Effects of Personality on Perceived Immersion in Low-Immersive Virtual Reality Stores

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Virtual reality (VR) stores can be differentiated into two main types: immersive and low-immersive. In immersive VR stores, the virtual store environment is typically experienced by putting on a head-mounted display, whereas in low-immersive VR stores, it is typically experienced via the flat screen of some commonly used information technology device, such as a computer or a mobile phone. In this study, we examine how the Big Five personality traits of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience affect perceived immersion in low-immersive VR stores. To do this, we first collect data from 420 US-based consumers via an online survey in which the respondents are requested to visit a real-life low-immersive VR store. We then analyse the collected data with partial least squares structural equation modelling (PLS-SEM). Our findings suggest that especially conscientiousness, but also extraversion and openness to experience, positively affect perceived immersion in low-immersive VR stores.

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1 Introduction

Over the recent years, the use of virtual reality (VR) in marketing and retail has captured the attention of both academics (e.g., Alcañiz et al., 2019; Loureiro et al., 2019; Xi & Hamari, 2021; Barrera & Shah, 2023; Yoo et al., 2023; Lu et al., 2025) and practitioners alike, which is not surprising when considering the forecasted growth of the global market of VR in retail from $3.33 billion in 2023 to $26.28 billion by 2032 (SNS Insider, 2025). However, when talking about the use of VR in marketing and retail, or in any other application area for that matter, it is important to note that there exists not only one kind of VR but numerous different kinds of VR, of which two notable examples are *immersive VR* and *non-immersive VR* (e.g., Mills & Noyes, 1999; Suh & Lee, 2005; Suh & Prophet, 2018). Of these, the former typically necessitates users putting on a head-mounted display (HMD) to experience the virtual environment in which they are fully enclosed. In contrast, the latter typically does not necessitate users putting on an HMD, but the virtual environment can be experienced via the flat screen of some commonly used information technology (IT) device, such as a desktop computer, a laptop computer, a tablet computer, or a mobile phone. In technological terms, non-immersive VR can be seen as somewhat less sophisticated than immersive VR. However, in practical terms, it is still able to offer users many similar benefits as immersive VR, such as the experience of telepresence (Peukert et al., 2019). This means that non-immersive VR can also be seen as immersive to some extent and should, therefore, more accurately be called *low-immersive VR* (Peukert et al., 2019). Because of this, also in this paper, we will be using the term low-immersive VR instead of non-immersive VR.

A similar differentiation can be made between *immersive VR stores* and *low-immersive VR stores* (e.g., Lombart et al., 2020; Zhang et al., 2025), of which the former typically necessitate putting on an HMD to experience the virtual store environment, whereas the latter do not typically necessitate putting on an HMD, but consumers can experience the virtual store environment via the flat screen of their commonly used IT device, such as a desktop computer, a laptop computer, a tablet computer, or a mobile phone. Of these, the low-immersive VR stores, which are also commonly called *360-degree virtual stores* or more simply *360-virtual stores* (Ruusunen et al., 2023), can be considered an extremely tempting option for many retailers to begin experimenting with VR and the metaverse because although they not necessitate

consumers owning and putting on an expensive HMD to experience the virtual store environment, they are still able to offer consumers immersive experiences to some extent and, therefore, also many similar benefits as immersive VR stores (e.g., Peukert et al., 2019; Lombart et al., 2020; Zhang et al., 2025). However, few prior studies have examined how immersive the experiences offered by low-immersive VR stores to consumers actually are and what kind of factors affect the immersion perceptions of consumers when they are visiting such stores. One critical factor is likely to be the personal characteristics of consumers, and especially the personality of consumers.

Although personality has been found to affect almost all aspects of human behaviour (e.g., Roccas et al., 2002), few prior studies have examined its effects on perceived immersion. In this study, our objective is to address this gap in the context of low-immersive VR stores by examining *how the Big Five personality traits of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience affect perceived immersion in low-immersive VR stores*. To do this, we first collect data from 420 US-based consumers via an online survey in which the respondents are requested to visit a real-life low-immersive VR store. We then analyse this collected data with partial least squares structural equation modelling (PLS-SEM). Our findings suggest several interesting effects of the Big Five personality traits on perceived immersion, which have important implications for both theory and practice.

2 Theoretical Background

The two main theoretical concepts of this paper are personality and perceived immersion. Today, the Big Five personality traits of extraversion, agreeableness, conscientiousness, emotional stability (or neuroticism), and openness to experience, which are also commonly referred to as the five-factor model (FFM) of personality, are the dominant paradigm for conceptualising human personality (e.g., Roccas et al., 2002). These five personality traits have been found to successfully capture human personality in a wide variety of contexts, ranging from clinical and counselling to industrial and organisational contexts (e.g., Roccas et al., 2002), which is why we have chosen to apply them also in this study. Often, the Big Five personality traits are defined by describing how individuals who score either high or low in each of the traits tend to be (e.g., Roccas et al., 2002). First, individuals who are extraverted have the tendency to be sociable, talkative, assertive, and active,

whereas individuals who are introverted have the tendency to be retiring, reserved, and cautious. Second, individuals who are agreeable have the tendency to be good-natured, compliant, modest, gentle, and cooperative, whereas individuals who are disagreeable have the tendency to be irritable, ruthless, suspicious, and inflexible. Third, individuals who are conscientious have the tendency to be careful, thorough, responsible, organised, and scrupulous, whereas individuals who are unconscientious have the tendency to be irresponsible, disorganised, and unscrupulous. Fourth, individuals who are emotionally stable (or not neurotic) have the tendency to be calm, poised, and emotionally stable, whereas individuals who are emotionally unstable (or neurotic) have the tendency to be anxious, depressed, angry, and insecure. And finally, fifth, individuals who are open to experience have the tendency to be intellectual, imaginative, sensitive, and open-minded, whereas individuals who are not open to experience have the tendency to be down-to-earth, insensitive, and conventional.

In turn, perceived immersion refers to a psychological state experienced by individuals in which they may become so involved, absorbed, engaged, or engrossed in an environment or experience that they lose awareness of their surroundings in terms of place and time (Agrawal et al., 2020). As summarised in the recent literature review by Colombini et al. (2026), few prior studies have examined the effects of the Big Five personality traits on perceived immersion. And those that have, have made inconsistent findings. For example, the prior study by Jasper et al. (2023) found extraversion and agreeableness – but not conscientiousness, neuroticism (or emotional stability), and openness to experience – to have a positive effect on perceived immersion. In contrast, the prior study by Weibel et al. (2010) found neuroticism (or emotional stability), openness to experience, and extraversion – but not agreeableness and conscientiousness – to have a positive effect on immersive tendency. Thus, although many of the Big Five personality traits have been found to have mainly positive (or negative in the case of emotional stability) effects on perceived immersion, the exact effects seem to vary considerably between different studies conducted in different contexts, thus calling for more context-specific examinations. In this study, we conduct such a more context-specific examination in the specific context of low-immersive VR stores, which has so far been completely overlooked in prior research. More particularly, we propose and test the following five hypotheses concerning the effects of the Big Five personality traits on perceived immersion:

H1: Extraversion has a positive effect on perceived immersion.

H2: Agreeableness has a positive effect on perceived immersion.

H3: Conscientiousness has a positive effect on perceived immersion.

H4: Emotional stability has a negative effect on perceived immersion.

H5: Openness to experience has a positive effect on perceived immersion.

3 Methodology

The data for this study was collected identically to a prior study by Makkonen (2026) with an online survey conducted by using the LimeSurvey service in September 2025. It consisted of three parts. We first asked the respondents questions about their basic background information, such as demographics and personality. We then requested the respondents to visit a real-life low-immersive VR store for about five minutes. Finally, we asked the respondents questions about their visit to the store and their perceptions and intention of using these kinds of stores in the future. Each respondent was randomly assigned to visit one of two low-immersive VR stores belonging to Amazon's Beyond program: the Logitech store or the Star Wars store. This was to promote the generalisability of our findings by covering not only one but a wider variety of stores in terms of their product offerings, with the products of the Logitech store being more utilitarian (e.g., mice, keyboards, headphones, loudspeakers, and web cameras) and the products of the Star Wars store being more hedonic (e.g., clothing, collectables, and toys). For illustrations of the two stores, please see Appendix B. In both stores, the respondents were able to freely move in and explore the virtual store environment enriched with both audio and video content, view the offered products embedded in the environment, and click on the offered products to see more information about them or purchase them. Based on their visit, the respondents were also requested to respond to a question concerning the price of one particular product in the store to prove that they had really conducted the visit.

In the survey, the Big Five personality traits were measured by using the ten-item personality inventory (TIPI) by Gosling et al. (2003), whereas perceived immersion was measured by using a four-item scale adapted from tom Dieck et al. (2023). These scales were selected due to their wide use, brevity, and clarity. In the wordings of the items that measured perceived immersion, low-immersive VR stores were referred to simply as "virtual stores", which were defined in the survey as "online stores that enable you to move and interact in three-dimensional 360-degree environments via your screen without a virtual reality headset or any other extra equipment". For the precise wordings of all the items, please see Appendix A. The standard seven-point Likert scale, ranging from strong disagreement (1) to strong agreement (7), was used to measure all the items. To avoid forced responses, the measurement scale also allowed for missing values. Before its launch, four researchers who had experience in the topic pilot tested the survey, resulting in some small revisions. The average completion time of the survey was about 22.5 minutes.

We recruited the respondents by using the Prolific crowdsourcing service. In general, crowdsourcing services have been found to be a reliable and valid data collection method in information systems (IS) research (Lowry et al., 2016). More specifically, the Prolific service has been found to provide a more heterogeneous participant population and at least equal data quality in comparison to its competitors, such as the Amazon Mechanical Turk (MTurk) service (Peer et al., 2017, 2022). To promote data quality, we adhered to the guidelines for using crowdsourcing services in IS research by Jia et al. (2017) by adding two attention trap items in the survey and recruiting only respondents who had at least 20 but no more than 10,000 prior submissions and whose approval rate for their prior submissions was at least 98%. To homogenise the visiting experience as much as possible, we also recruited only respondents who were fluent in English, resided in the US, and were willing to complete the survey by using either a desktop computer or a laptop computer. All the respondents who completed the survey received a minor monetary reward of a few US dollars, on average exceeding the US federal minimum wage of $7.25 per hour.

When analysing the collected data, the Big Five personality traits constructs were inserted into the estimated model as composite variables formed by first unreversing the coding of the reverse-coded items and then averaging the scores of the two items that measured each personality trait. Model estimation was conducted with partial

least squares structural equation modelling (PLS-SEM) by using the SmartPLS 4.1.1.8 software (Ringle et al., 2026) and adhering to the guidelines by Hair et al. (2022). For example, bootstrapping with 10,000 subsamples was used to test the statistical significance of the model estimates, whereas the statistical significance of potential differences in the model estimates between the Logitech and Star Wars subsamples was tested by using bootstrapped multi-group analysis with 10,000 subsamples, in which the Logitech and Star Wars subsamples constituted the two compared groups. In both, $p < 0.05$ was used as the threshold for statistical significance. Mean replacement was used to handle the potential missing values. When estimating the model, we also used gender, age, educational attainment, and prior experience in visiting low-immersive VR stores as control variables for perceived immersion.

4 Results

4.1 Sample Statistics

The survey was completed by 455 respondents, of whom 35 (7.7%) had to be discarded due to incorrect responses to the two attention trap items or to the question concerning product price. Thus, 420 respondents formed the final sample. Table 1 reports the descriptive statistics of this sample in terms of the gender, age, educational attainment, and prior experience in visiting low-immersive VR stores of the respondents. The sample had a very balanced gender distribution between men and women (49.3% vs. 49.8%). The age of the respondents ranged from 19 to 81 years, with a mean of 42.9 years and a standard deviation of 13.0 years. In terms of education, most of the respondents (66.0%) had attained an undergraduate, graduate, or postgraduate degree, diploma, or certificate. And in terms of prior experience in visiting low-immersive VR stores, most of the respondents (66.7%) had never previously visited such a store. In addition, Table 1 reports the visited low-immersive VR store during the survey, showing that 207 respondents (49.3%) visited the Logitech store and 213 respondents (50.7%) visited the Star Wars store.

Table 1: Sample statistics (N = 420)

	N	%
Gender		
Man	207	49.3
Woman	209	49.8
Other	4	1.0
Age		
18–29 years	64	15.2
30–39 years	133	31.7
40–49 years	88	21.0
50–59 years	90	21.4
60 years or over	45	10.7
Educational attainment		
Less than secondary school or high school	2	0.5
Secondary school or high school	65	15.5
Some post-secondary studies but no degree, diploma, or certificate	76	18.1
Undergraduate degree, diploma, or certificate	191	45.5
Graduate or postgraduate degree, diploma, or certificate	86	20.5
Prior experience in vising low-immersive VR stores		
Has never visited	280	66.7
Has visited 1–2 times	75	17.9
Has visited 3–5 times	29	6.9
Has visited 6–10 times	8	1.9
Has visited 10 times or more	15	3.6
No response	13	3.1
Visited low-immersive VR store		
Logitech	207	49.3
Star Wars	213	50.7

4.2 Measurement Reliability and Validity

The reliability of the perceived immersion and the Big Five personality traits constructs was evaluated by using their Cronbach's alpha (CA), which are reported in Table 2. For all constructs except for agreeableness and openness to experience, these were found to be greater than or equal to 0.7, thus suggesting acceptable reliability (Nunnally & Bernstein, 1994). However, we also consider the lower CAs of agreeableness (0.508) and openness to experience (0.624) as acceptable because they were found to be in the typical range from 0.40 to 0.73 of the TIPI scale by Gosling et al. (2003). In addition, as instructed by Fornell and Larcker (1981), the reliability of the reflectively measured perceived immersion construct was evaluated by using its composite reliability (CR), which is reported in Table 2. This was found to be greater than or equal to 0.7, thus suggesting acceptable reliability (Nunnally & Bernstein, 1994). In turn, the validity of the reflectively measured perceived

immersion construct was evaluated by using the two criteria proposed by Fornell and Larcker (1981), which enable its evaluation from the aspects of both convergent and discriminant validity. They both are based on the average variance extracted (AVE) of a construct, which is the average proportion of variance explained by a construct in its indicators. Of these, the first criterion expects a construct to have an AVE of greater than or equal to 0.5 to suggest acceptable convergent validity. In turn, the second criterion expects a construct to have a square root of AVE greater than or equal to its absolute correlations with the other model constructs to suggest acceptable discriminant validity. The AVE of the perceived immersion construct, its square root (the on-diagonal cells of the correlation matrix), and the correlations of the perceived immersion construct with the other model constructs (the off-diagonal cells of the correlation matrix) are reported in Table 2, showing that the perceived immersion construct met both these criteria.

Table 2: Construct statistics (N = 420)

	CA	CR	AVE	1	2	3	4	5	6
1 Perceived immersion	0.880	0.916	0.732	0.856					
2 Extraversion	0.733	–	–	0.246	–				
3 Agreeableness	0.508	–	–	0.249	0.248	–			
4 Conscientiousness	0.720	–	–	0.340	0.250	0.480	–		
5 Emotional stability	0.809	–	–	0.226	0.353	0.411	0.519	–	
6 Openness to experience	0.624	–	–	0.254	0.435	0.255	0.231	0.223	–
7 Gender	–	–	–	0.137	0.039	0.160	-0.004	-0.074	0.114
8 Age	–	–	–	0.035	0.111	0.223	0.112	0.182	-0.012
9 Education	–	–	–	0.103	0.122	0.102	0.186	0.181	0.136
10 Prior experience	–	–	–	0.059	0.098	0.036	0.006	0.045	0.167

Finally, the reliability and validity of the indicators that were reflectively measuring the perceived immersion construct were evaluated by using their standardised loadings, which are reported in Table 3. In the typical case of each indicator loading on only one construct, these are typically expected to be statistically significant and greater than or equal to 0.707 (Fornell & Larcker, 1981) in order to suggest acceptable reliability and validity. As shown, this criterion was met by all indicators. In addition, Table 3 reports the means (M) and standard deviations (SD) of and the

percentages of missing values in the indicator scores for all the indicators measuring the perceived immersion and the Big Five personality traits constructs.

Table 3: Item statistics (N = 420, *** = p < 0.001)

Item	M	SD	Missing	Loading	Item	M	SD	Missing	Loading
PI1	5.401	1.564	0.2%	0.881***	**AGR2**	5.307	1.709	0.0%	–
PI2	4.538	1.743	0.0%	0.843***	**CON1**	5.784	1.312	1.0%	–
PI3	5.064	1.618	0.0%	0.886***	**CON2**	5.557	1.613	0.0%	–
PI4	4.340	1.793	0.0%	0.811***	**ES1**	5.459	1.462	0.5%	–
EXT1	3.809	1.968	0.2%	–	**ES2**	4.810	1.839	0.0%	–
EXT2	3.077	1.820	0.7%	–	**OTE1**	5.513	1.307	0.7%	–
AGR1	5.792	1.278	1.4%	–	**OTE2**	5.307	1.696	0.0%	–

4.3 Estimation Results

Table 4: Estimation results (N = 420, *** = p < 0.001, ** = p < 0.01, * = p < 0.05)

	All	Logi-tech	Star Wars	Diffe-rence
Hypothesised effects				
H1: Extraversion → Perceived immersion	0.110*	0.129	0.086	-0.043
H2: Agreeableness → Perceived immersion	0.051	0.032	0.056	0.024
H3: Conscientiousness → Perceived immersion	0.252***	0.308**	0.213**	-0.095
H4: Emotional stability → Perceived immersion	0.025	0.025	0.021	-0.004
H5: Openness to experience → Perceived immersion	0.106	-0.015	0.234**	0.249*
Effects of the control variables				
Gender → Perceived immersion	0.129*	0.113	0.132	0.019
Age → Perceived immersion	-0.050	-0.086	-0.023	0.063
Education → Perceived immersion	0.025	-0.003	0.015	0.018
Prior experience → Perceived immersion	0.030	0.015	0.047	0.032
R^2				
Perceived immersion	0.178***	0.170**	0.211***	0.041

Table 4 reports the estimation results in terms of the standardised path coefficients of the hypothesised effects and the effects of the control variables, first for the whole sample (N = 420) and then for the Logitech (N = 207) and Star Wars (N = 213) subsamples. As can be seen, in the whole sample, only conscientiousness (0.252***), extraversion (0.110*), and gender (0.129*) were found to have statistically significant and positive effects on perceived immersion, suggesting that women and individuals who are more conscientious and extraverted perceive low-immersive VR stores as more immersive. In the Logitech subsample, only conscientiousness (0.308**) was found to have statistically significant and positive effect on perceived immersion,

whereas in the Star Wars subsample, both conscientiousness (0.213**) and openness to experience (0.234**) were found to have statistically significant and positive effects on perceived immersion. The effect of openness to experience on perceived experience was also the only effect in which a statistically significant difference (0.249*) was found between the Logitech and Star Wars subsamples. In terms of the proportion of explained variance (R^2) in the perceived immersion construct, the Big Five personality traits constructs and the control variables were together found to explain 17.8% of the variance in the whole sample, 17.0% of the variance in the Logitech subsample, and 21.1% of the variance in the Star Wars subsample.

5 Discussion and Conclusion

In this study, we examined the effects of the Big Five personality traits on perceived immersion in low-immersive VR stores. Of the five hypotheses concerning the effects of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience on perceived immersion, we found either full (supported in the whole sample and in both of the two subsamples) or partial (supported in at least one of the three samples or subsamples) support for three hypotheses (i.e., H1, H3, and H5), whereas no support was found for two hypotheses (i.e., H2 and H4).

First, we found conscientiousness to have the most stable effect on perceived immersion in terms of being positive both in the whole sample and in the Logitech and Star Wars subsamples. This finding is best explained by the fact that individuals who score higher in conscientiousness tend to be more organised by nature, thus likely being able to better concentrate on the virtual store environments of low-immersive VR stores when visiting them and thus also perceiving these environments as more immersive. Second, we also found extraversion to have a positive effect on perceived immersion in the whole sample, although this effect was found to be weaker than the effect of conscientiousness on perceived immersion, so much so that no statistically significant effect could be found when examined separately in the Logitech and Star Wars subsamples. This finding is best explained by the fact that individuals who score high in extraversion tend to be more sociable by nature, thus being more ready to engage in social interactions that may be encountered in the virtual store environments of low-immersive VR stores and thus also perceiving these environments as more immersive. But because such social interactions may not be encountered in the virtual store environments of all low-

immersive VR stores, the effect of extraversion on perceived immersion remains weaker than the effect of conscientiousness on perceived immersion. Third, we found openness to experience to have the most interesting effect on perceived immersion because whereas this effect was found to be positive in the Star Wars subsample, no such effect was found in the Logitech subsample or in the whole sample. This finding is best explained by the fact that individuals who score higher in openness to experience tend to be more open-minded by nature, thus being able to better imagine themselves in different environments. This is likely to make it easier for them to imagine themselves especially in the virtual store environments of low-immersive VR stores that are not mere replicas of physical store environments (as was the case of the Logitech store) but more fantasy-like environments (as was the case of the Star Wars store), thus helping them to perceive especially these latter environments as more immersive.

We see that our study makes important theoretical and practical contributions. From a theoretical perspective, our study promotes the current understanding of the effects of the Big Five personality traits on perceived immersion in low-immersive VR stores by both supporting and conflicting with some of the findings of prior research. For example, our study supports the positive effects of extraversion and openness to experience on perceived immersion, which were also found by Weibel et al. (2010), but conflicts with the studies by both Jasper et al. (2023) and Weibel et al. (2010) by finding also conscientiousness to have a positive effect on perceived immersion. From a practical perspective, the retailers managing low-immersive VR stores can use this understanding to further promote the adoption and diffusion of their stores by better targeting them to consumers with different personality traits. An example of this would be using low-immersive VR stores with more fantasy-like virtual store environments to target consumers who are more open to experience.

6 Limitations and Future Research

We see that our study has three main limitations, each of which calls for future research to appropriately address them. First, our study focused on consumers who resided only in the US, thus calling for future studies focusing on consumers residing also in other countries, especially in countries with different cultures. Second, although our study was based on a survey in which the respondents were requested to visit a real-life low-immersive VR store, this store was visited only for about five

minutes, thus limiting the visiting experience and raising a call for future studies that are less cross-sectional and more longitudinal. Third, although our study examined the effects of personality traits on perceived immersion in the case of not only one but two real-life low-immersive VR stores, of which one offered more utilitarian products and the other offered more hedonic products – these two stores are only two examples of low-immersive VR stores, thus calling for future studies focusing on a wider variety of stores in terms of the offered products and otherwise.

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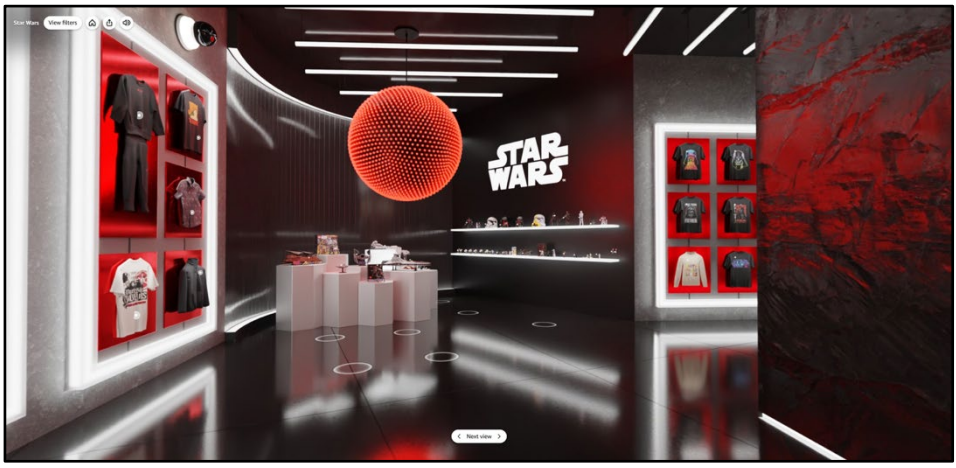
Appendix A: Item Wordings

Item	Wording
Perceived immersion (PI)	
PI1	I was completely immersed in the virtual store.
PI2	I lost track of time while visiting the virtual store.
PI3	I became very involved in my visit to the virtual store, forgetting about other things.
PI4	I became unaware of my surroundings while visiting the virtual store.
Extraversion (EXT)	
EXT1	I see myself as extroverted, enthusiastic.
EXT2*	I see myself as reserved, quiet.
Agreeableness (AGR)	
AGR1	I see myself as sympathetic, warm.
AGR2*	I see myself as critical, quarrelsome.
Conscientiousness (CON)	
CON1	I see myself as dependable, self-disciplined.
CON2*	I see myself as disorganized, careless.
Emotional stability (ES)	
ES1	I see myself as calm, emotionally stable.
ES2*	I see myself as anxious, easily upset.
Openness to experience (OTE)	
OTE1	I see myself as open to new experiences, complex.
OTE2*	I see myself as conventional, uncreative.

* = reverse-coded item

Appendix B: Logitech and Star Wars Stores

Source: Own



Source: Own