for wearables are better judged and the consensus on these judgements are also greater.

RQ2 and RQ3 are answered by using fsQCA. For RQ2, we have found that effective MES constructs explain asymmetrical use and non-use. The acceptance (rejection) of wearables is strongly (adequately) explained by fsQCA configurations. Conversely—whereas fsQCA models using MES provide an excellent fit for the non-use of insideables— the veracity of models explaining acceptance of insideables is poor. In both cases, the configurations explaining use and non-use are asymmetrical. RQ3 is answered by comparing fsQCA models fitted for use and non-use of wearables and insideables, which facilitates the observation of several differential nuances in how MES variables explain attitudes towards these kinds of ITDs.

The study is developed as follows. In Section 2, we develop the test hypotheses using existing literature. Subsequently, we describe our survey and testing methods, and in Section 4 we present our results. We finally highlight our principal conclusions and suggest avenues for further research.

2. Modelling the influence of ethical dimensions on the use of intelligent technological devices (ITDs)

2.1. Literature review

The introduction to MES by Reidenbach and Robin [23] explains human decision-making in situations containing deep ethical concerns [25–28]. Following Shawver and Sennetti [24]; Pelegrín-Borondo et al. [21] and Olarte-Pascual [15] successfully employ a revised version of MES to explain the acceptance of wearables and insideables. Their scale comprises five ethical variables: moral equity, utilitarianism, egoism, relativism and contractualism.

Nguyen and Biderman [22]; p. 628) indicate that moral equity is linked to individual feelings of justice—in the widest sense what is right and wrong. Hofmann et al. [17] find that justice is a key factor determining the IU for smart glasses and Pelegrín-Borondo et al. [21] indicate that *moral equity* positively influences the acceptance of insideables; conversely, in the case of wearables, Olarte-Pascual et al. [15] fail to identify this relationship.

Relativism is the community perception of commonly accepted issues [22,23]. Duarte and Park [4] outline how people normally accept cyborg technologies when their use enables the curing of diseases or solving disability challenges. Alternatively, a segment of society may feel that cyborgs are a source of social disruption. Pelegrín-Borondo et al. [21] and Murata et al. [3] found perceived social acceptance of the use of insideables promotes their IU significantly. Surprisingly, Olarte-Pascual et al. [15] found a negative relationship between people's social and cultural acceptance of wearables and their IU, but a positive relationship for insideables.

Egoism promotes long-term self-interest [22]. Leonard et al. [26] indicate that personal intention to behave ethically is critically influenced by the benefits that persons perceive from that behaviour. Pelegrín-Borondo et al. [21] found that egoism exhibited stronger explanatory powers of IU insideables and Olarte-Pascual [15] also found this construct to be significant in explaining the acceptance of wearables.

Following Nguyen and Biderman [22] utilitarianism is founded on cost-benefit analyses. Segura-Anaya et al. [18] indicate that wearables improve life quality, induce lifestyle enhancements, and enable material resource savings. However, they also acknowledge significant challenges involving privacy and security. The balance between the costs and benefits are linked from a utilitarian perspective. Pelegrín-Borondo et al. Pelegrín-Borondo et al. [21] state that utilitarianism significantly influences IU insideables. Likewise, Olarte-Pascual et al. [15] identify utilitarianism as the most important factor in explaining the intention to use wearables.

Contractualism constitutes an individual's feelings about what is right and wrong within the framework of an implied community contract [22]; p. 633). Following Reidenbach and Robin [23]; this dimension comes from deontology and imposes implicit obligations and duties on citizens towards a society that consequently influence individual conduct [26]. Empirical literature offers contradictory results: Reinares-Lara et al. [13] indicate that social norms—a proxy of contractualism—are linked to the acceptance of implants aimed at improving memory. Alternatively, Pelegrín-Borondo et al. [21] suggest that the impact of contractualism on IU insideables is insignificant. However, Olarte-Pascual et al. [15] found a negative and significant relationship between contractualism and IU for both wearables and insideables.

2.2. Research questions and hypotheses

We propose the following research questions to guide the analysis of associated hypotheses:

RQ1: Do ethical judgement factors influencing *intention to use* and exhibit the same acceptance and consensus for wearables and insideables? Given that insideables, unlike wearables, are disruptive ITDs, we formulate the following hypothesis:

H1. The ethical dimensions influencing *intention to use* and the variability of these judgements differ between wearables and insideables.

The influence of ethics on decision-making arises more frequently in questions where moral concerns are greater than in issues of smaller moral magnitude [36]; p. 389). Following Olarte-Pascual et al. [15]; the ethical intensity of wearables and insideables are dissimilar—in 2021 wearables have moved closer to being an ordinary technology, whereas insideables are still considered disruptive.

RQ2: How do ethical factors from MES influence the (intention to) use and non-use of wearables and insideables? In addressing this question, the following hypotheses are tested:

H2a. The combination of positive perceptions of the ethical dimensions of wearables/insideables induce acceptance of these ITDs.

H2b. The combination of negative perceptions of the ethical dimensions of wearables/insideables induce rejection of these ITDs.

All reviewed literature indicates that, theoretically, the relationship between ethical judgements in MES and attitudes toward technology is positive. Thus, positive judgements on dimensions of MES should elicit acceptance and negative judgements should elicit rejection. Empirical evidence, however, failed to confirm these hypotheses which may even be completely contradictory. Surveyed potential users of ITDs have offered judgements on the five dimensions of MES. Consequently, attitudes towards a given type of ITD may not arise out of an evaluation of isolated ethical constructs, but rather from their combination—logically suggesting that acceptance (rejection) comes from the combination of positive (negative) ethical evaluations.

Moreover, the combinations of variables that induce a positive attitude towards ITDs are not necessarily symmetrical with those that produce rejection, thereby necessitating the need to test separately for acceptance (IU) and rejection (~IU), using fsQCA is a suitable method to achieve this.

RQ3: How does MES explain the differences in the (intention to) use and non-use of wearables and insideables? In this case, we test the following hypothesis:

H3. The influence of ethical factors on the IU/non-use of ITDs have differential nuances for wearables and insideables.

3. Methodology

3.1. Survey description

We utilise an online survey questionnaire (see Table 1). The target participants are a sample of digital-native people identified previously by Pelegrín-Borondo et al. [21] and Olarte-Pascual et al. [15]. Questions linked to ethical concerns are adapted from the revision of MES in Reidenbach and Robin [23] by Shawver and Sennetti [24]. IU was

Table 1
Questionnaire items.

Item	Source
Moral equity	
Moral equity 1: Unjust/Just	
Moral equity 2: Unfair/Fair	
Moral equity 3: Not morally right/Morally right	
Relativism	MES by [24]
Relativism 1: Unacceptable to close people/Acceptable to close people	
Relativism 2: Unacceptable in my culture/Acceptable in my culture	
Relativism 3: Traditionally non-acceptable/Traditionally acceptable	
Egoism	
Egoism 1: Not self-promoting/Self-promoting	
Egoism 2: Not personally gratifying/Personally gratifying	
Utilitarianism	
Utilitarianism 1: Generates the smaller utility/Produces the biggest utility	
Utilitarianism 2: Minimum benefit and maximum cost/ Maximum benefit and minimum cost	
Contractualism	
Contractualism 1: Brokers an implied contract/Does not broker an implied contract	
Contractualism 2: Brokers an implied promise/Does not broker an implied promise	
Intention to use	Venkatesh and Davis [37]
Intention to use 1: I intend to use wearables/insideables	
Intention to use 2: I predict I will use wearables/insideables	

measured using the scale in Venkatesh and Davis [37] of the technology acceptance model (TAM2). All items were measured using an 11-point Likert scale.

We feel that the number of answers (more than 1563) and covered countries (seven from Europe, North America and Asia) provides a reasonable degree of cultural diversification. The distribution of answers by countries and ages are given in Fig. 1 and Fig. 2, respectively. Answers from men and women are in a ratio of 48:52.

3.2. Analysis

The research process is conducted sequentially.

Step 1. Measurement of scales.

Reliability of scales is checked by calculating Cronbach alpha, convergent reliability and average variance extracted and also running exploratory factor analysis. It is implemented basically with the use of SPSS.

Step 2. Implement Wilcoxon, Student t-ratio and Levene tests for every item and MANOVA tests conjointly for the set of items that embeds all constructs. This procedure enables the evaluation of H1. In all cases, we test the significance of the dichotomy of wearables versus insideables. Likewise, we use the Levene variance test to evaluate whether the consensus level of answers on ITDs is affected by the dichotomy of ITDs.

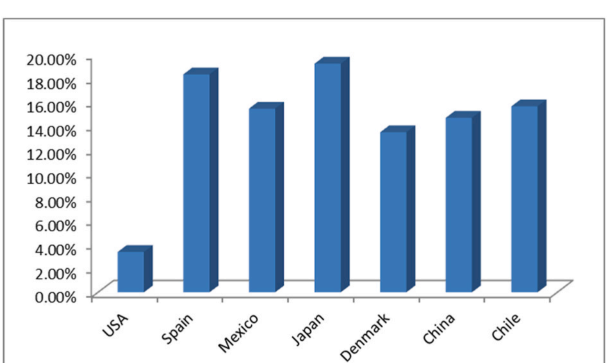

Fig. 1. Country distribution of surveyed persons.

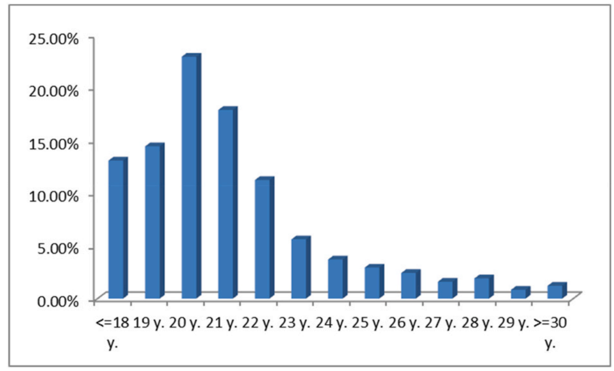

Fig. 2. Age distribution of surveyed persons.

Step 3. State combinatorial effects of ethical dimensions on use and non-use of ITDs. This enables the evaluation of H2a, H2b and H3. We apply qualitative comparative analysis (QCA) [30] and fuzzy set QCA (fsQCA) [31] as follows:

Step 3.1. We perform a contrarian case analysis revealed in Pappas and Woodside [35] with the help of SPSS. Factor loadings on constructs obtained in exploratory factor analysis are used to implement this assessment. Subsequently, we divide the sample by using quintiles of variables and then build up cross-tabulations across the quintiles These crosstabs enable us to compute the degree of association between the variables. From these tabulations, we state the main effect between input and output variables and the existence of cases—outside of the main effect—that justify a configurational analysis.

Step 3.2 We construct the *membership function* of every construct. Because constructs embed several items, to implement fsQCA these values must be aggregated [35]. DiStefano et al. [38] reflect on several approaches to this. In their opinion, when explanatory factor analysis is run on these items and the results are satisfactory, a refined and reliable value for the aggregation is their factor loadings. If we state for the score in the *i*th embedded dimension by the *j*th individual that comes from factor analysis $Score_{i,j}$, following Arias-Oliva et al. [34]; for the *j*th individual in the *i*th dimension, we adjust the following membership value $m_{i,j}$:

$$m_{i,j} = \frac{Score_{i,j} - \min_j\{Score_{i,j}\}}{\max_j\{Score_{i,j}\} - \min_j\{Score_{i,j}\}}$$

Step 3.3. We implement fsQCA with fsQCA 3.1. software by Ragin [39]. It enables finding logical implicates that fit output results by running a Boolean minimization algorithm. If we symbolize the negation of a variable as "~", we independently evaluate for wearables and insideables using two Boolean functions:

$$\text{IU} = \text{f(equity, relativism, egoism, utilitarianism, contractualism)} \quad (1)$$

$$\sim\text{IU} = \text{f(equity, relativism, egoism, utilitarianism, contractualism)} \quad (2)$$

Whereas (1) explains the intention, (2) explains the non-acceptance of the assessed technology. fsQCA 3.1 software provides three solutions, consisting of a set of essential prime implicates also known as recipes [39].

- Qualitative comparative analysis–complex solution (CQA-CS) that is fitted with no more assumption than data.
- Qualitative comparative analysis–parsimonious solution (QCA-PS). Because QCA-CS is usually difficult to interpret, QCA-PS is adjusted by using any hypothesis on the unobserved configuration of variables that discovers the "easiest" solution regardless of hypotheses that might suppose "difficult counterfactuals" [39].

- Qualitative comparative analysis–intermediate solution (QCA-IS). Following Ragin [31]; this solution is developed from theoretically well-founded hypotheses of unobserved configurations. It must be hypothesized if an explanatory factor influences output exclusively when it is present or non-present or if that repercussion arises in both circumstances.

To measure the explanatory power of a given recipe, its *consistency (cons)* and *coverage (cov)* must be established. *Consistency* measures the membership degree of a combination of causes (a recipe) within the outcome set. It is similar to a statistical measure of significance [40]. There is a wide consensus that to consider an essential prime implicate as a sufficient condition, cons >0.75 (or better cons > 0.8). *Coverage* measures the proportion of outcomes explained by a recipe (a measure of empirical relevance similar to R^2). Following Legewie [41]; an essential prime implicate is completely sufficient when cons >0.9 and cov >0.5.

Step 3.4. fsQCA solutions are interpreted to accept or reject H2a, H2b and H3. There is no unified opinion on what solution (complex, parsimonious or intermediate) must be interpreted to extract conclusions. QCA-CS uses strictly empirical data; hence, theoretically, this solution must be uniquely used to obtain explanations from those data. Unfortunately, the recipes contained in that solution are often difficult to interpret which explains why, in common practice, QCA-IS is applied—it provides a balance between the straightforwardness of QCA-PS and the more significant nuances provided by CQA-CS [31]. Alternatively, authors such as Pappas and Woodside [35] advise combining both QCA-IS and QCA-PS to state core conditions (those in QCA-PS) and peripheral conditions (those that only are present in QCA-IS).

Step 3.5. Testing the predictive validity of the framework proposed to explain output. We follow the procedure proposed in Pappas and Woodside [35] by randomly dividing the whole sample (1563 observations) into two subsamples: an estimation sample (1200 observations) and a holdout sample (363 observations). In the estimation sample, we again fit fsQCA models. Subsequently, we assess the operation of these models in the holdout sample. Framework tests that explain output exhibit strong prediction capability if the coverage and consistency of the models in the holdout sample do not contradict those measures in the estimation sample.

4. Results

4.1. Reliability of scales and comparison between wearables and insideables acceptance

Descriptive statistics of the survey are presented in Table 2. When validating the scales, we check that except for *egoism*, all constructs presented a Cronbach alpha and composite reliability >0.7 and average

Table 2
Descriptive statistics of item responses.

Item	Cronbach's alpha	CR	AVE	Mean	Median	SD	Q1	Q3	IQV
WEARABLES									
Moral equity	0.873	0.837	0.632	6.27	6	2.33	5	8	3
Moral equity 1									
Moral equity 2				6.34	6	2.31	5	8	3
Moral equity 3				6.16	6	2.35	5	8	3
Relativism	0.868	0.835	0.627	6.38	6	2.32	5	8	3
Relativism 1									
Relativism 2				6.67	7	2.57	5	9	4
Relativism 3				6.69	7	2.49	5	9	4
Egoism	0.589	0.675	0.510	5.84	6	2.54	5	8	3
Egoism 1									
Egoism 2				5.77	5	2.40	5	7	2
Utilitarianism	0.793	0.815	0.687	6.23	6	2.54	5	8	3
Utilitarianism 1									
Utilitarianism 2				6.66	7	2.43	5	9	4
Contractualism	0.777	0.804	0.672	6.28	6	2.21	5	8	3
Contractualism 1									
Contractualism 2				6.21	6	2.47	5	8	3
Intention to use	0.904	0.909	0.834	6.26	7	2.76	5	8	3
Intention to use 1									
Intention to use 2				6.46	7	2.69	5	9	4
INSIDEABLES									
Moral equity	0.924	0.902	0.754	4.17	5	2.80	2	6	4
Moral equity 1									
Moral equity 2				4.60	5	2.71	3	6	3
Moral equity 3				4.57	5	2.70	3	6	3
Relativism	0.887	0.856	0.665	4.45	5	2.75	2	6	4
Relativism 1									
Relativism 2				4.27	5	2.84	2	6	4
Relativism 3				4.47	5	2.65	3	6	3
Egoism	0.685	0.740	0.587	4.04	4	2.72	2	5	3
Egoism 1									
Egoism 2				4.87	5	2.75	3	7	4
Utilitarianism	0.794	0.816	0.689	4.62	5	2.87	2	7	5
Utilitarianism 1									
Utilitarianism 2				5.63	5	2.75	4	8	4
Contractualism	0.807	0.825	0.702	4.90	5	2.66	3	7	4
Contractualism 1									
Contractualism 2				4.51	5	2.72	3	6	3
Intention to use	0.958	0.958	0.920	3.66	3	3.13	0	6	6
Intention to use 1									
Intention to use 2				3.70	3	3.09	1	6	5

Note. SD: standard deviation; CR: composite reliability; AVE: average variance extracted; Q1 and Q3: 1st and 3rd quantile; IQV: interquartile variation Q3-Q1.

variance extracted >0.5. For *egoism* (both for wearables and insideables), the average variance extracted is > 0.5 but Cronbach alpha is < 0.7. Likewise, for wearables, we also observe composite reliability <0.7 (although close at 0.687). Table 3 shows that in all the dimensions exploratory factor analysis extracts, a significant proportion of the variance of items in the first factor loadings are ≥0.7. Thus, we have robust evidence on the internal consistency of moral equity, relativism, utilitarianism and contractualism. Likewise, the consistency of egoism cannot be rejected despite it being less robust. The results in Table 3 suggest that the first principal component in all the constructs is sufficient to represent them, and are appropriated using factor loadings for the aggregated values of the items, as proposed by DiStefano et al. [38].

The mean and median values in Table 2 suggest that IU is greater for wearables than for insideables. For wearables, the mean response indicates agreement (mean > 6, median = 7) whereas for insideables the mean and median evaluations suggest disagreement (mean < 4, median = 3). Results of Wilcoxon and t-tests reject equality between the degree of IU wearables and insideables (see Table 4). Similar patterns are found for items linked to ethical dimensions, —wearables indicate significantly stronger ethical perceptions than insideables for all MES dimensions (see Tables 2 and 4). MANOVA tests also reject all the constructs that have the same evaluation for wearables and insideables.

The results in Table 2 indicate that wearable items have less variability than insideables. This smaller (greater) variability (consensus) for the items in the survey is statistically significant except for the relativism item "it is traditionally acceptable/it is traditionally unacceptable" (see Table 4).

In conclusion, we assert that H1 cannot be rejected because responses on wearables for all items imply a greater acceptance and higher consensus than for insideables—this difference is statistically significant.

4.2. Assessment of fsQCA results

4.2.1. Contrarian case analysis

Table 5 shows the results of the contrarian case study. The statistical measure *phi* suggests that a significant association exists between attitude towards ITDs and ethical constructs. However, by observing the bottom left and top right crosstab cells we deduce that a configurational analysis—to explain cases outside the main effect—is justified. It is noteworthy that in all cases 0.05 < phi^2 <0.5.

Table 4
Pairwise Wilcoxon, Student t-test, and Levene test for items; MANOVA test for constructs.

Item	Wilcoxon	Student t	Levene	Wilks' lambda (MANOVA)
Moral equity Moral equity 1	23.939***	28.645***	68.123***	0.814***
Moral equity 2	22.017***	24.845***	22.979***	
Moral equity 3	20.085***	22.396***	14.682***	
Relativism Relativism 1	23.058***	26.790***	33.882***	0.856***
Relativism 2	24.622***	30.139***	9.774***	
Relativism 3	23.848***	28.416***	0.689	
Egoism Egoism 1	21.099***	23.925***	11.537**+	0.819***
Egoism 2	12.749***	13.183***	15.485***	
Utilitarianism Utilitarianism 1	19.413***	21.423***	23.807***	0.919***
Utilitarianism 2	14.317***	14.873***	11.898***	
Contractualism Contractualism 1	18.580***	20.150***	12.282***	0.896***
Contractualism 2	20.759***	23.253***	3.476*	
Intention to use Intention to use 1	25.172***	31.099***	61.062***	0.898***
Intention to use 2	25.712***	32.484***	66.382***	

Notes. *** is significant at the 1 % level and * at the 10 % level. Due to the stage 1 results, question 7 linked to egoism (Egoism 1) has been removed.

4.2.2. Models obtained with fsQCA across the entire sample

In all the models evaluated, we found that QCA-IS is the same as QCA-PS. Thus, the choice of approach to solution analysis does not apply to our database and all conditions must be labelled as *core conditions*. We further check that equivalent results are obtained if membership scores are defined by implementing the calibrating function of fsQCA 3.1. at 5 %, 50 % and 95 % percentiles of factor loadings. Truth tables are presented in Annexure A.

Table 6 presents the results of functions (1) and (2) for wearables. For IU we observe that moral equity, egoism, utilitarianism and contractualism judgements must be positive to participate in recipes—only relativism appears negated. Consistency and coverage of terms where utilitarianism converges with moral equity or contractualism are consistently high (cons > 0.9 and cov > 0.75). It is noted that the

Table 3
Exploratory factor analysis.

	Wearables			Insideables		
Item	Loading	Barlett	%Var	Loading	Barlett	%Var
Moral equity		2381.02	79.74 %		3577	86.77 %
Moral equity 1	0.787			0.863		
Moral equity 2	0.826			0.883		
Moral equity 3	0.770			0.858		
Relativism		2309	79.15 %			
Relativism 1	0.763			0.805	2619	81.57 %
Relativism 2	0.817			0.823		
Relativism 3	0.795			0.819		
Egoism		314.22	71.31 %		519.68	76.61 %
Egoism 1	0.714			0.766		
Egoism 2	0.714			0.766		
Utilitarianism		883.64	82.88 %		891	82.98 %
Utilitarianism 1	0.829			0.83		
Utilitarianism 2	0.829			0.83		
Contractualism		822.27	82 %		953.66	83.10 %
Contractualism 1	0.820			0.838		
Contractualism 2	0.820			0.838		
Intention to use		1784.84	91 %		2898.73	95.93 %
Intention to use 1	0.913			0.959		
Intention to use 2	0.913			0.959		

Note. (1) Bartlett's measure enables rejecting where p < 0.001 and correlations between variables are null. (2) %Var is the whole variance extracted in whole dimensions.

Table 5
Contrarian case analysis.

WEARABLES							INSIDEABLES						
Intention to use vs moral equity							**Intention to use vs moral equity**						
		IU Percentile group							IU Percentile group				
		1	2	3	4	5			1	2	3	4	5
	1	132	75	44	**29**	**30**		1	145	100	23	**41**	**4**
Percentile of moral equity	2	81	113	50	**34**	**35**	Percentile of moral equity	2	81	93	64	**49**	**20**
	3	47	64	98	63	42		3	61	77	126	78	45
$phi^2 = 0.312$	4	**28**	**40**	88	107	59	$phi^2 = 0.488$	4	**8**	**33**	68	84	51
	5	**19**	**24**	35	77	149		5	**10**	**23**	24	61	194
Intention to use vs relativism							**Intention to use vs relativism**						
		IU Percentile group							*IU Percentile group*				
		1	2	3	4	5			1	2	3	4	5
	1	115	74	44	**30**	**30**		1	133	99	26	**44**	**10**
Percentile of relativism	2	77	118	68	**40**	**29**	Percentile of relativism	2	82	96	65	**54**	**16**
	3	51	64	87	67	44		3	29	54	58	58	26
$phi^2 = 0.241$	4	**32**	**35**	72	103	72	$phi^2 = 0429$	4	**54**	**51**	129	98	70
	5	**32**	**25**	44	70	140		5	**7**	**26**	27	59	192
Intention to use vs egoism							**Intention to use vs egoism**						
		IU Percentile group							*IU Percentile group*				
		1	2	3	4	5			1	2	3	4	5
	1	96	52	46	**39**	**35**		1	136	89	37	**52**	**16**
Percentile of egoism	2	118	154	103	**66**	**63**	Percentile of egoism	2	67	94	67	**65**	**47**
	3	27	39	55	43	21		3	25	41	22	29	10
$phi^2 = 0.187$	4	**41**	**46**	77	108	74	$phi^2 = 0.317$	4	**63**	**73**	149	123	77
	5	**25**	**25**	34	54	122		5	**14**	**29**	30	44	164
Intention to use vs utilitarianism							**Intention to use vs utilitarianism**						
		IU Percentile group							*IU Percentile group*				
		1	2	3	4	5			1	2	3	4	5
	1	147	67	50	**28**	**27**		1	149	82	29	**53**	**1**
Percentile of utilitarianism	2	72	118	41	**35**	**39**	Percentile of utilitarianism	2	61	99	48	**47**	**15**
	3	43	64	92	61	37		3	63	69	135	64	26
$phi^2 = 0.323$	4	**31**	**43**	86	100	64	$phi^2 = 0.487$	4	**18**	**50**	69	89	80
	5	**14**	**24**	46	86	148		5	**14**	**26**	24	60	192
Intention to use vs contractualism							**Intention to use vs contractualism**						
		IU Percentile group							*IU Percentile group*				
		1	2	3	4	5			1	2	3	4	5
	1	119	51	44	**14**	**19**		1	139	86	29	**50**	**5**
Percentile of contractualism	2	111	125	64	**34**	**23**	Percentile of contractualism	2	80	109	71	**57**	**16**
	3	42	80	107	96	45		3	53	68	119	62	32
$phi^2 = 0.380$	4	**22**	**37**	62	84	62	$phi^2 = 0.462$	4	**23**	**44**	59	82	66
	5	**13**	**23**	38	82	166		5	**10**	**19**	27	62	195

Notes. (1) Phi measure reveals that main effects between variables are statistically significant for $p < 0.001$. (2) Crosstabs indicate the number of cases; contrarian cases are in bold.

Table 6
QCA-IS and QCA-PS for models IU (1) and ~IU (2) for wearables.

Recipes for IU (1)	Raw coverage	Unique coverage	Consistency
equity * utilitarianism	0.787	0.012	0.913
utilitarianism * contractualism	0.802	0.027	0.906
~relativism * egoism * utilitarianism	0.375	0.001	0.936
~relativism * egoism * contractualism	0.380	0.010	0.928
Coverage: 0.831			
Consistency: 0.892			
Recipes for ~ IU (2)	**Raw coverage**	**Unique coverage**	**Consistency**
~contractualism	0.756	0.045	0.778
~relativism	0.715	0.012	0.760
~egoism * ~utilitarianism	0.706	0.013	0.783
~equity * ~utilitarianism	0.713	0.007	0.803
~equity * ~egoism	0.698	0.006	0.791
Coverage: 0.858			
Consistency: 0.708			

absence of relativism combined with egoism appears in two recipes with low cov (<0.35)—however, these are significant combinations (cons > 0.9). It appears that the most relevant variable to explain wearables' IU is utilitarian because it participates in 3 recipes that include greater coverage (utilitarianism*contractualism) and consistency (~relativism*egoism*utilitarianism). Thus, in purity, H2a is rejected; although the combination of judgements on dimensions of MES is relevant in explaining IU wearables, relativism is negated in all recipes where this dimension participates (instead of being affirmed), which contradicts H2a.

Regarding non-use (~IU), Table 6 reveals that unfavourable judgements on contractualism and relativism in isolation produce ~ IU (cons > 0.75 and cov > 0.7). It is noteworthy that, paradoxically, adverse perceptions of the relativism dimension motivate some people's IU of wearables but generates resistance in others. Negative perceptions of other ethical dimensions (egoism, utility and equity) may also generate non-use of wearables by combining them in couples. All recipes have cons ≈0.8 and cov ≈0.7. Thus, all ethical dimensions are relevant to the assumed sign to explain resistance to wearables; H2b is thus accepted.

Configurations that explain IU attain greater consistencies than those explaining ~ IU. Therefore, it seems that the combination of configurations analysis and MES is more effective in explaining the acceptance (rather than the rejection) of wearables.

Table 7 shows QCA-IS and QCA-PS for functions (1) and (2) for insideables. The recipes for IU suggest that equity and relativism in insolation, and confirmed as expected, cause IU. The balance of the variables in couples (and confirmed) also produce IU. All cases—despite recipes presenting high coverages (>0.8)—also attain low consistencies (≈0.7). When using a conventional statistical test, we could conclude that the observed sign for the relationship between input and output variables supports H2a, however, our finding exhibits weak statistical significance. In conclusion, the combination of ethical judgement variables on MES provides an unsatisfactory explanation for the acceptance of insideables; H2a is thus rejected.

Five logical configurations for ~ IU reach significant con (≥ 0.9) and cov (≈0.75 except for utilitarianism)—they are practically sufficient conditions to explain the rejection of insideables. These five logical implicates are straightforward: the negative judgement of any ethical dimension explains the absence of IU. This result implies that H2b is accepted—MES adequately explains the resistance to using insideables.

For RQ3, our findings highlight that the influence of ethics on IU and non-IU presents similar patterns between wearables and insideables. However, we validate several nuances that lead us to conclude that H3 cannot be rejected—the influence of ethical dimensions on IU and ~IU depends on the assessed ITD.

- For wearable technology, IU is adequately explained by MES ethical dimensions. The recipes present high cons and covs, and utilitarianism is the more important factor in explaining IU. Moral equity, egoism and contractualism are also positively linked to IU. Moreover, negated relativism combined with utilitarianism/egoism/contractualism offers a consistent explanation for IU. However, this implies that H2a is rejected. When examining the IU of insideables, we found that MES dimensions in isolation are insufficient in explaining IU.
- Configurational analysis and MES provide a stronger explanation for the non-use of insideables (compared to wearables). For insideables, the negative evaluation of any ethical dimension leads to a refusal to use them. Despite all ethical factors presenting sufficient consistency to explain ~ IU, it is evident that weaker cov arises from ~utilitarianism. For wearables, ~contractualism and ~relativism considered in isolation cause non-use. Although the consistency of these simple recipes is acceptable (>0.75), it is weaker than consistency for insideables nonuse. For wearables, ~egoism, ~utilitarianism and ~equity also cause ~ IU when combined as couples.

4.2.3. *Prediction capability of MES and fsQCA*

In Table 8 and Table 9, models fitted to the estimation sample are

Table 7
QCA-IS and QCA-PS for models IU (1) and ~IU (2) for insideables.

Recipes for IU (1)	Raw coverage	Unique coverage	Consistency
Equity	0.855	0.012	0.708
Relativism	0.845	0.008	0.708
Egoism * utilitarianism	0.819	0.007	0.730
Egoism * contractualism	0.801	0.001	0.735
Utilitarianism * contractualism	0.855	0.017	0.718
Coverage: 0.925			
Consistency: 0.643			
Recipes for ~ IU (2)	**Raw coverage**	**Unique coverage**	**Consistency**
~contractualism	0.763	0.010	0.910
~egoism	0.726	0.012	0.943
~relativism	0.797	0.015	0.898
~utilitarianism	0.42	0.0022	0.935
~equity	0.79	0.0144	0.903
Coverage: 0.873			
Consistency: 0.871			

Table 8
QCA-IS and QCA-PS for models IU (1) and ~IU (2) for wearables: Estimation and holdout samples.

Model fitted to estimation sample	Estimation sample		Holdout sample	
Recipes for IU (1)	Raw coverage	Consistency	Raw coverage	Consistency
equity * utilitarianism	0.827	0.9081	0.8196	0.9096
utilitarianism * contractualism	0.8307	0.9014	0.8174	0.9018
~relativism * equity * egoism * contractualism	0.2971	0.9334	0.2973	0.9516
coverage: 0.86884				
consistency: 0.8903				
Recipes for ~ IU (2)	**Raw coverage**	**Consistency**	**Raw coverage**	**Consistency**
~utilitarianism * ~contractualism	0.6163	0.7808	0.6149	0.7663
~egoism * ~utilitarianism	0.6293	0.7803	0.6324	0.7747
~relativism * ~utilitarianism	0.5671	0.7927	0.5628	0.7662
~equity * ~utilitarianism	0.6121	0.8013	0.6085	0.7747
~equity * ~egoism * ~relativism * * ~contractualism	0.5497	0.7943	0.5534	0.7715
Coverage: 0.7150				
Consistency: 0.7442				

Table 9
QCA-IS and QCA-PS for models IU (1) and ~IU (2) for insideables: Estimation and holdout samples.

Model fitted to estimation sample	Estimation sample		Holdout sample	
Recipes for IU (1)	Raw coverage	Consistency	Raw Coverage	Consistency
equity * utilitarianism	0.8327	0.7485	0.8079	0.7027
relativism * utilitarianism	0.8245	0.7382	0.8199	0.700
equity * relativism * egoism	0.7695	0.7636	0.7546	0.7504
equity * relativism * contractualism	0.7834	0.7609	0.7663	0.74
equity * egoism * contractualism	0.7720	0.7626	0.7630	0.7479
relativism * egoism * contractualism	0.7720	0.7549	0.7697	0.7384
Coverage: 0.878				
Consistency: 0.7021				
Recipes for ~ IU (2)	**Raw coverage**	**Consistency**	**Raw Coverage**	**Consistency**
~utilitarianism	0.6888	0.9344	0.6739	0.9388
~relativism * ~contractualism	0.669	0.9219	0.6587	0.9207
~equity * ~contractualism	0.6666	0.9227	0.655	0.9256
~equity * ~relativism	0.7091	0.9098	0.7012	0.8971
Coverage: 0.8000				
Consistency: 0.8891				

similar—but not equal—to those fitted to the whole sample. However, this result is usual, as confirmed by the tutorial example in Pappas and Woodside [35]. For wearables, Table 8 shows that:

- The combination of positive (negative) judgements on moral equity, egoism, utilitarianism and contractualism (relativism) produces IU.

Alternatively, the combination of negative perceptions on ethical dimensions elicits rejection of the UI of wearables.

- MES produces models with extremely high consistency and coverage in explaining the acceptance of wearables. However, the quality of models in explaining rejection is lower.
- fsQCA models have prediction capability, and when adjusted to the estimation sample exhibit similar consistency and coverage to when they are applied in the validation sample.

For insideables, Table 9 shows that:

- The combination of positive (negative) judgements across five dimensions of MES produces acceptance (rejection) of insideables.
- MES produces models with extremely high consistency and coverage to explain the rejection of insideables. Conversely, the quality of models that explain rejection is low.
- fsQCA models that explain non-use exhibit strong prediction capability. Recipes that explain use—despite presenting similar values in consistency and coverage in the holdout and estimation sample—are slightly weaker. Thus, their prediction capability is demonstrably weaker for IU insideables.

5. Conclusions

This study extends the results of Pelegrin-Borondo et al. [21] and Olarte-Pascual et al. [15] by using the same database and MES theoretical basis. However, by using fsQCA (instead of PLS) we have assessed not only the *intention to use* but also how ethical dimensions interact to explain non-use. Following Gauttier [20]; explaining factors that induce technology rejection is as important as explaining IU; there is a paucity of literature on this. This study shows that fsQCA, unlike conventional correlational methods, can isolate asymmetrical consequences of ethical perceptions on the intention to use and non-use.

In addressing RQ1 (“Do ethical judgement factors influencing *intention to use* and exhibit the same acceptance and consensus for wearables and insideables?“) we find that wearables present significantly greater IU and ethical acceptance than insideables. Likewise, we find that responses to items for wearables presented significantly less variability than for insideables.

In addressing RQ2 (“How do ethical factors from MES influence the (intention to) use and non-use of wearables and insideables?“) we summarise our findings for wearables:

- IU is sufficiently explained by MES factors. All prime implicates present a consistency >0.9. The most important explanatory factor is utilitarianism and, as we postulated, is linked positively with IU in all configurations where it is present. This finding supports [15]. We also find a positive relationship of moral equity and egoism with IU in several configurations, and the negative influence of relativism on IU in two recipes [15]. found a positive (negative) significant relationship between egoism (relativism) and IU, but failed to identify moral equity as significant. Likewise, we find that favourable perceptions on contractualism are present in some explanatory configurations of IU; there is no configuration where the contractualism dimension is negated—contradicting the findings of Olarte-Pascual et al. [15].
- Non-use is sufficiently explained by MES factors, but consistencies are weaker than those explaining IU. However, consistencies in all cases exceeded 0.75. As with H2b, ~IU always arises by combining negative perceptions of ethical dimensions.
- It is noteworthy that favourable perceptions from the relativism dimension produce neither IU nor ~ IU. The negation of relativism occurs in configurations with poor coverage but high consistency (that elicit IU). Hence, we can deduce that there is a significant segment of potential consumers of wearables associated with rebellious behaviours towards tradition and family opinion, among others. Moreover, negated relativism is also a cause of non-use. Therefore, the perception that a wearable is unacceptable for cultural, familial or traditional reasons convinces other potential users not to use that technology.

For insideables, our findings indicate that:

- Our MES models are not highly significant in explaining IU despite the sign of ethical factors in prime implicates being as expected in H2a. This contradicts Pelegrín-Borondo et al. [21] in that, except for contractualism, they found that all ethical dimensions have a positive and significant link to IU. Olarte-Pascual et al. [15] show similar results.
- Non-use is convincingly explained by MES dimensions. All prime implicates present a consistency of at least 0.9. These recipes suggest that if insideables are considered unethical from any MES construct perspective, this will lead to non-acceptance of that technology; these ~ IU findings support H2b. A negative judgement on utilitarianism is a less relevant factor (cov < 0.5) whereas for the negation of other dimensions cov > 0.7. It is noteworthy that the recipe ~ egoism displays greater consistency in explaining its rejection. These findings follow Pelegrín-Borondo et al. [21] and Olarte-Pascual et al. [15] who identify egoism as the most important ethical dimension in explaining attitudes toward wearables.

fsQCA is more effective in explaining consumers’ attitudes to wearables than to insideables. For wearables, configurations explaining IU exhibit high consistencies and those for ~ IU—despite being less consistent—reach levels of at least 0.75. When analysing attitudes towards insideables we establish that configurations explaining ~ IU also present high consistency (similar to IU for wearables), but the models fitted to explain their use have poor consistency (<0.70). In contrast, Olarte Pascual et al. [15] found better adjustments using PLS for insideables (R^2 = 53 %) than for wearables (R^2 = 44 %).

Our fsQCA models present prediction integrity that is linked with their capability to explain IU and non-IU in the whole sample. Models linked to IU wearables and ~IU insideables exhibit excellent prediction capability. For ~ IU wearables, the predictive power of fsQCA is acceptable. Conversely, fsQCA configurations for IU insideables produce low-quality predictions. Whereas fsQCA seems to perform better in predicting attitudes towards ITDs for wearables, Olarte-Pascual et al. [15] find that correlational methods more accurately predict attitudes towards insideables.

In answering RQ3 (“How does MES explain the differences in the use and non-use of wearables and insideables?) we find many similar patterns, together with certain nuances requiring explanation. Unfavourable judgements on MES dimensions for ITDs may explain their non-use. Empirical findings enable complementary classifications to those of Gauttier [20] on non-users of technology (resisters, rejecters, expelled and excluded) and Selwyn [42,43] for reasons leading to the rejection of technology (non-access, technophobia and ideological).

The findings in this study are useful in developing and commercialising capacity enhancing ITDs. The use of fsQCA reveals that combinations of ethical judgements are important in understanding digital natives’ acceptance and rejection of ITDs. Any firm concerned with the ITD market must consider among decision variables those linked to potential users’ moral perceptions and their combinatorial effects on their IU of ITDs. Likewise, our findings reveal that ethical perceptions of ITDs influence wearables and insideables in different ways. The configurations that explain IU in wearables inform different segments of potential consumers for such devices. Positive judgements on usefulness seem to be a key variable. We also detect a small yet significant segment of potential consumers that combine negative judgements from a relativism perspective with positive judgements from other moral dimensions. The configurations that explain rejection reveal profiles of people who are not potential consumers which is useful in avoiding marketing expenses—through unproductive efforts—aimed at these segments.

Similar suggestions arise from our results for insideables, although the explanation of IU by combining fsQCA and MES must be considered cautiously because it exhibits a low consistency. In contrast, the explanation of non-use is reliable.

This study has certain limitations and some of these may inspire further research. This study is centred on a fixed age segment: people 20–30 years old (see Fig. 1). Future studies could focus on other population segments, including boomers and GenX among others. Despite the international scope of the survey, we have not covered many cultures (such as those from Africa or East European countries). Conclusions may differ somewhat if the survey targeted another geographic location. Likewise, it can be useful to extract more precise conclusions for concrete geographic areas (such as a region or a state) of interest, thereby constraining the survey to a particular location. Because ethical perceptions towards any technology change continuously, a technology that is considered disruptive (such as cars at the beginning of the 20th century) may over time evolve into a common good. This applies to wearables, which currently are closer to being common goods than disruptive technologies (especially insideables); hence our results may need revising over time.

Author statement

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been submitted to any other publication than in Technology in Society.

All authors have contributed equally in all the steps of the paper elaboration and its revision.

Acknowledgment

This research was supported by the Centre for Business Information Ethics (CBIE), Meiji University, Japan; and the JSPS Grant-in Aid for Scientific Research (C) 20K01920 "Cross-cultural study on the market acceptance of cyborg technologies" led by CBIE.

Appendix A. Truth tables of the estimates for subsection 4.2.2.

Table A1
Truth table explaining IU wearables

moral equity	relativism	egoism	utilitarianism	contractualism	observations	raw consist	PRI consist	SYM consist
1	0	1	1	1	7	0.9440	0.7790	0.7791
1	1	0	1	1	75	0.9396	0.8184	0.8193
1	0	0	1	1	25	0.9383	0.7565	0.7588
0	0	1	1	1	2	0.9381	0.7356	0.7356
1	0	1	1	0	1	0.9371	0.7106	0.7106
0	1	1	1	1	18	0.9334	0.7611	0.7630
0	1	0	1	1	12	0.9326	0.7390	0.7394
1	0	1	0	1	2	0.9321	0.7061	0.7061
1	1	1	1	1	562	0.9319	0.8699	0.8985
0	0	1	1	0	1	0.9317	0.6791	0.6791
1	0	0	1	0	4	0.9311	0.6881	0.6881
1	1	0	1	0	8	0.9296	0.7029	0.7033
0	0	0	1	1	15	0.9287	0.7063	0.7067
1	1	1	1	0	11	0.9280	0.7188	0.7199
0	0	1	0	1	2	0.9252	0.6689	0.6694
0	1	1	1	0	3	0.9242	0.6715	0.6715
0	1	0	1	0	5	0.9239	0.6623	0.6623
1	0	1	0	0	1	0.9231	0.6443	0.6443
1	0	0	0	1	8	0.9222	0.6724	0.6732
1	1	0	0	1	18	0.9220	0.7061	0.7064
1	1	1	0	1	29	0.9216	0.7390	0.7407
0	1	1	0	1	11	0.9194	0.6794	0.6796
0	1	0	0	1	4	0.9186	0.6613	0.6613
0	0	0	1	0	8	0.9161	0.6294	0.6294
0	0	1	0	0	7	0.9120	0.6004	0.6007
1	0	0	0	0	14	0.9107	0.6120	0.6135
1	1	0	0	0	5	0.9106	0.6176	0.6183
1	1	1	0	0	14	0.9102	0.6355	0.6367
0	0	0	0	1	11	0.9097	0.6238	0.6245
0	1	1	0	0	5	0.9072	0.5981	0.5982
0	1	0	0	0	8	0.9043	0.5845	0.5845
0	0	0	0	0	91	0.8528	0.4899	0.4974

Table A2
Truth table explaining ~ IU wearables

moral equity	relativism	egoism	utilitarianism	contractualism	observations	raw consist.	PRI consist.	SYM consist
0	0	1	0	0	7	0.8677	0.3990	0.3993
0	1	0	0	0	8	0.8653	0.4155	0.4155
0	1	1	0	0	5	0.8618	0.4017	0.4018
1	0	1	0	0	1	0.8608	0.3557	0.3557

(continued on next page)

Table A2 (*continued*)

moral equity	relativism	egoism	utilitarianism	contractualism	observations	raw consist.	PRI consist.	SYM consist
1	0	0	0	0	14	0.8586	0.3855	0.3865
0	0	0	1	0	8	0.8576	0.3706	0.3706
0	0	1	1	0	1	0.8555	0.3209	0.3209
1	1	0	0	0	5	0.8554	0.3812	0.3817
0	0	0	0	0	91	0.8543	0.4951	0.5026
0	1	0	1	0	5	0.8507	0.3377	0.3377
0	0	0	0	1	11	0.8500	0.3751	0.3755
0	0	1	0	1	2	0.8488	0.3303	0.3306
1	0	0	1	0	4	0.8480	0.3119	0.3119
1	0	1	1	0	1	0.8455	0.2894	0.2894
0	1	1	1	0	3	0.8451	0.3285	0.3285
1	1	1	0	0	14	0.8430	0.3626	0.3633
0	1	0	0	1	4	0.8410	0.3387	0.3387
1	0	0	0	1	8	0.8401	0.3265	0.3268
1	0	1	0	1	2	0.8368	0.2939	0.2939
1	1	0	1	0	8	0.8334	0.2965	0.2967
0	1	1	0	1	11	0.8290	0.3203	0.3204
0	0	0	1	1	15	0.8284	0.2931	0.2933
0	0	1	1	1	2	0.8279	0.2644	0.2644
1	1	1	1	0	11	0.8156	0.2797	0.2801
1	1	0	0	1	18	0.8125	0.2935	0.2936
0	1	0	1	1	12	0.8091	0.2605	0.2606
1	0	0	1	1	25	0.8074	0.2405	0.2412
1	0	1	1	1	7	0.8028	0.2209	0.2209
0	1	1	1	1	18	0.7872	0.2365	0.2370
1	1	1	0	1	29	0.7773	0.2587	0.2593
1	1	0	1	1	75	0.7276	0.1805	0.1807
1	1	1	1	1	562	0.5281	0.0983	0.1015

Table A3
Truth table explaining IU insideables

moral equity	relativism	Ego ism	utilitarianism	contractualism	observations	raw consist.	PRI consist.	SYM consist.
1	1	1	1	1	571	0.7856	0.6067	0.6320
1	1	0	1	1	44	0.7691	0.3759	0.3763
1	1	1	1	0	26	0.7634	0.3259	0.3262
1	0	1	1	1	32	0.7618	0.3388	0.3393
1	1	0	1	0	8	0.7550	0.2948	0.2948
1	0	0	1	1	29	0.7488	0.3110	0.3113
0	1	1	1	1	36	0.7471	0.3072	0.3072
1	0	1	1	0	5	0.7459	0.2635	0.2635
1	1	1	0	1	24	0.7416	0.2453	0.2453
0	1	0	1	1	13	0.7388	0.2788	0.2788
1	0	0	1	0	22	0.7339	0.2586	0.2588
0	1	1	1	0	14	0.7336	0.2501	0.2501
1	1	1	0	0	9	0.7329	0.2160	0.2160
1	1	0	0	1	17	0.7293	0.2145	0.2145
1	0	1	0	1	8	0.7233	0.1934	0.1935
0	1	0	1	0	4	0.7209	0.2332	0.2332
0	1	1	0	1	5	0.7208	0.1879	0.1879
0	0	1	1	1	53	0.7169	0.2590	0.2593
1	1	0	0	0	10	0.7149	0.1932	0.1932
1	0	1	0	0	6	0.7093	0.1748	0.1748
0	1	1	0	0	5	0.7049	0.1706	0.1706
1	0	0	0	1	14	0.7035	0.1798	0.1798
0	1	0	0	1	5	0.7031	0.1735	0.1735
0	0	1	1	0	25	0.6950	0.2139	0.2139
0	0	0	1	1	54	0.6946	0.2372	0.2377
0	0	1	0	1	19	0.6829	0.1526	0.1526
1	0	0	0	0	18	0.6766	0.1553	0.1553
0	1	0	0	0	10	0.6728	0.1492	0.1492
0	0	0	1	0	55	0.6569	0.1900	0.1906
0	0	0	0	1	27	0.6415	0.1308	0.1308
0	0	1	0	0	40	0.6379	0.1242	0.1242
0	0	0	0	0	351	0.4367	0.0671	0.0675

Table A4
Truth table explaining ~ IU insideables

moral equity	relativism	Ego ism	utilitarianism	contractualism	observations	raw consist.	PRI consist.	SYM consist.
0	0	0	0	0	351	0.9562	0.9274	0.9325
0	0	1	0	0	40	0.9487	0.8758	0.8758
0	0	0	0	1	27	0.9461	0.8692	0.8692
0	1	0	0	0	10	0.9426	0.8508	0.8508
0	0	1	0	1	19	0.9429	0.8474	0.8474
1	0	0	0	0	18	0.9405	0.8447	0.8447
0	1	1	0	0	5	0.9392	0.8291	0.8294
0	1	0	0	1	5	0.9377	0.8265	0.8265
1	0	1	0	0	6	0.9384	0.8252	0.8252
1	0	0	0	1	14	0.9350	0.8202	0.8202
0	1	1	0	1	5	0.9354	0.8121	0.8121
0	0	0	1	0	55	0.9182	0.8070	0.8094
1	1	0	0	0	10	0.9317	0.8067	0.8068
1	0	1	0	1	8	0.9335	0.8061	0.8065
0	0	1	1	0	25	0.9170	0.7860	0.7861
1	1	0	0	1	17	0.9261	0.7855	0.7855
1	1	1	0	0	9	0.9264	0.7840	0.7840
0	1	0	1	0	4	0.9151	0.7667	0.7668
0	0	0	1	1	54	0.9042	0.7606	0.7623
1	1	1	0	1	24	0.9160	0.7547	0.7547
0	1	1	1	0	14	0.9112	0.7499	0.7499
1	0	0	1	0	22	0.9069	0.7406	0.7412
0	0	1	1	1	53	0.9006	0.7399	0.7407
1	0	1	1	0	5	0.9091	0.7365	0.7365
0	1	0	1	1	13	0.8990	0.7211	0.7212
1	1	0	1	0	8	0.8976	0.7052	0.7052
0	1	1	1	1	36	0.8879	0.6928	0.6928
1	0	0	1	1	29	0.8862	0.6879	0.6887
1	1	1	1	0	26	0.8853	0.6732	0.6738
1	0	1	1	1	32	0.8775	0.6600	0.6607
1	1	0	1	1	44	0.8606	0.6232	0.6237
1	1	1	1	1	571	0.6475	0.3533	0.3680

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