Influence of Cultural Factors on Wearable Technology Acceptance in Healthcare

An empirical study with Chinese and Swiss consumers

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Management Summary

The market of healthcare wearables is compelling and expected to reach USD 14.4 billion by 2022 at a CAGR of 18.3%. The term “wearables” refers to “wearable technology or devices”, with computers incorporated into accessories and clothing worn on the body. Healthcare wearables can monitor real-time health vitals, diagnose diseases, and provide reminders for medicine or exercises. They are generally classified into consumer and medical-grade devices, but the distinction is increasingly blurred with advancing sensor technology. Global companies like Apple, Google, Fitbit, Xiaomi etc. developing wearables integrating medical technology aim to target consumers worldwide. The intention to accept these devices varies yet tremendously among people with diverse cultural backgrounds.

In this study, certain patterns of influential factors associated with usage intention of healthcare wearables are investigated through comparing essential acceptance motives and usage barriers of Chinese and Swiss consumers. The different perceptions between both groups in view of varied national culture are examined.

A conceptual model is established based on an existing framework of wearables acceptance, incorporating predictors adapted from theories of technology acceptance, health behavior, and privacy calculus. “China/Switzerland” distinguished by national culture acts as a moderator, which affect influence degree in the model. A web-based survey translated into Chinese and German is conducted in both countries respectively after modifications through pilot study. Finally, 110 valid Swiss and 201 Chinese respondents are included in data analysis.

Statistical analysis suggests the model fits well for the research purpose. Results reveal performance expectancy (PE), social influence (SI), hedonic motivation (HM) and effort expectancy (EE) positively affect behavior intention (BI) of consumers to adopt wearables. Functional congruence (FC), health consciousness (HC), perceived privacy risk (PPR) do not affect BI significantly. Nevertheless, moderating analysis indicates HC is a key factor affecting BI of Chinese positively, and PPR affecting BI of Swiss negatively. Chinese display considerably higher BI than Swiss, which relates to their higher values on PE, FC, EE and SI than Swiss. These differences are explained by

cultural values, e.g. low individualism, low uncertainty avoidance and high power distance of Chinese in contrast to Swiss.

This study is one of the first to investigate consumers' intention to adopt wearables from a cross-cultural perspective, which provides theoretical and methodological foundation for future research with specific wearables or other countries. Practical implications are given to global vendors and insurers for developing and promoting wearables with suitable features in different countries. Positive opinions of physicians, evident measurement accuracy and clear data protection measures would make Swiss in favor of wearables; Involvement of Chinese employers, multifunctional apps providing credible healthcare advices and social interactions would increase Chinese's interests in wearables.

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List of Abbreviations

AI	Artificial Intelligence
ARPU	Average Revenue per User
CAGR	Compound Annual Growth Rate
CH	Switzerland
CN	China
Edöb	Eidgenössische Datenschutzbeauftragte
ECG	Electrocardiography
EE	Effort Expectancy
FC	Functional Congruence
FDA	Food and Drug Administration
HC	Health Consciousness
HM	Hedonic Motivation
ICT	Information and Communications Technology
IDC	International Data Corporation
IDV	Individualism
IND	Indulgence
LLCI	Lower Limit of Confidence Interval
IS	Information System
LTO	Long-term Orientation
MAS	Masculinity
MHRA	Medicines and Healthcare Products Regulatory Agency
PDI	Power Distance
PE	Perceived Expectancy
PEOU	Perceived Ease of Use
PMT	Protection Motivation Theory
PPR	Perceived Privacy Risk
PU	Perceived Usefulness
SE	Self-Efficacy

SI	Social Influence
SUDEP	Sudden Unexpected Death in Epilepsy
TAM	Technical Acceptance Model
UAI	Uncertainty Avoidance
ULCI	Upper Limit of Confidence Interval
UTAUT	Unified Theory of Acceptance and Use of Technology
VSM	Values Survey Module
WTAH	Wearable Technology Acceptance in Healthcare

1. Introduction

1.1. Background

The terms “wearable technology“, “wearable devices“, and “wearables” all refer to electronic technologies or computers incorporated into items of accessories and clothing, which can comfortably be worn on the body (Tehrani et al., 2014). In this paper, the word “wearables” represents the terms “wearable technology” and “wearable devices“. Wearables play an important role in digital health, constantly collecting important user data while giving users the ability to self-monitor their health vitals (IDC, 2019).

The worldwide market for wearables is growing to 198.5 million units by the end of 2019, and expected to reach 279 million units by the end of 2023, with a compound annual growth rate (CAGR) of 8.9% according to the newest report “Worldwide Quarterly Wearable Device Tracker” of International Data Corporation (IDC). Driving that growth will be the continued increase of smartwatches, ear-worn devices, and wristbands as well as further adoption in the healthcare segment (IDC, 2019). The following graphic (Figure 1) displays the growth of shipment units of wearables in defined segments of devices.

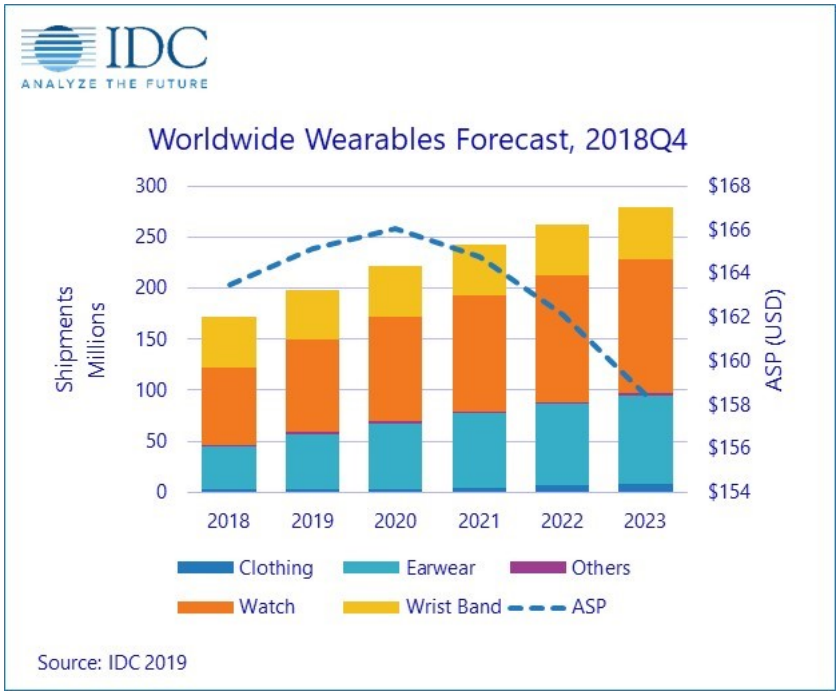

Figure 1: Worldwide wearables forecast in segments (IDC, 2018)

Global comparison of market research portal Statista forecasts China will generate the most revenue of wearables in 2019 with a market volume of USD 4’553 million, followed by the USA (USD 3’096 million), India (USD 1’446 million), UK (USD 482 million) and Germany (USD 423 million). The revenue of Switzerland in 2019 is predicted to reach USD 65 million in 2019 (Statista, 2019).

Researchers like Gao et al. (2019) state there are two main types of wearables in current market related to healthcare. The first is consumer-grade wearables such as fitness/wellness devices, which help users to track and monitor their daily fitness conditions such as steps, distance, calories burned, sleep, and diet. These wearables from Fitbit, Xiaomi, Huawei, Garmin etc. are more suitable for the young and healthy users (Gao et al., 2015, 1705). The second type is medical-grade wearables like glucose monitoring system of Abbott Freestyle Libre, which are generally designed for certain disease such as diabetes. Medical-grade wearables, in contrast to fitness devices, are more likely to be adopted by the elder and unhealthy users (Gao et al., 2015, P. 1705). However, the consumer-grade wearables like smartwatches are starting to resemble medical-grade wearables in that they are now able to collect more accurate health vital information (Young, 2018). For example, Apple announced it is adapting its smartwatches to monitor hypertension and diabetes (Young, 2018). Although Google has several patents of medical-grade wearables, it still researches other related technologies like genetic testing (Gao et al.,2015, P.1705).

As the potential users continue to grow, wearables will have more sociological and cultural impact in the future (Tehrani et al., 2014). In recent years, people who track many kinds of vitals about themselves have gained a new name called “Quantified-selfers” (Choe et al., 2014, p. 1143). Quantified-selfers share their data with their peers and form the quantified-self community. Using wearables has become part of the quantified-self movement, which is based on the premise that “self-tracking” of health behavior leads to “self-knowledge” ultimately ending with “self-help” (Scutti, 2015). With advances in wearables moving from technical gadgets to retail products, the quantified-self movement has been fueled by these advances (Seiler & Hüttermann, 2015).

1.2. Research objective and question

The wearables developed by numerous global companies aim to target consumers in different countries. However, the utility of wearables might not be as high as the market forecast hype. Some questions arise while people using the wearables: do the wearables help to target the people who would benefit the most from them? Do they collect the useful data? Do people like to wear them? Studies disclosed 32% of users stop wearing them after six months and 50% after one year (Vlaev&Lubczanski, 2018). Many wearables suffer from being a “solution in search of a problem" (Vlaev&Lubczanski, 2018). They don’t add functional value that is already expected from personal technology of that type, and they require too much effort, which breaks the seamless user experiences (Vlaev&Lubczanski, 2018).

Furthermore, the intention to accept and adopt information technology including wearables varies tremendously among people with diverse cultural backgrounds. It is evident that countries differ greatly regarding their technical development, social structure, and usage habits face considerable different level of technology acceptance (Alagöz et al., 2011, p. 151). Many research studies have been found in the area of explanation and prediction of user’s adoption of information technology (system) by using technology acceptance model (TAM) of Davis (1989) or unified theory of acceptance and use of technology 2 (UTAUT2) of Venkatesh et al. (2012). UTAUT2 incorporates predictors with regard to consumer behaviors (e.g. hedonic motivation, price value, habits etc.) and moderating variables (e.g. age, gender, experience) comparing its original model of UTAUT (Venkatesh et al., 2003) and main structure of Davis’ (1989) TAM. However, the impact of cultural factors on the users’ behavior intention has seldom been researched. There is notable insufficient knowledge on how society and culture affect the technology acceptance and the underlying reasons for or against technology usage (Alagöz et al., 2011, p. 152)

Some literatures can be found in researching the consumers’ acceptance and adoption of wearables. To the knowledge of the author until today, there are yet no studies dedicated to the influence of cultural factors on consumer’s perception and behaviors regarding wearables. There is a remarkable research gap concerning the influence of cultural factors on consumers’ acceptance and intention to use healthcare wearables.

The objective of this study is to investigate certain patterns of influential factors associated with usage intention of healthcare wearables through comparing essential acceptance motives and usage barriers of Chinese and Swiss consumers. The different perceptions between Chinese and Swiss are examined in view of varied national culture of these two countries. Results of the study provide implications for the global digital technology providers to develop and market wearables successfully across borders; as well as for the insurers to offer incentives for lifestyle changes to enhance health conditions of people effectively.

Based on this, the following research questions are formulated:

- What are the influential factors on the behavior intention to adopt wearables?
- What are the perceptions of Chinese and Swiss consumers toward wearables?
- How do cultural values influence the differences between Chinese and Swiss?

1.3. Research framework and thesis structure

In order to answer the above research questions, a conceptual model is established based on an existing framework of Gao et al. (2015) examining wearable technology acceptance, which incorporate predictors adapted from theories of technology acceptance, health behavior, and privacy calculus.

Swiss and Chinese have distinguished national culture in many aspects based on cultural value dimensions of various anthropologists and management scholars. Given the author is familiar with the cultural differences between both countries through practical experiences and academic studies, Switzerland and China are chosen as the example countries to test the conceptual model, and to examine the influence of national culture on the different perceptions and intentions of consumers.

The proposed model is tested by analyzing data with 110 valid Swiss respondents and 201 valid Chinese respondents in SPSS. Through a survey conducted in April 2019 in Switzerland and China respectively, the perceptions toward smartwatches of both Chinese and Swiss respondents were investigated empirically. Smartwatches are the most popular wearables gradually integrating the functions of consumer- and medical-grade wearables. Some hypotheses are validated by the descriptive and inferential statistics of the data. For example, the predictors such as performance expectancy (PE), social influence (SI), hedonic motivation (HM) and effort expectancy (EE) affect

behavior Intention (BI) to adopt healthcare wearables of all users positively. Health consciousness (HC) is an important predictors only affecting BI of Chinese positively, and perceived privacy risk (PPR) is a key factor only affecting BI of Swiss negatively. Chinese display considerably higher BI than Swiss consumers, which relates to their higher values of PE, EE and SI then Swiss. Different results of Chinese and Swiss respondents are explained with varied cultural values of both countries. This study is believed to present both theoretical foundations for future research and practical contributions for further developing strategy of global firms and insurers.

The remainder of this thesis is organized as follows: Chapter 2 reviews related literatures about general information on wearables, wearables in healthcare, smartwatches, adoption trends of wearables in China and Switzerland, theories and models of wearable technology acceptance in healthcare, as well as theories on cultural value dimensions. The conceptual model and hypotheses for research are provided in Chapter 3, which is followed by the research methodology in Chapter 4. Chapter 5 displays results of data analysis and discussion of this study. The conclusions and implications are presented in Chapter 6. Limitations and future research direction are indicated in Chapter 7.

2. Literature Review

A literature review is conducted at first to search for the relevant information and knowledge around the research questions and conceptual model. Since the research questions are quite complex, and incorporate various fields of knowledge, the literatures selected are segmented in three categories:

- Features and developments of wearable technology and devices in healthcare; status and trends of adopting healthcare wearables in China and Switzerland
- Research models for information technology acceptance; theories related to wearable technology acceptance
- Theories of culture, cultural value dimensions distinguishing national culture; and cultural differences between Chinese and Swiss

The included literatures are primarily peer-viewed research papers, articles from scientific magazines, extracts from books, as well as websites of digital health and market research companies etc. All the related documents are collected in the reference management program Zotero.

2.1. Wearable technology and devices

Enabled by mobile computing and wireless networking, wearables are small electronic devices worn by users on different body parts. They includes wrist wear such as smartwatches and wristbands, headwear & eyewear such as augmented reality (AR), virtual reality (VR), footwear such as athletic, fitness, and sports shoes, as well as other devices such as body worn camera and ring scanners. The concept of electronic (smart) textiles has recently emerged from the concept of integration of wearable computers in clothing and apparel (MarketsandMarkets, 2019).

A recent survey of Seneviratne et al. (2017) provides a comprehensive summary of the existing commercial wearable products and research level prototypes, which are listed in Table 1. In their survey, Seneviratne et al. (2017) only reviewed the devices that can be easily worn by the user without any medical procedure. A number of medical wearables such as ingestible sensors, wearable injectors and wearable insulin pumps that require some initial medical intervention to decide whether the user needs such

device and to place it properly on the human body (e.g. devices that require approval of Food and Drug Administration) are not considered (Seneviratne et al., 2017, p. 2).

	Description	**Existing Products**	**Research Prototypes**
Accessories			
Wrist-worns			
Smart watches	Wrist-worn devices with a touchscreen display	- Apple iWatch - Samsung Gear S2 - Moto 360 - Pebble Time	- Smartwatch Life Saver - Finger-writing with Smartwatch
Wrist bands	Wrist-worn devices with fitness tracking capabilities or other functionalities, generally without a touchscreen display	- UP by Jawbone – - Fitbit Flex - MOOV NOW – - Nymi Band	- Wrist-worn Bioimpedance Sensor - Wrist-worn Smoking Gesture Detector - Ultrasonic-speaker - Embedded Wrist Piece and Neck Piece
Head-mounted Devices			
Smart eyewear	Spectacles or contact lenses with sensing, wireless communication, or other capabilities.	- Microsoft HoloLens - FUNIKI Ambient Glasses - Recon Jet	- Google Glass - Google Contact Lens - Object Modelling Eye-Wear - iShadow Mobile Gaze Tracker - Indoor Landmark Identification Supporting Wearables - Chroma
Headsets and Ear-buds	Bluetooth enabled headsets or earplugs; Sensor-embedded hats and neck-worn devices	- Sony Xperia Ear - Apple AirPods - Bragi Dash Pro	
Other Accessories			
Smart jeweler	Jewelry designed with features such as health monitoring and handless-control.	- Smarty Ring - Kerv - Bellabeat Leaf	- Typing ring - Gesture Detection Ring
Straps	Chest straps, belts, arm bands, or knee straps equipped with sensors for health tracking or other functionalities.	- MYO Armband - Zephyr - Bioharness	- Pneumatic Armband - BodyBeat
E-Textiles			
Smart garments	Main clothing items that also serve as wearables such as shirts, pants, and undergarments.	- Athos - Hug Shirt - Solar Shirt - Spinovo	- Myovibe - Dopplesleep
Foot / Hand-worn	Shoes, socks, insoles, or gloves embedded with sensors.	- Lechal - Sensoria - Fujitsu Gesture-control Gloves	- LookUp - Gait Analysis Foot Worns - Foot-worn Inertial Sensors

E-Patch			
Sensor patches	Sensor patches that can be adhered to the skin for either fitness tracking or haptic applications.	- HealthPatch MD - Thync - UPRIGHT	- DuoSkin - Tattoo-Based Iontophoretic-iosensing System - Smart Tooth Patch
E-Tattoo / E-Skin	Tattoos with flexible and stretchable electronic circuit to realize sensing and wireless data transmission.	- Motorola e-tattoo Wearable – - Interactive Stamp Platform	

Table 1: Example products of diverse wearable categories (Seneviratne et al., 2017, P.3)

The report of the American market research firm MarketsandMarket (2019) indicates the wearable technology market size is expected to grow from USD 15.74 billion in 2015 to USD 51.60 billion by 2022, at a CAGR of 15.51% between 2016 and 2022 (MarketsandMarkets, 2019). Among them, the product segment of wrist wear is expected to cover the maximum size of the wearables market. Wrist wear measures fitness parameters and health vitals, including heartrate, calories burned, distance & steps travelled, and blood pressure etc. All such parameters can be synchronized with a smartphone to store data. Moreover, people can access the smartphone with the help of wrist wears.

The market share of top five wearable vendors according to IDC (2019) is illustrated in Figure 2. Apple maintained its position atop the wearables market with market-beating growth and continued demand for its LTE-enabled[1] Watch. Xiaomi and Huawei priced at the low end of the market, which have been heavily focused on the Chinese market though they slowly start to experience growth outside their home country. Fitbit is one of the few Original Equipment Manufacturers (OEMs) that continues to actively target the commercial market and remains a market leader in this space. Garmin extended its lead over Samsung to become the fifth largest vendor worldwide.

[1] Long Term Evolution (LTE) is the latest, fastest standard for 4G wireless communication between devices. In terms of smartwatch, this allows you to take calls, use apps, receive and send messages etc. without your smartphone being nearby (i.e. while you go out on a run).

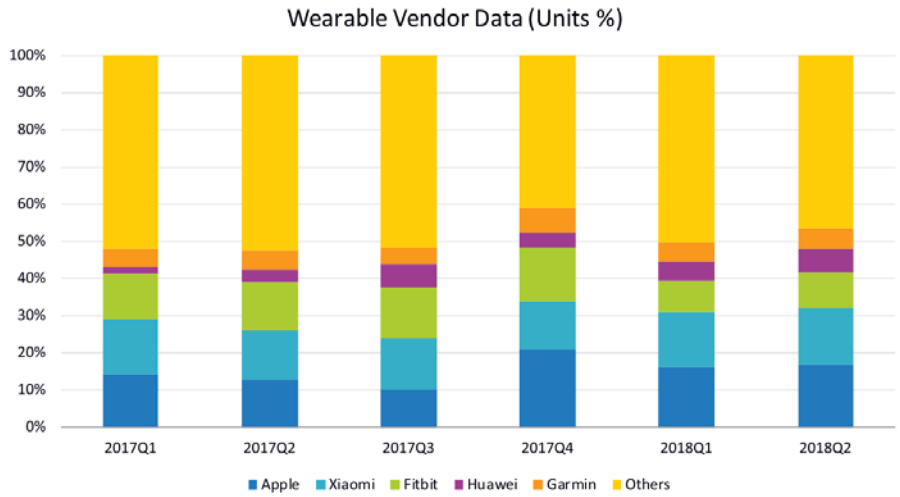

Figure 2: Wearables vendor data (IDC, 2019)

2.1.1. Wearables in healthcare

The market basis for wearables in healthcare are compelling, reinforced by numerous social, demographic, epidemiological, economic and technical trends. At the center of these are societal aging, a corresponding focus on healthy living, the possibilities for "quantified-selfer" by smart sensors, and digital revolution (Pharmaphorum, 2016, P.7).

The example products of healthcare wearables are illustrated in Figure 3, with an array of health vitals and activities the devices measure.

Figure 3: Examples and measured health vitals of healthcare wearables (Anderson, 2019)

According to the presentation of Young (2018) – an expert of SwissRe on their recent conference “Wearables & Health Apps” in Zurich, the insurance companies focus on two types of devices, they are fitness/consumer-grade devices and medical-grade devices. These two segments are in line with the empirical study of Gao et al. (2015) as mentioned in Chapter 1. Young (2018) explains there are over 300 sorts of consumer-grade devices available, which are heavily purchased consumer products. The consumer devices capture some health parameters, which provide less health vital accuracy but high engagement. The medical-grade devices can measure heartrate, blood oxygenation, skin temperature, skin blood perfusion, steps, and motion etc. They are less consumer available, more widely used in clinical settings. They can capture high volume, high-grade health vitals and better analyze health status (Young, 2018). Medical-grade wearables used in a disease rather than a wellness setting require approval of Food and Drug Administration (FDA) in the US or equivalent institutions like Medicines and Healthcare products Regulatory Agency (MHRA) in UK (IHS, 2013). In the US, the FDA grades wearables in the same manner as medical devices, from Class I – simple devices with no potential risk to Class III – intricate in design with possible risk factors for patients (Pharmaphorum, 2016, P.6).

Nevertheless, the technical distinction between consumer-grade wellness products and medical-grade devices becomes increasingly blurred as advances in sensors and processors drive performance gains in both areas. Such gains are an important aspect of addressing the healthcare needs of the world's aging population with the increasing chronic diseases such as obesity, diabetes, and cardiac disorders – all of which require some form of continuous monitoring (Anderson, 2019). At the World Economic Forum earlier this year in Davos, Switzerland, Rajeev Suri, CEO of Nokia, stated: "We believe in a world where you can move from reactive care to continuous monitoring and really move to preventive care. At Nokia, we are trying to work on noninvasive wearable sensory devices so you can continually monitor the human body."

In the white paper on world market for wearable technology of business intelligence company IHS Markit (2013), the wearable technology and products in fitness/wellness and medical applications are segmented in Table 2 accordingly.

Application	Product Categories	
Healthcare and Medical	Blood Pressure Monitors Continuous Glucose Monitoring Defibrillators Drug Delivery Products ECG Monitors Hearing Aids	Insulin Pumps Smart Glasses Patches PERS Pulse Oximetry
Fitness and Wellness	Activity Monitors Emotional Measurement Fitness & Heart Rate Monitors Foot Pods & Pedometers Heads-up Displays	Sleep Sensors Smart Glasses Smart Clothing Smart Watches Audio Earbuds

Table 2: Medical and fitness/wellness wearables (IHS 2013)

In a recent report on "Wearable Medical Devices Market by Device, Application, Type, Distribution Channel - Global Forecast to 2022" of Report Buyer (2018), the fitness wearables are included in the category of medical devices. This report explains that the wearable medical devices market is segmented into home healthcare, sports & fitness, and remote patient monitoring by application. Until 2022, the sports & fitness segment is expected to grow at the highest CAGR. This growth is mainly due to the increasing focus on physical fitness among people to improve the life quality and growing trend of tracking health progress continuously (Report Buyer, 2018).

By device type, the wearable medical devices market is segmented into diagnostic & monitoring devices and therapeutic devices. The segment of diagnostic & monitoring devices is expected to register the highest CAGR during the forecast period. The growth of this segment can be attributed to the growing prevalence of chronic and lifestyle diseases, as well as the increasing need for regular and continuous monitoring with fast data sharing (Report Buyer, 2018).

Report Buyer (2018) estimates that the medical wearable devices market is expected to reach USD 14.4 billion by 2022 from USD 6.22 billion in 2017, at a CAGR of 18.3%. Mordor Intelligence (2015) puts global sales of wearable medical devices at USD 3.2 billion in 2015, rising to a more modest USD 7.9 billion by 2020. The differences might lie in the different definition of medical wearables. Although the market forecasts for this sector vary, the development trend it certain: the wearables applied to healthcare is going to disrupt the healthcare industry and offer multiple advantages to healthcare professionals as well as the patients (Mischke, 2018).

Based on the above explanation, the healthcare wearables are synonym to wearable medical devices in this paper, which include consumer-grade fitness/wellness devices as well as medical-grade remote diagnostic & monitoring and therapeutic devices.

A survey of Pharmaphorum (2016) around the topic of "transition from consumer to medical-grade wearables" were conducted with different stakeholders such as life sciences and pharmaceutical companies, users of healthcare wearables and healthcare consultants. This survey reveals that a range of future applications of healthcare wearables in combination with mobile apps and big data will provide benefit to healthcare from the perspectives of healthcare providers as follows:

- Improving treatments through better understanding of patient behavior (personalized medicine)
- Monitoring and adjusting treatments as part of an integrated telemedicine system (remote patient monitoring and optimum decision by the doctor)
- preventing exacerbations and providing early warning signals to healthcare professionals (early diagnosis)
- Capturing real-world data to prove value of medicines and drug candidates (information registry)
- Clinical-trial monitoring for endpoint development (research & development)

In addition to being beneficial to healthcare providers and pharmaceutical R&D, respondents of Pharmaphorum's (2016) survey also saw a role of healthcare wearables in helping patients to self-manage their conditions such as taking medicine on time and embrace healthy behaviors, which associates with savings in public health expenditure (Pharmaphorum, 2016, P.8). Furthermore, remote healthcare via wearables mentioned above reduces the needs for the patient to be continuously transferred to the healthcare providers, which saves time and further healthcare costs (Mischke, 2018).

2.1.2. Smartwatches

Smartwatches are one of the most popular healthcare wearables (Seneviratne et al., 2017). Usually there are two main types of functionality of current smartwatches. First, they serve as communication and notification tools by complementing smartphones with features such as receiving notifications and performing micro interactions (SMS, email, voice control, weather updates, add reminders, and taking voice commands etc.).

Second, most of the smartwatches can also monitor some human physiological signals and biomechanics, and thus act as fitness tracking devices that help users to log their daily activities such as automatically recording work out times, tracking heartrate, step counts, and calories burnt (Seneviratne et al., 2017). With added apps and sensors, modern and future smartwatches can measure further heath vitals such as Electrocardiography (ECG), glucose level and blood pressure, as well as detect certain diseases, such as arrhythmia and seizure. Smartwatches usually rely on compatible smartphones for displaying the real-time data and analyzing the historical progress over a Bluetooth connection.

Smartwatches are on pace to make up the highest unit sales of all wearables from 2019 to 2021 as confirmed by another market research company Gartner (2017). By 2021, sales of smartwatches are estimated to approximately 81 million units representing 16% of total sales of wearables, with a revenue of USD 17 billion.

The smartwatch segment is divided into four main divisions: leading consumer electronics brands, fashion and traditional watchmakers, children's watches and special purpose brands and start-ups offering niche products, for example in the healthcare sector (Gartner, 2017).

In the healthcare sector, smartwatches could break out as medical devices, as Nield (2018) explicated: “Smartwatches are well suited for bringing essential medical monitoring into the home – they are easy to use, they are always running, and they are always in contact with our bodies. In many ways they're the ultimate medical sensor”. However, the capabilities and the accuracy of all wearables need to improve before smartwatches can become valid medical devices, and there are additional steps required for getting regulatory approval to be used as serious health monitors. The regulatory approval from FDA in the US to MHRA in the UK – is required before a smartwatch or a smartwatch add-on can make the leap from being a rough guide to step count, then to a clinically accurate medical device (Nield, 2018) .

Nevertheless, some potential use cases are emerging. Reeder & David (2016) conducted a systematic review of smartwatch uses for health and wellness, which highlighted some of the cases these wearables are already breaking through as medical devices. Reeder & David (2016) concluded at last that the consumer-grade smartwatches have penetrated the space of health research rapidly since 2014. However, their technical function,

acceptability, and effectiveness in supporting health must be validated in larger field studies with actual participants living with the conditions these devices target (Reeder & David, 2016, p. 270).

Nield (2018) summarized some of the realized and researching functions of smartwatches as medical devices, which are listed below with supplement information from additional sources:

Heart monitoring

The FDA-approved KardiaBand from AliveCor takes ECG readings to measure electrical activity in the heart. People who know they are at a high risk for heart disease or stroke can continuously monitor their heartrate. With the help of artificial intelligence (AI), it will notify the person if it detects an abnormal heartrate and prompts him to take an ECG at a time when he is most likely to capture an arrhythmia. Apples Watch Series 4 possesses similar function, which has obtained also the FDA approval (Apple Watch Series 4 - Health & ECG, 2019).

Seizure detection

Every year worldwide, more than 50’000 otherwise healthy people with epilepsy suddenly die – a condition known as Sudden Unexpected Death In Epilepsy (SUDEP) (TED Talks, 2019). These deaths may be largely preventable. The accelerometers built into smartwatches can potentially be deployed to detect seizures and tremors (Nield, 2018). Leading affective computing scientist Rosalind Picard of Massachusetts Institute of Technology and her colleagues created the first AI-based smartwatch named embrace 2 that can detect seizures as they occur and alert nearby people in time to help (TED Talks, 2019). This smartwatch was cleared by FDA in Neurology (Embrace Watch, 2019).

Managing diabetes

Many conditions, including diabetes, rely on the regular and accurate taking of medication and a smartwatch can be used as a medication diary. Blood glucose sensors should be added to smartwatches before this can all be made automatically. Apple's engineers have been researching how to non-invasively track glucose, but that effort could take years according to Nield (2018). Interestingly, some Chinese respondents in this study reported that they use already smartwatch to measure glucose. The author

assumes that could be a local Chinese product, for which Chinese regulatory authorities do not yet require specific approval.

Speech therapy

Many smartwatches are being equipped with microphones, which can be used to check up on speech therapy exercises, giving feedback to users when they are practicing speech patterns on their own. For example, smartwatches could make it easier for Parkinson patients to adhere to therapy exercises when they are away from the clinic (Nield, 2018).

Posture aid

There are a number of medical conditions and health issues where good posture is vital to avoid exacerbating existing problems. The sensors inside a smartwatch might be able to detect how well you are sitting. It is still early days, but the current smartwatches are already better at detecting posture than smartphones (Nield, 2018).

Due to the numerous realized healthcare functions of smartwatches and their immense potentials as medical device, smartwatches have been chosen as a representative example of wearable devices in healthcare for the empirical study of this paper, through which the different behavior intentions of Chinese and Swiss to adopt wearables can be compared.

2.1.3. Wearables in China

Ramon T. Llamas, Research Director for the wearables team at IDC, said in a research note that "China – the largest market for wearables and more than double the size of the US market – has grown thanks to strong device development and experimentation, low-cost products and strong demand for basic devices to draw in new users." (Chinadaily, 2018).

The high growth in China is attributed to the increasing spending on healthcare, economic growth, huge population base, and increasing prevalence of chronic diseases. Changes in lifestyle and increasing awareness on wellness and fitness are also expected to drive market growth in the region (ReportBuyer, 2018).

According to market forecast of Statista (2019), the revenue of wearables in China amount to USD 4’553 million and the average revenue per user (ARPU) amounts to

USD 34.56 in 2019. This revenue is expected to grow at a CAGR of 3.6%, resulting in a market volume of USD 5'252 million by 2023. The number of users is expected to reach 133.7 million by 2023. The largest names in technology, including Apple, Samsung, and Xiaomi etc. are penetrating the China market of wearables.

Today, around half (52%) of urban Chinese consumers own a smart wristband and 42% owning a smartwatch. What's more, over two in three (69%) smartwatch owners have also purchased smart wristbands (Mintel Research, 2017).

By considering the functions of wearable devices, Mintel research indicates that 53% of their survey respondents consider comprehensive health monitoring functions attractive, while 50% are interested in monitoring features that will allow them to track family members (Mintel Research, 2017)

Tencent ISUX (2015) released "2015 smart wearable market white paper" which indicated that 25% of their QQ[2] users in China have the potential demand for wearables, but after wearing equipment for three months, the loss rate of customers is as high as 30% (Tencent ISUX, 2015b). The reasons are, for example, lack of functionality and creativity of wearables, bad interface and operation experience, troublesome connecting of mobile phone, not being able to read data directly and short battery life etc. (Tencent ISUX, 2015).

Wen et al. from Beijing University conducted a survey in 2017 about "Consumers' perceived attitudes to wearable devices in health monitoring in China" with 2058 valid respondents from every provincial level administrative region of China. Results of the study reveal that the main applications of current wearables in China are smartphone accessories, activity monitoring, and location tracking. There are a large gap between the actual functions and the higher level of health monitoring functions expected by the consumers. The expected monitoring functions of health vitals made by Chinese respondents is ordered as follows: heartrate monitoring, ECG monitoring, oxygen saturation monitoring, professional sports recording, daily pedometer, body temperature analysis, blood glucose monitoring, and healthy lifestyle reminder, which are basically consistent with the importance of the vital sign indicators (Wen et al., 2017, p.133). The

[2] Tencent QQ, also known as QQ, is an instant messaging software and social media platform developed by the Chinese tech giant Tencent. At the end of June 2016, there were 899 million active QQ accounts (Wikipedia, 2019).

top five future popular functions anticipated by Chinese are: data monitoring and analysis, exercise coaching, child tracking, smartphones, and voice assistant (Wen et al., 2017, p.133).

The concerns and worries toward wearables of the respondents are analyzed by Wen et al. (2017) in three stages, which are before, during and terminating using of the wearables. The top three concerns before the use are lack of attractive features, privacy concerns, and the low ratio of performance to price; during the course of use are topped by short battery life, too simple functions, inaccurate data recording, and the lack of valuable data analysis. The top three factors that might lead a user to terminate using a wearable device are inclination toward being damaged or lost, incapability of providing credible and easily executable health advice based on an analysis of the monitoring data, and being uncomfortable to wear (Wen et al., 2017, p.133). In terms of the negative social disputes that wearable devices may cause, the top three items were the influence on the judgment of one's health status, the fear of triggering a data privacy security crisis, and the likelihood of causing health problems (Wen et al., 2017, p.134).

Furthermore, the high penetration of wearables in China, coupled with its ability to deliver real-time insights into the behavioral and lifestyle patterns of the wearer, presents an enormous opportunity for health and life insurance companies in China. The insurance companies have better possibility to encourage healthy behaviors, offer premium discounts as incentives and better predict risk (Pacific Prime, 2017). This trends are also confirmed by the behavior researcher of SwissRe (Lubczanski, 2019).

2.1.4. Wearables in Switzerland

The wearables market in Switzerland has grown strongly as well in recent years. Swiss use increasingly smartwatches, smart health and fitness trackers or sports watches in daily life. According to GfK Switzerland, around 289'100 wearables were sold from January to November in Switzerland in 2018. This amounts to a turnover of 66.6 million Swiss Francs[3], which is equivalent to an increase of 7.7% in comparison with 2017 (CE Today, 2019). The relevant turnover are depicted in Figure 4 about "core wearables on Switzerland panel market".

[3] According to exchange rate in May 2019: 1 Swiss Franc = 0.992 US Dollar

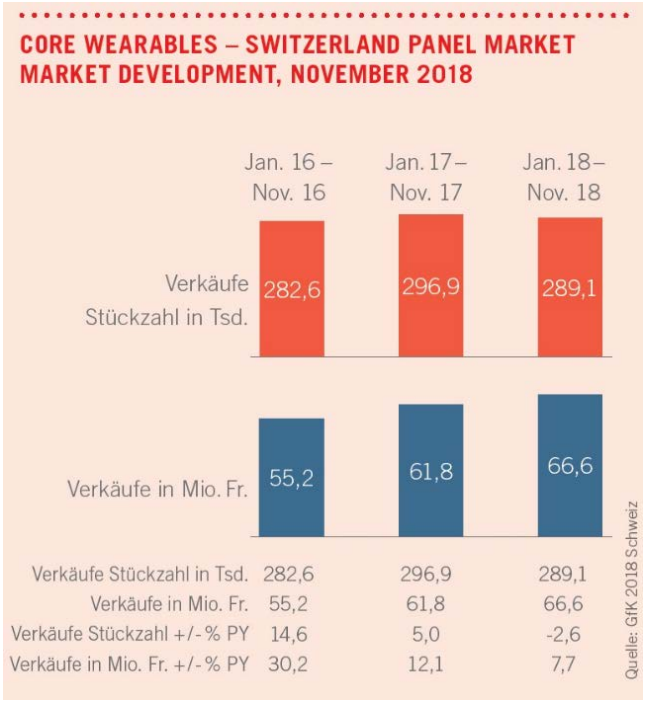

Figure 4: Core wearables in Switzerland panel market (GfK, 2018)

With reference again to Statista (2019), the revenue of wearables in Switzerland is forecasted to USD 65 million, and the ARPU to USD 96.49 in 2019. This revenue is expected to grow at a CAGR of 3.1%, resulting in a market volume of USD 73 million by 2023. The number of users is expected to reach 0.7 million by 2023. In the year of 2017, a share of 28.6% of Swiss users is 25 - 34 years old.

Research of Seiler & Hüttermann of ZHAW through a study in 2015 about the use of fitness trackers and wearables among students in Greater Zurich Area provides some information regarding the application of wearables by the young Swiss. A total of 51 respondents (26%) reported at that time using a fitness-tracking device compared to 144 (74%) non-users. Of those not having used a tracker, 93 (51%) had no need, 36 (20%) claimed insufficient utility, 25 (14%) mentioned the awareness is too low, 11 (6%) stated quality, 5 (3%) complexity, and 4 (2%) emissions and 3 (1%) material feel are reasons for not using a fitness tracking device, respectively (Seiler & Hüttermann, 2015, p. 7). The study revealed further the use of tracking devices has a positive effect on the regularity of exercise, and thus consequently has a positive effect on users' physical performance. However, the self-reported health effect using wearable trackers was contradictory (Seiler & Hüttermann, 2015, p. 8). Design was until the date of survey the most important aspect for buyers of tracking devices, followed by a heart measuring ability, which was missing in most fitness devices at that time. Many respondents

learned about fitness trackers and apps by word-of-mouth. Others relied heavily on the use of the Internet, including social media(Seiler & Hüttermann, 2015, p. 9). This shows that the social influence plays an important role for influencing perceptions of young Swiss wearable users. Participants in general are satisfied with the products with regard to their quality. Less satisfaction was reported regarding the measurement accuracy. A more neutral attitude is reported for value for money(Seiler & Hüttermann, 2015, p. 8).

Smartwatches are now the largest category of wearables with sales of 39.4 million Swiss francs (+9%) for 127'000 watches sold (+19.3%) between January and November 2018 in Switzerland, according to GfK market report for wearables in 2018 (CE Today, 2019). The sold smartwatches in pieces amount to roughly 44% of all sold wearables in 2018 (59% of sales).

The Apple Watch was the most sold watch in the world in 2017, according to Apple CEO Tim Cook (CE Today, 2018). Apple Watch has become a threat to the classic Swiss watch industry, especially in the lower and middle low price segment. Traditional watch manufacturers are increasingly looking to enter the smartwatch market or have already done so. There are smartwatches from Tag Heuer, Breitling, Mondaine and others (CE Today, 2018).

Some Swiss health insurance companies such as Helsana rewards their clients for a healthy lifestyle. With the Helsana+ app, the insurance clients can collect plus points through sport activities to receive more than 300 Swiss Francs a year, benefit from partner offers, or donate the plus points for good deeds (Helsana+ app, 2019). Research of Seiler & Hüttermann (2015) revealed in their survey that 79 respondents (41%) reported discounts on health insurance, 58 (30%) reported discounts on insurance in general and 56 (29%) reported rebates on fitness club memberships as incentives that would convince them to wear and use fitness tracking devices (Seiler & Hüttermann, 2015, p. 7).

Edöb (Eidgenössische Datenschutzbeauftragte) – Swiss Federal Data Protection Commissioner, however, accused that Helsana violate against the privacy policy with this reward system and won partly support from the federal administration court. Nonetheless, the Swiss consumers seem to be less sensitive to the use of their data unlike Edöb asserted. A survey conducted by the comparative service "Comparis" revealed a significant majority of Swiss would release their personal health records if

they received a monthly premium reduction of 10 to 50 Francs. According to the survey, 9% of respondents already provide their data on exercise, nutrition, exercise or sleep to their insurances (Alder, 2019).

To summarize, the above analyses from literature review demonstrate that healthcare wearables have exert large economic and social influences worldwide. The wearable products and related services have attracted attention of industrial, healthcare, insurance and other service sectors. There are numerous factors influence people's intention to adopt, terminate or avoid using wearables. How to attract the users to experience the products, how to keep the users become crucial issues for product and business managers of the global wearable providers an insurance companies. Chinese and Swiss users demonstrate similar as well as different traits in perceiving and using wearables. There are significance to research systematic difference between consumers of these two countries because of diverse cultural values, and to apply the findings in practice.

2.2. Models and theories of technology acceptance

"One of the biggest hurdles of digital health is acceptance and engagement and this is where the smartwatch shines," says Rosario Iannella, co-founder and CTO at Qardio, which makes blood pressure monitors that work with mobile devices like the Apple Watch (Nield, 2018).

Technology acceptance is a widely acknowledged key player in explaining technology adoption, which describes the approval and favorable reception and ongoing use of newly introduced devices and systems (Alagöz et al., 2011, p. 152). The acceptance of medical technology is a highly sensitive topic, touching on intimate and personal aspects, and is in many ways different from the usage and acceptance of Information and Communications Technology (ICT) from the perspective of users, even though the underlying technology might be the same (Alagöz et al., 2011, p. 165). In this section, the models and theories regarding acceptance motives and usage barriers of wearables are elaborated. They cover traditional theories of technology acceptance, health behavior and privacy calculus, which then build the model of wearable technology acceptance in healthcare.

2.2.1. Technology acceptance

The first model of technology acceptance (TAM) had been formulated and empirically validated by Davis et al. (1989). Davis et al. (1989) suggested that the attitude of a user toward a system was a major determinant of whether the user will actually use or reject the system. In TAM, Davis (1989) proposed two main factors that predict the attitude of the user to adopt computer technology. They are perceived usefulness (PU, the degree to which a person thinks that a technical system increases his job performance) and perceived ease of use (PEOU, the degree to which a person believes that using a particular system would be free of effort), with PEOU having a direct influence on PU. Both PU and PEOU are influenced by the system design characteristics, represented by X1, X2, and X2 in Figure 5.

Since then, researchers have continuously studied and expanded TAM to predict the usage of different computer-related technologies. The two major upgrades are the TAM 2 (Venkatesh & Davis, 2000) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003). A TAM 3 has also been proposed in the context of e-commerce with an inclusion of the effects of trust and perceived risk on system use (Venkatesh & Bala, 2008).

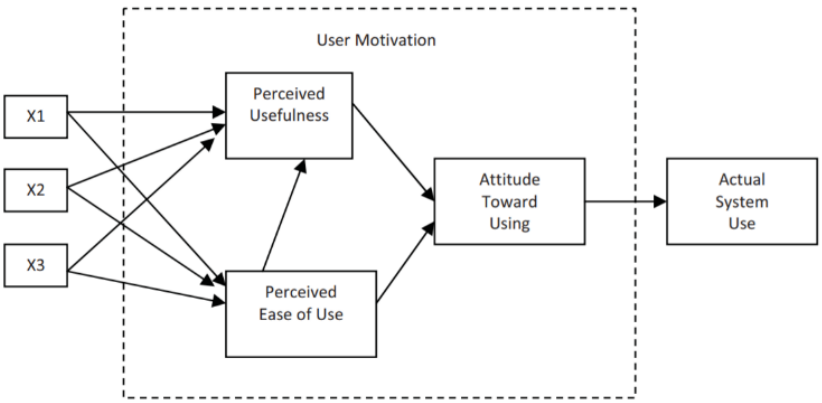

Figure 5: Original technology acceptance model (Davis, 1989)

2.2.2. Unified theory of acceptance and use of technology

Recent studies investigated the consumer's technology acceptance especially in the area of information technology, applied often the model of unified theory of acceptance and use of technology 2 (UTAUT2) from Venkatesh, et al. (2012). Among all further developed technology acceptance models, UTAUT2 displayed in Figure 6 is the most comprehensive one to explain consumer's technology acceptance and use (Wong et al.,

2014), which is different from workplace technology use. Based on the four key constructs (i.e. performance expectancy, effort expectancy, social influence, and facilitating conditions) of the first UTAUT, which emphasizes the importance of utilitarian value (extrinsic motivation), one construct related intrinsic motivation – hedonic motivation and two more constructs – price value and habit are added as critical factors predicting consumers' intention to use a technology. Also, individual difference variables, namely age, gender, and experience are conceived to moderate various UTAUT relationships (Venkatesh et al.,2012, p. 161).

The definitions of variables related to healthcare wearables in model UTAUT2 are explained in Table 3 in section 2.2.3, together with the model of wearable technology acceptance in healthcare.

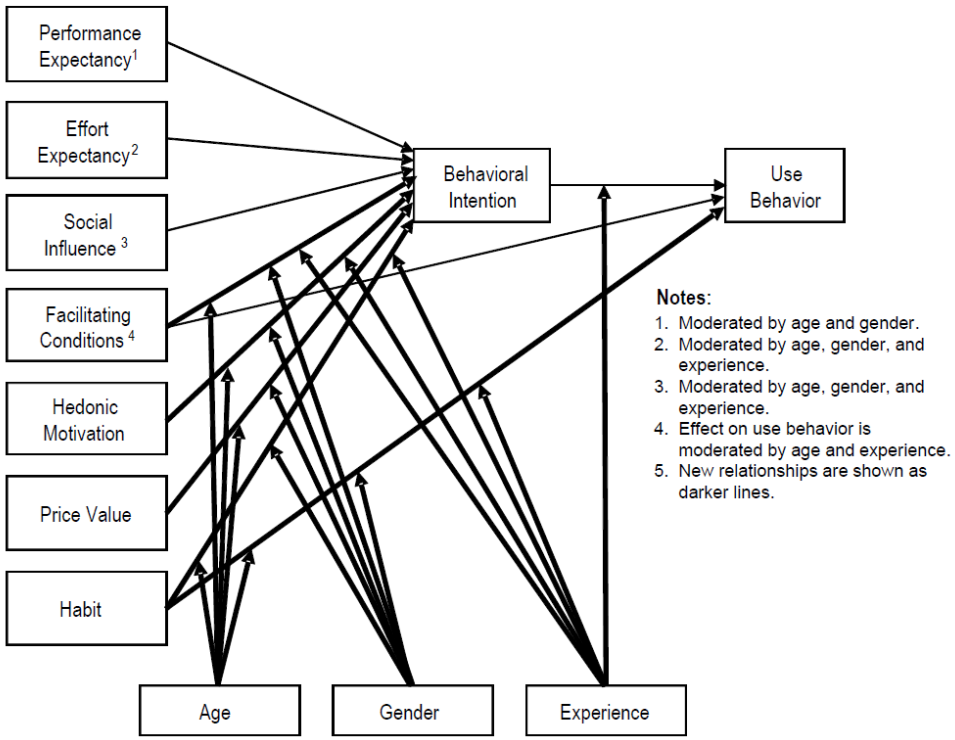

Figure 6: Model of UTAUT2 (Venkatesh, et al., 2012)

2.2.3. Protection motivation theory

Besides the factors on consumers' technology acceptance, factors related to health behaviors should be considered when examining the influential factors on healthcare wearable technology acceptance. People use healthcare wearables either with aim to promote their health condition or prevent themselves from certain diseases. Among health behavior models, protection motivation theory (PMT) is often used when

discussing health issues, i.e., disease prevention and health promotion. PMT was founded by R.W. Rogers in 1975 in order to better understand fear appeals[4] on health attitudes and behaviors (Floyd et al., 2000, p. 409). PMT is organized along two cognitive mediating process: first, the coping appraisal that includes response efficacy and self-efficacy; and second, the threat appraisal that includes perceived vulnerability and perceived severity (Floyd et al., 2000, p.410). Response efficacy is the effectiveness of the recommended behavior in removing or preventing possible harm. Self-efficacy is the belief in one's ability to execute the recommended courses of action successfully. Perceived vulnerability refers to the possibility that one will experience health threat, while perceived severity represents the extent of threat from unhealthy behaviors (Rogers, 1975). Sun et al. (2013) examined the influence of PMT factors on the mobile health technology acceptance. They concluded that the factors relevant to coping appraisals (response efficacy and self-efficacy) are more important than the factors associated with threat appraisals (perceived vulnerability and perceived severity) in predicting health technology acceptance (Sun et al., 2013, p. 195). According to Sun et al. (2013), response efficacy is found to be the most influential factor to affect health technology acceptance, which is reflected by perceived expectancy in the model of UTAUT2 (Sun et al., 2013, p. 189).

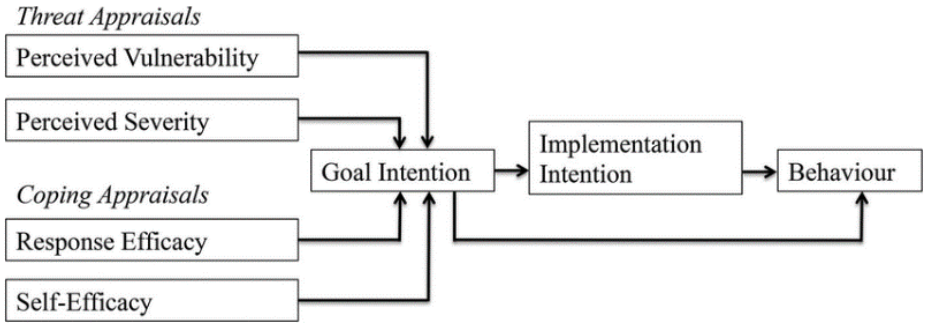

Figure 7: Model of protection motivation theory (adapted from Rogers, 1975)

2.2.4. Privacy calculus theory

Generally, individuals would perform risk-benefit analysis that accounts for drivers and restrainers of information disclosure when they are requested to provide personal information to organizations, which is widely known as privacy calculus (Awad & Krishnan, 2006, p. 18).

[4] Fear appeals generally describes a strategy for motivating people to take a particular action, by arousing fear. For example, health campaigns of anti-smoking and AIDS prevention.

Healthcare wearables continuously collect user's personal health information in real time, and individual's personal health information is more sensitive than other types of information such as demographic and general transaction information (Bansal et al., 2010, p. 139). Healthcare wearables exhibit not only advantage on improving healthcare efficiency, but also generate higher level of privacy risk. Individuals' decisions to adopt healthcare wearable devices would involve in obvious privacy calculus in which users may face the tradeoff between perceived benefit and perceived privacy risk (Li et al., 2016, p.10). Therefore, privacy calculus is essential while considering individuals' intention to adopt healthcare wearables.

2.2.5. Wearable technology acceptance in healthcare

In order to examine user's intentions to adopt healthcare wearables comprehensively, an integrated framework (exhibited in Figure 7) on wearable technology acceptance in healthcare (WTAH) combining the abovementioned unified theory of acceptance and use of technology 2, protection motivation theory, and privacy calculus theory was developed by Gao et al. (2015).

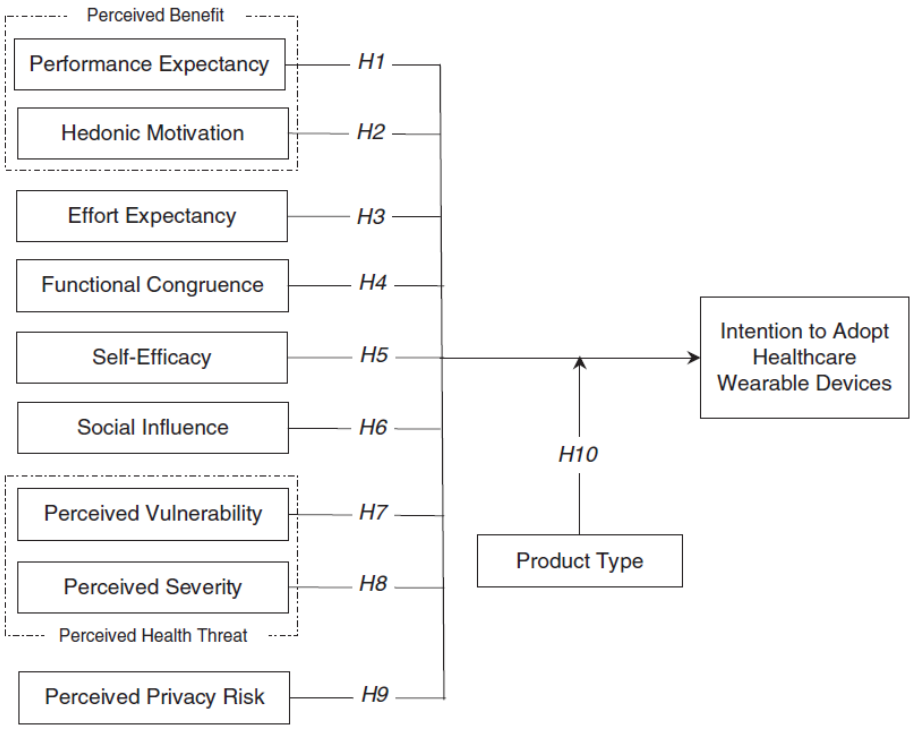

Figure 8: Model of wearable technology acceptance in healthcare (Gao. et al., 2015)

The definitions of all determinants and the explanations in the context of healthcare wearables are elaborated in Table 3:

Variables	Definition / Explanation	Original Model	Source
Performance Expectancy (“Perceived Usefulness” of TAM; “Response Efficacy” of PMT)	Degree to which adopting a technology will bring effectiveness to users in performing certain activities; For healthcare wearables, the effectiveness can be regarded as the degree to which the device can help consumers to monitor daily physical conditions, make personal healthcare plans, and reduce health-related threats, etc.	UTAUT2	Venkatesh et al., 2012; Gao et al., 2015
Hedonic Motivation (Perceived Enjoyment)	Pleasure or enjoyment derived from adopting and using a technology; For healthcare wearables, users can directly wear the sensor and continuously check physical activities such as steps, sleep, calorie burned and heartrate etc., which makes wearable devices like a special “toy” more than just a healthcare device. The “quantified-selfers” enjoy monitoring their vitals and share this data with their peers within the community (Seiler et al., 2015).	UTAUT2	Venkatesh et al., 2012; Gao et al., 2015;
Effort Expectancy (“Perceived Effort to Use” of TAM)	Degree of ease related to consumer’s use of technology; For healthcare wearables, it is introduced to measure consumer’s perceived ease of using wearable devices in healthcare. The operations of these devices are generally more complicated than other emerging technologies, since they require users to continuously wear them and use other devices such as mobile phone or tablet for data analysis at the same time.	UTAUT2	Venkatesh et al., 2012; Gao et al., 2015;
Functional Congruence (replaced the “Price Value” in the model UTAUT2)	Perceived suitability of a product to fulfill the functional and basic product-related needs (price reasonability, fashion, ergonomic design). Users of wearable device in healthcare are generally required to wear the sensor 24 hours a day to monitor personal physical conditions in real-time, the ergonomic design (i.e. material, buttery, and comfort) issue is more important for healthcare wearables than any other technologies (Chan et al., 2012).	Self-congruency Theory	Huber et al., 2010, P1115; Gao et al., 2015;
Self-efficacy (replaced the “Facilitating Conditions” in the model UTAUT2)	Measurement of the influence of consumers’ capacities on effectively using the wearables to self-monitor and self-manage their own physical conditions. Users can personalize and self-monitor their physical conditions through the adoption of healthcare wearables, but whether they have enough abilities and knowledge to handle these functions would challenge their possibilities of adopting the products.	PMT	Rogers, 1975; Sun et al., 2013, p.190
Social Influence	Extent to which user’s decision making is influenced by others’ perceptions. Most users tend to make their decisions of adopting healthcare wearables reliant on others’ suggestions		Venkatesh et al., 2003; Sun et al., 2013; Gao et al., 2015; p.

	since this kind of product and function is very new for them, and sometimes the new technological products are perceived fashionable and trendy.		1710
Perceived vulnerability	Possibility that one will experience health threat.	PMT	Rogers, 1975; Sun et al., 2013, p.190
Perceived severity	Degree of threat from unhealthy behaviors.	PMT	Rogers, 1975; Sun et al., 2013, p.190
Perceived privacy risk	Influences of privacy concern on consumer's acceptance of healthcare wearables. Users may face the tradeoff between perceived benefits and perceived privacy risks. Since the perceived benefit of adopting healthcare wearables has been measured by perceived expectancy and hedonic motivation, only the effect of perceived privacy risk is considered separately.	Privacy Calculus Theory	Li et al., 2016, p.10; Gao et al., 2015, Chan et al., 2012
Product Type - Fitness and medical wearables	Fitness and medical wearables act as moderating variables affecting the influential degree of the above predictors and the consumer's intention to adopt the wearables differently. The younger and healthier consumers of fitness wearables are more likely to have higher perceptions on the enjoyment, comfort, and battery duration of the device; whereas the elder and unhealthy users of medical wearables should have more perceptions on the effectiveness and the perceived ease of use of the device, and are more sensitive toward private health information.		Chan et al., 2012; Chan et al., 2015, p. 1711

Table 3: WTAH model - influential variables on behavior intention (Gao et al., 2015)

Gao et al. (2015) tested this framework through an empirical survey conducted in China with 462 qualified responses (users of healthcare wearables) and confirmed that the first eight antecedents in this model – perceived expectancy, hedonic motivation, effort expectancy, functional congruence, self-efficacy, social influence, perceived vulnerability and perceived severity influence positively the individual's intention to adopt healthcare wearables. Perceived privacy risk negatively affects individual's intention to adopt healthcare wearables. Among all factors, social influence and perceived privacy risk are the most significant predictors. This result indicates that consumers are more affected by other people's behaviors and privacy issues when they decide to adopt a wearable to manage their health conditions in current market of healthcare wearables (Gao et al., 2015, p. 1716).

The moderating effect of product type – fitness vs. medical wearables on the hypothesized relationships is only partially confirmed. For example, users fitness wearables care more about social influence and perceived privacy risk than users of medical wearables do, which is opposite from what Gao's et al. (2015) originally hypothesized. Although the statistical results did not support the whole hypotheses of moderating effect, significant differences between fitness and medical wearables users exist (Gao's et al., 2015, p.1717).

From the above describes models and theories, it can be summarized that the model of wearable technology acceptance is one of the most comprehensive models incorporated many different aspects from technology acceptance, consumers' intention and behavior, healthcare behavior as well as privacy calculus theory. Various researchers have added and abandoned variables according to the characteristics of technology and the targeted user groups. Plenty of variables are related to predicting the wearable technology acceptance in healthcare. Therefore, clear definition of the research scope and selecting the most influential factors is essential for the significance of this study.

2.3. Cultural values and wearable technology acceptance

Many business organizations today are striving to move beyond their geographical boundaries by expanding into international markets (Ugur, 2017. p.123). To be successful in the global market, companies must understand the obstacles they face while developing and marketing their products, not only in their own country but also in other countries with different social and cultural background. With the popularity of healthcare wearables over the globe, it becomes significant to assess the applicability of model of WATH (Section 2.2.5) in predicting the consumers' usage intention of wearables in different countries.

Most countries have a dominant language, identifiable education systems, and other institutions that inculcate members with common values (Alshare et al., 2011, p. 33). Country is a political entity – politically created boundaries are usually stable over time and can be defined and precisely identified in space and time (Hofstede, 1980). Therefore, country variable "China/Switzerland" is used in this paper as a sampling and analysis unit, as well as a moderating variable.

National culture is a fundamental factor that distinguishes consumers of one country from those of another country. A country's cultural values have long been identified as a factor that influences user behavior, and thus it is reasonable to assume that these values influence technology acceptance in a country as a whole (Alshare et al., 2011, p. 33). Some studies examined the influence of cultural values on the technology acceptance and IT adoption of different national cultures. These studies argue that there are reasons to expect the established technology acceptance model may not work cross-culturally, and culture may be considered as a moderator variable for the technology acceptance model (Alshare et al., 2011, p. 33). Hofstede's cultural dimension were the most used variables until now to examine the models cross-culturally (Alshare 2011; Ugur, 2017; Zakour, 2004).

2.3.1. National culture & cultural value dimensions

Culture has been defined in many ways, from the most complex and comprehensive to the most simple and symbolic ones. According to Kluckhohn (1962), "Culture consists of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievement of human groups, including their embodiments in artifacts" (Kluckhohn, 1962, p.73). Hofstede (2011) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others". Therefore, culture is always considered as a collective phenomenon, which can be related to different collectives such as nations, ethnic groups, organizations, occupations etc. The term of culture can also be applied to the genders, generations, or social classes (Hofstede, 2011, p. 3). National, societal, and gender cultures, which children acquire from their earliest youth onwards, are much deeper rooted in the human mind than occupational cultures acquired at school, or than organizational cultures acquired on the job (Hofstede, 2011, p. 3).

Several sets of dimensions have been developed to characterize the concept of national culture (Zakour, 2004, p. 157). At present, at least six models of national cultures are widely cited and utilized in the management research literature (Nardon, 2006, P.4). These include models proposed by Kluckhohn and Strodtbeck, Hofstede, Hall, Trompenaars and Hampden-Turner, Schwartz, and House and his GLOBE associates. Each model highlights different aspects of societal beliefs, norms, or values (Nardon,

2006, P.4). Table 3 provides an overview of the most known cultural dimensions found in several fields of studies.

Cultural Value Dimensions	**Authors**
An evaluation of human nature (evil - mixed - good)	Kluckhohn and Strodtbeck (1961)
The relationship of man to the surrounding natural environment (subjugation -harmony - mastery)	Kluckhohn and Strodtbeck (1961)
The orientation in time (toward past - present - future);	Kluckhohn and Strodtbeck (1961)
The orientation toward activity (being - being in becoming - doing)	Kluckhohn and Strodtbeck (1961)
Relationships among people (Lineal – Collateral – Individualistic)	Kluckhohn and Strodtbeck (1961)
Power Distance (high vs. low): Beliefs about the appropriate distribution of power in society.	Hofstede (1980, 2001, 2010)
Uncertainty Avoidance (high vs. low): Degree of uncertainty that can be tolerated and its impact on rule making.	Hofstede (1980, 2001, 2010)
Individualism-Collectivism: Relative importance of individual vs. group interests.	Hofstede (1980, 2001, 2010)
Masculinity-Femininity: Assertiveness vs. passivity; material possessions vs. quality of life.	Hofstede (1980, 2001, 2010)
Long-term vs. Short-term Orientation: Outlook on work, life, and relationships.	Hofstede (1980, 2001, 2010)
Indulgence versus Restraint, related to the gratification versus control of basic human desires related to enjoying life.	Hofstede (1980, 2001, 2010)
Context (high vs. low): Extent to which the context of a message is as important as the message itself.	Hall (1981, 1990)
Space: Extent to which people are comfortable sharing physical space with others (center of power vs. center of community).	Hall (1981, 1990)
Time: Extent to which people approach one task at a time or multiple tasks simultaneously (Monochronic vs. Polychronic).	Hall (1981, 1990)
Universalism-Particularism: Relative importance of applying standardized rules across societal members; role of exceptions in rule enforcement.	Trompenaars and Hampden-Turner (1998)
Individualism-Collectivism: Extent to which people derive their identity from within themselves or their group.	Trompenaars and Hampden-Turner (1998)
Specific-Diffuse: Extent to which people's various roles are compartmentalized or integrated.	Trompenaars and Hampden-Turner (1998)
Neutral-Affective: Extent to which people are free to express their emotions in public.	Trompenaars and Hampden-Turner (1998)
Achievement-Ascription: Manner in which respect and social status are accorded to people.	Trompenaars and Hampden-Turner (1998)
Time Perspective: Relative focus on the past or the future in daily activities; Sequential vs. Synchronous time	Trompenaars and Hampden-Turner (1998)
Relationship with Environment: Extent to which people believe they control the environment or it controls them (inner vs. outer directed).	Trompenaars and Hampden-Turner (1998)

Conservatism-Autonomy: Extent to which individuals are integrated in groups.	Schwartz (1994)
Hierarchy-Egalitarianism: Extent to which equality is valued and expected.	Schwartz (1994)
Mastery-Harmony: Extent to which people seek to change the natural and social world to advance personal or group interests.	Schwartz (1994)
Power Distance: Degree to which people expect power to be distributed equally.	GLOBE study (2004)
Uncertainty Avoidance: Extent to which people rely on norms, rules, and procedures to reduce the unpredictability of future events.	GLOBE study (2004)
Humane Orientation: Extent to which people reward fairness, altruism, and generosity.	GLOBE study (2004)
Institutional Collectivism: Extent to which society encourages collective distribution of resources and collective action.	GLOBE study (2004)
In-Group Collectivism: Extent to which individuals express pride, loyalty, and cohesiveness in their organizations and families.	GLOBE study (2004)
Assertiveness: Degree to which people are assertive, confrontational, and aggressive in relationships with others.	GLOBE study (2004)
Gender Egalitarianism: Degree to which gender differences are minimized.	GLOBE study (2004)
Future Orientation: Extent to which people engage in future-oriented behaviors such as planning, investing, and delayed gratification.	GLOBE study (2004)
Performance Orientation: Degree to which high performance is encouraged and rewarded.	GLOBE study (2004)

Table 4: Overview most known cultural dimensions (adapted from Nardon, 2006; Zakour, 2004)

Taken together, these six culture models attempt to provide well-reasoned set of dimensions along which various cultures can be compared. This allows the researchers to break down various cultures into frameworks, and organize their thoughts to examine the impact of culture values on differences in other fields such as communication style, leadership effectiveness, organizational behavior, or consumer behavior. Furthermore, some of these models offer numeric scores for rating various cultures (e.g. Hofstede, Trompenaars, GLOBE study). Regardless of whether these ratings of countries are highly precise or only generally indicative, they nevertheless provide one direction of how these countries might vary culturally (Nardon, 2006, P.8).

Given this paper is to examine the influence of cultural factors on consumer's intention to adopt wearables empirically, it is important to consider and measure the differences in what people value. Several studies discussed cross-cultural technology acceptance using Hofstede's cultural dimension can be found. Hofstede (2013) provides detailed

guidelines to explain and measure cultural value differences applied to national culture. For this reason, the dimension of Hofstede is chosen primarily in this paper to describe, explain and partially measure the cultural differences between Chinese and Swiss consumers. Moreover, Nardon's (2006) "Big Five" cultural dimensions through a comparative analysis and integration of six competing theories of culture (Table 4) are used to explain cultural difference additionally.

2.3.2. Cultural differences of China and Switzerland

Although there are several other models of societal culture (Trompenaars, GLOBE study), Hofstede's model remains popular and continues to be one of the most cited works in the Social Science Citation Index (Alshare et al., 2011, p. 28). Hofstede's cultural framework is widely accepted in marketing and other international business disciplines (Nakata & Sivakumar, 2001).

Even though Hofstede' s conceptualization of national culture, particularly the data set on which it was based has been criticized by some researchers, it nonetheless provides a sound basis for testing the influence of national culture on technology acceptance (Alshare et al., 2011, p. 28). McCoy et al. (2005) conducted a simple ANOVA for each of Hofstede's cultural dimensions measured at the individual level across eight countries. All the F-scores were significant at less than the 0.001 level which argue that national culture exists – the variance between groups is larger than the variance within groups (McCoy et al., 2005, p. 219)

Hofstede's empirically based milestone study, which was completed in the 1970's and 1980's and involved IBM employees in more than 50 countries with more than 116'000 responses collected, resulted in a classification of national culture into four cultural dimensions (power distance, individualism, uncertainty avoidance, and masculinity). His later research with other participants who are unrelated to IBM from 30 countries has proved the results of identified national cultural systems. A fifth dimension (long-term orientation) and sixth dimension (indulgence) was added in 2001 and 2010 respectively. These cultural dimensions exemplified by the cultural differences of China and Switzerland are elaborated in the following paragraphs. The country scores of China and Switzerland using Hofstede's on-line comparison tool are exhibited in Figure 9. This does not suggest that everyone in China and Switzerland is programmed in the same way as illustrated in the graphic; there are considerable differences between

individuals (Hofstede, 2019) . Besides, as there are obvious subcultures in Switzerland framed by the language region, the German, French and Italian parts of Switzerland can have widely different scores (Hofstede, 2019). In this paper, only the cultural value of German speaking part of Switzerland, which encompasses more than 70% of the Swiss population, is considered and discussed.

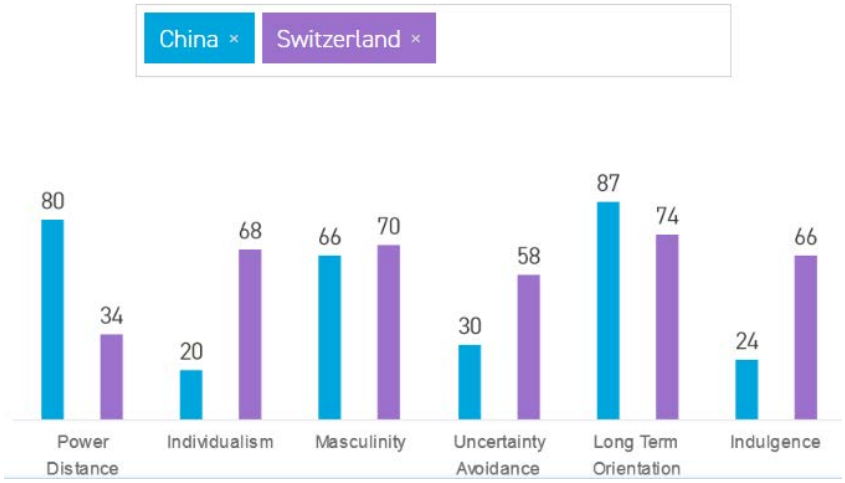

Figure 9: Cultural scores of China and Switzerland (Hofstede, 2019)

Power Distance (PDI)

PDI is defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally. This dimension deals with the fact that not all individuals in societies are equal – it expresses the attitude of the culture towards these inequalities amongst us.

With a score of 80, China sits in the higher rankings of PDI – i.e. a society that believes that inequalities amongst people are acceptable. The subordinate-superior relationship tends to be polarized. Decisions are centralized and subordinates are often not willing to disagree with their superiors. The superiors hold normally paternalistic leadership style and take care even personal issues of their subordinates. Individuals are influenced by formal authority and their employers.

With a score of 34, Switzerland sits in the lower rankings of PDI – i.e. a society that believes inequalities amongst people should be minimized. Power is decentralized and managers count on the experience of their team members. Employees expect to be consulted. Control is disliked and attitude towards managers are informal and on first name basis. Communication is direct and participative.

Individualism (IDV)

IDV addresses the degree of interdependence a society maintains among its members. The two extremes of the individualism-collectivism continuum can be differentiated as the "I" society versus the "we" society. In individualist societies people are supposed to look after themselves and their direct family only. In collectivist societies, people belong to “in groups” that take care of each other in exchange for loyalty.

At a score of 20 (low IDV), China is a highly collectivist culture where people act in the interests of the group and not necessarily of themselves. In-group considerations affect hiring and promotions with closer ones (e.g. family members) getting preferential treatment. Employees commit to the people in an organization. Personal relationships prevail over task and company.

Switzerland score relatively high with 68 on IDV, and it is therefore considered as an individualist society. This means there is a high preference to a loose social framework in which individuals are expected to be independent, self-responsible and self-reliant. In individualist societies the employer-employee relationship is a contract based on mutual advantage, hiring and promotion decisions are supposed to be based on quality only.

Masculinity (MAS)

MAS refers to traditional, stereotypical gender roles of society, in which assertiveness and competitiveness define masculinity; nurturing, caring, and a focus on quality of life define femininity. A high score (masculinity) on this dimension indicates that the society will be driven by competition, achievement and success, which is defined by the winner – a value system that starts in school and continues throughout organizational life. A low score (femininity) on the dimension means that the dominant values in society are caring for others and quality of life, which is the sign of success. The fundamental issue here is what motivates people, wanting to be the best (masculine) or liking what you do (feminine).

At a score of 66, China is a masculine society – success oriented and driven. This can be exemplified by the fact that many Chinese sacrifice family and leisure and give priorities to work in order to ensure success. The migrated farmer workers leave their families behind far away in order to obtain better work and payment in the cities.

Chinese students care very much about their exam scores and ranking as this is the main criteria to achieve success.

Switzerland scores 70 in MAS, indicating it is a masculine society as well. Switzerland is highly success oriented and driven, which is more noticeable in the German speaking part. In masculine countries, people "live in order to work", managers are expected to be decisive, and emphasize on competition and performance. The public voting results in 2012, which turned down the referendum of 6-week-holiday, is a typical explanation for masculinity value of Swiss.

Uncertainty Avoidance (UAI)

UAI is the extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions to try to avoid these.

At 30, China has a low score on UAI. Cultures that are low in UAI accept uncertainty and its unavoidability. These cultures are more prepared to unknown situations, people, and ideas. The Chinese are comfortable with ambiguity; the Chinese language is full of ambiguous meanings that can be difficult for Western people to follow. Chinese are adaptable, flexible and entrepreneurial.

Switzerland scores higher than Chinese with 58 does in UAI. Cultures that are high in uncertainty avoidance are intolerant for uncertain or ambiguous situations. In these cultures, there is an emotional need for rules (even if the rules never seem to work), precision and punctuality are the norm, innovation may be resisted, and security is an important element in individual motivation. Decisions are taken after careful analysis of all available information.

Long-Term Orientation (LTO)

LTO describes how every society has to maintain some links with its own past while dealing with the challenges of the present and future, and societies prioritize these two existential goals differently.

China scores 87 in LTO, which means that it is a very pragmatic culture. In societies with a pragmatic orientation, people believe that truth depends very much on situation, context and time. They show an ability to adapt traditions easily to changed conditions, a strong propensity to save and invest thriftiness, and perseverance in achieving results.

With a score of 74, Swiss culture is definitely pragmatic as well. Compare with Chinese culture, Swiss prefer to maintain time-honored traditions and norms and focus more on personal steadiness and stability.

Indulgence (IND)

IND is defined as the extent to which people try to control their desires and impulses, based on the way they were raised since they were a child. Relatively weak control is called "indulgence" and relatively strong control is called "restraint". Accordingly, cultures can be described as indulgent or restrained.

China is a restrained society as can be seen in its low score of 24 in IND. In contrast to indulgent societies, restrained societies do not put much emphasis on leisure time and control the gratification of their desires. People with this orientation have the perception that their actions are restrained by social norms and feel that indulging themselves is somehow wrong.

Switzerland scores high in IND with 66, indicates that the culture is one of indulgence. Many Swiss generally exhibit a willingness to realize their impulses and desires with regard to enjoying life and having fun. They place a higher degree of importance on leisure time, act as they please and spend money as they wish.

To summarize, Hofstede's (2019) comprehensive assessment profiled German-speaking Switzerland as a culture of high individualism, masculinity, long-term orientation, moderately high uncertainty avoidance, indulgence, and low power distance. China is characterized as a culture with low individualism (collectivism), low indulgence (restraint), moderately low uncertainty avoidance, moderately high masculinity, high power distance and long-term orientation.

Additionally, the cultural difference between Chinese and Swiss are further presented in Table 5 corresponding to "Big Five" dimensions in Nardon's (2006) comparative study of all cultural dimensions. In her view, these five dimensions account for most of the conceptual variance across cultures from different cultural frameworks. Among these five dimensions, Hofstede does not explicitly mention "relationship with the environment" and "time orientation". Relationship with the environment defines the extent to which people seek to change and control or live in harmony with their natural and social surroundings, which are polarized as "harmony" and "mastery" values. Time

orientation refers the extent to which people organize their time based on "sequential attention to single tasks" or "simultaneous attention to multiple tasks", which are defined as "monochronic" and "polychronic" values.

Country	Relationship with the environment	Social organization	Power distribution	Rule orientation	Time orientation
China	Harmony	Collectivist+	Hierarchical	Relationship-based	Polychronic
Switzerland	Mastery	Individualist	Egalitarian	Rule-based+	Monochronic+

Table 5: Country ratings China & Switzerland in line with "Big Five" dimensions (Nardon, 2016, p.22).

Note: All ratings are comparative in nature, with a "+" sign indicates a stronger tendency towards a particular dimension.

Coming back to the topic of the adoption of wearables, in Switzerland, the user penetration rate[5] of wearables is 7.8% in 2019 and is expected to hit 8.1% by 2023 (Statista, 2019), whereas the user penetration rate in China is 9.3% in 2019 and is expected to hit 9.4% by 2023 (Statista, 2019). Today, around half (52%) of urban Chinese consumers own a smart wristband and 42% owning a smartwatch (Mintel Research, 2017). The absolute user number in China is huge considering the large population base. Another way around, per capita GDP of Switzerland is about USD 62'100 comparing USD 16'700 of that of China (CIA Country Comparison, 2017). What is the reason that the majority of Swiss people do not use wearables contrary to Chinese? With regard to the above analyses on culture values, Swiss and Chinese display quite different characteristics in many cultural dimensions. To distinguish the influence of cultural factors are important for the acceptance, sustainability and competitive capacity of any global developers of wearables.

2.3.3. Moderating effect of national culture on technology acceptance

Until today, there are no literature found as regards influence of cultural factors on adoption of wearables, since the usage of wearables is quite a novel technological and social trend. Some literatures proved there are connections between national culture and the technology acceptance model as well as other extended models assessing the usage of information system (IS).

[5] "Penetration Rate" shows the share of active paying customers from the total population of the selected market for each year.

Ugur (2017) categorized the researches on cross-cultural IT adoption into two main areas in his comparative study, with one area related to individual factors (i.e. ease of use, subjective norms, trust, and gender) and the other area to national factors (i.e. uncertainty avoidance, individualism/collectivism, power distance, and masculinity/femininity). Differences in national culture can explain differences in adoption of technology. End users' attitudes toward new technology may be shaped by their different cultural values and lifestyles (Ugur, 2017, p. 123).

The vast majority of previous studies used either the original or extended TAM to predict the intended or actual usage of IT were primarily conducted in Western countries (Alshare et al., 2011, p. 28). While the technology acceptance model (TAM) has been used extensively when studying IT adoption in the US, researchers have noted that TAM is not valid when applied to other cultures (Ugur, 2017, p. 123). For example, Straub et al. (1997) compared TAM across three countries (USA, Japan, and Switzerland) and found that TAM holds for both the U.S. and Switzerland but not for Japan (Alshare et al., 2011, p. 28).

UTAUT, introduced and validated in North America by Venkatesh et al. (2003), is a model of user acceptance of IS, combining elements from several prevailing acceptance models. UTAUT has four core determining factors (performance expectancy, effort expectancy, social influence, facilitating conditions) of intention and usage, and up to four moderators (age, gender, experience, voluntariness of use) of key relationships. The model has been recently tested in non-Western cultures such as Saudi Arabia by (Al-Gahtani et al., 2007), India by Bandyopadhyay & Fraccastoro (2007) and China versus the USA by Venkatesh and Zhang (2010). The most recent cross-country study of Venkatesh and Zhang (2010) in this connection, has only considered the cultural dimension of collectivism/individualism. The above authors conclude that they have provided some evidence that there is interaction between the two phenomena – technology acceptance and national culture.

Hofstede's cultural dimensions utilize a national level of analysis whereas TAM was developed for an individual level of analysis. Ford et al. (2003) asserted that it would be beneficial to consider national culture as a moderating variable as it might play an important role in comparing different populations (Ford et al., 2003, p. 22). Alshare et al. (2011) proved this statement in their empirical study with samples from the USA, Chile

und the UAE that national culture dimensions as represented by masculinity, power distance, individualism and uncertainty avoidance, moderate four relationships of an extended TAM Model, with computer knowledge incorporated as an external variable. McCoy et al. (2007) showed that high-power distance, high masculinity, low uncertainty avoidance, and high collectivism seem to nullify the effects of perceived ease of use and/or perceived usefulness in the model of TAM (McCoy et al., 2007, p. 81).

Taken together, these studies were successful in suggesting that national culture moderates relationships in the extended TAM, UTAUT and other related models (Alshare et al., 2011, p. 28). Following similar path of consideration, the moderating role of national culture is examined in this paper with the conceptual model of wearable technology acceptance in healthcare.

3. Conceptual Model and Hypotheses

3.1. Conceptual model

To summarize the findings in literature review of Chapter 2, wearables are increasing in both countries due to technological development, change of life style, societal ageing, and social influence. However, obvious barriers such as user lack of technical knowledge, device not meeting expected functionality, various healthcare behavior or privacy concerns prevent the usage of wearables from expanding to a larger scale. On account of the descriptions in Section 2.1.3 and 2.1.4 about wearables adoption in China and Switzerland, plenty of similarities among Chinese and Swiss potential and current consumers can be found. Consumers of both countries seem to do not have sufficient technological knowledge on the application of wearables, but expect more functions in health monitoring especially heart related indicators either from a perspective of health pursuing or disease prevention. The accuracy of the measured data, the credibility and feasibility of health advices, and wearing comfort in terms of ergonomic design and material are among others the most pronounced issues for users to decide whether to adopt or continue using the wearables. The level of privacy concern is high for both Chinese and Swiss, as healthcare wearable devices collect user's personal health data in real-time. In order to analyze influential factors for the intention to adopt healthcare wearables comprehensively, and especially tell the different perspectives between Swiss and Chinese consumers, a conceptual model is developed in this study and exhibited in Figure 10.

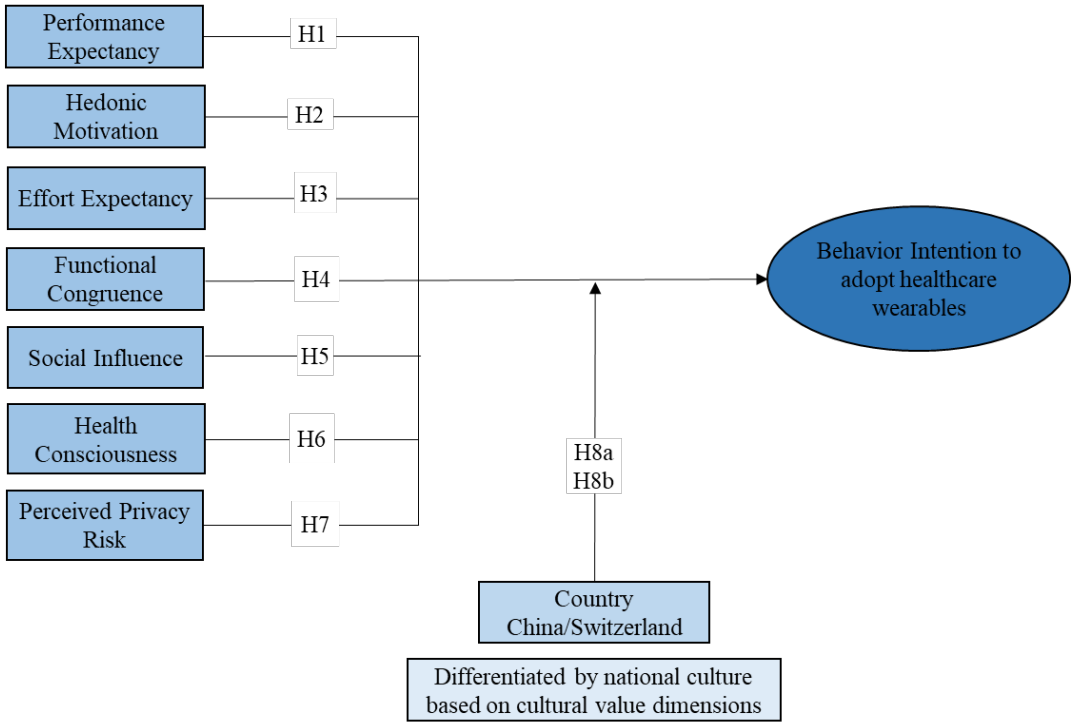

Figure 10: Conceptual model

The definitions of all constructs in the proposed model are listed in Table 6:

Construct	**Abb.**	**Definition / Explanation**
Perceived expectancy	PE	Degree to which adopting healthcare wearables will bring effectiveness to users in improving their health condition, which includes monitoring daily physical conditions, making personal healthcare plans, and reducing health-related threats etc.
Hedonic motivation	HM	Pleasure or enjoyment derived from adopting and using healthcare wearables, such as enjoying the technical functions of the devices, sharing data with peers, and feeling of accomplishment after reaching the training goals.
Effort expectancy	EE	Degree of perceived ease of using healthcare wearables, which includes wearing device easily on the body, using other devices like smartphone to analyze the data, and understand the data.
Functional congruence	FC	Perceived suitability of healthcare wearables to fulfill the functional and basic product-related needs such as price-quality-ratio, fashion, battery life, ergonomic design etc.
Social influence	SI	Extent to which user's decision making is influenced by others' perceptions. These "others" include closed ones such as family members and friends, important persons like employer or peers around, professionals like physicians and technical specialists.
Health consciousness	HC	Extent to which individuals have interests in and are aware of their own health condition and degree to which health concerns are integrated into their daily activities.

Perceived privacy risk	PPR	Perceived risk of reputation damage or other disadvantages by disclosing personal health data to people/organizations unwished.
Country China/Switzerland	CN-CH	Country variable China versus Switzerland distinguished by different national cultural values
Behavior Intention	BI	Users' formulating of consciously use or increasingly use of healthcare wearables

Table 6: Definitions of constructs in conceptual model

In the conceptual model illustrated in Figure 10, the variables such as perceived expectancy, hedonic motivation, effort expectancy, functional congruence, social influence and perceived privacy risk are predictors that influence the behavior intention of consumers to adopt healthcare wearables, which are taken over from Gao's et al. (2015) framework (details described in Section 2.2.5). However, three other predictors (self-efficacy, perceived vulnerability and perceived severity) of Gao's et al. (2015) model based on PMT are replaced by one variable named "health consciousness" in this study. Perceived vulnerability and perceived severity of PMT are used originally to understand the threat appeals, and later have been used in healthcare related to perceived threats of unhealthy behaviors and certain diseases. Sun et al. (2013) argued that the factors relevant to threat appraisals have only relatively weak (perceived vulnerability) or no (perceived severity) effects on behavioral intention to accept healthcare technologies. This is consistent with the meta-analysis results of Floyd et al. (2000) (Sun et al., 2013). Taking account of the healthcare wearables researched in this study, most purchased wearables are still consumer-grade devices, which are used by healthy and relatively younger population who are interested in fitness/wellness (described in the chapter 2.1.1 and 2.1.2). Some quantified-selfers simply enjoy monitoring and comparing the data with their peers. Therefore, the determinants in PMT-model would not be suitable to measure the acceptance of fitness/wellness wearables, which constitute a large part of healthcare wearables. This was confirmed especially during the pilot study with the first version of questionnaire including the variables of PMT. Some Swiss participants of the pilot study could not answer the related questions, even they were given the hints to imagine they would suffer from a certain disease and have poor knowledge about self-care regarding that disease. Details about this process and replaced measurement items are going to be described in the section 4.3 on "pilot study".

3.2. Hypotheses with independent and dependent variables

Health consciousness is defined as "the degree to which health concerns are integrated into a person's daily activities" (Jayanti & Burns, 1998, p.10). It is conceptualized as the extent to which individuals have interests in and are aware of their own health conditions and well-being (Cho et al., 2014, p. 861), and the extent to which a person maintains his or her health (Dutta-Bergman, 2004). Jayanti & Burns (1998) proved that individuals with higher levels of health consciousness will exhibit greater levels of general preventive healthcare behaviors, such as eating nutritious foods and exercising regularly, than those who are not health conscious. Cho et al. (2014) enrolled a sample of college students to test a series of cognitive determinants of attitudes toward smartphone-based diet and fitness apps based on the TAM model. The researchers detected that HC has a significant direct effect on health app usage. Chen & Lin (2018) confirmed as well HC exerts a positive effect on the perceived ease of use and usefulness of dietary and fitness apps (Chen & Lin, 2018, p. 351). MarketsandMarkets (2019) described in their report that there is a growing demand for cost-effective and time-efficient fitness solutions with the increasing health consciousness among people, which drives the growth of wearable technology market. Taken together, health consciousness is proposed in this study to represent people's general health concern, awareness and behavior, which affect consumers' intention to adopt wearables.

The effect of all the other predictors except the above described "health consciousness" in this conceptual model were confirmed by Gao et al. (2015) in their empirical study with the Chinese respondents (see Section 2.2.5). As Swiss and Chinese consumers are involved in this study, all the predictors in the conceptual model are tested with the entire valid respondents to see if the relationships in this adapted model hold for both groups.

Following this, the hypotheses are drawn as follows:

H1. Performance expectance is positively related to individual's intention to adopt healthcare wearables.

H2. Hedonic motivation is positively related to individual's intention to adopt healthcare wearables.

H3. Effort expectancy is positively related to individual's intention to adopt healthcare wearables.

H4. Functional congruence is positively related to individual's intention to adopt healthcare wearables.

H5. Social influence is positively related to individual's intention to adopt healthcare wearables.

H6. Health consciousness is positively related to individual's intention to adopt healthcare wearables.

H7. Perceived Privacy Risk is negatively related to individual's intention to adopt healthcare wearables.

3.3. Hypotheses with moderating variables

In the conceptual model, country "China/Switzerland" (CN-CH) acts as a moderating variable, which affect the influential degree of the abovementioned predictors and the consumer's intention to adopt the wearables differently. This is based on the cultural differences of Swiss and Chinese explained by culture dimensions models (Section 2.3.2), and the results of numerous studies suggesting national culture as the moderator in the models of technology acceptance (Section 2.3.3).

According to Hofstede's cultural dimension (described in Section 2.3.2), the German-speaking Switzerland hold the cultural values of high individualism, moderately high uncertainty avoidance, indulgence, and low power distance in contrast to the cultural values of China with low individualism (collectivism), low indulgence (restraint), moderately low uncertainty avoidance, and high power distance. Both countries have similar values of masculinity and long-term orientation. The related scores are indicated in Table 7.

Hofstede Dimension	Switzerland	China
Power Distance	34	80
Individualism	68	20
Masculinity	70	66

Uncertainty Avoidance	58	30
Long Term Orientation	74	87
Indulgence	66	24

Table 7: Cultural scores of China and Switzerland (Hofstede, 2019)

Chinese holding collectivist values generally tend to assimilate their opinions or behaviors in their close community. Thus, they might perceive the accessories of new technology trendy and fashionable if many of their peers wear them. They enjoy conducting certain activities in a group. For this reason, Chinese would have more fun than Swiss using the wearables to compare and share data of their health-related activities with their peers though a platform such as healthcare or sport apps.

It might be easy for Chinese to use the function of wearables because they get support effortlessly from people around due to more frequent and multilateral social contact. In China, technology ease of use not only influence the user's motivation but also make the technology more adaptive in the organization (Ugur, 2017, p. 125).

Chinese holding collectivist values are more concerned about the maintenance of the group cohesion, put more weight on the opinions of the in-group members. Researcher found that in collectivist countries the positive effect of social influence on technology acceptance is stronger than in individualist countries (Choi et al, 2014, p. 15). People in collectivist countries (Chinese) tend to seek out new information from others like themselves who have already adopted the technology in contrast to people in individualist countries (Swiss), who tend to seek information on their own from formal/external sources (Ugur, 2017, p.125).

The high power distance of Chinese leads to the strong influence of superiors, employers or authority on adopting wearables for healthcare or other purposes. For example, some Chinese companies distribute local produced smartwatches to all their employees as a kind of fringe benefit for healthcare. There was one cleaning company giving smartwatches to their employees for tracking their working activities, which was frowned upon by the public. Through the encouragement, support and influence of people around, it is easy for Chinese to be in a group of wearable users, which foster further their intention to adopt the wearables.

It is well-known that the healthcare and -insurance system in China is far from developed, the healthcare providers are usually overloaded with a large amount of patients and the expenditures are relative high for individuals. The health conscious Chinese might choose to perform a healthier lifestyle through using wearables to track their health condition and prevent them from diseases than going for treatment at a hospital after getting ill. This would save their time and expenditures on healthcare.

People in individualist cultures such as Swiss pursue independence, freedom and advocate self-responsibility and self-reliance. The opinions of peers around would not have much weight on their decision to adopt wearables. The wearables enable them to perform more autonomous and free lifestyle through self-monitoring of their health conditions. Therefore, their perception of higher performance expectancy on wearables, might lead to higher intention to adopt healthcare wearables. On the contrary, the high uncertainty avoidance of Swiss might cause them reluctant to engage with new technology and devices, and to treat personal information more discretely. They would perceive the privacy risk much higher than Chinese, and demand clear regulations before adopting digital healthcare appliances, which might exert more negative influence on their intention to use wearables.

In line with the above analyses, the hypotheses of moderating effect of country variables are listed as follows:

H8a: Hedonic motivation, effort expectance, functional congruence, social influence, and health consciousness have greater impact on intention to adopt wearable devices of Chinese than Swiss.

H8b: Performance expectancy, perceived privacy risk have greater impact on intention to adopt wearable devices of Swiss than Chinese.

4. Research Methodology

In order to validate the above-described conceptual model and hypotheses, a quantitative research approach is employed by developing a written questionnaire, conducting an online survey and analyzing the collected data. Most of the questions regarding the determinants on usage intention of wearables in the survey are based on previous well-validated instruments, and are adapted slightly in connection with wearables, thus this part of research is descriptive. The moderating effect by country variables based on national culture, which affect the influencing degree of usage intention was not considered by any other studies before, thus this part of research is exploratory.

Several interviews were held in Switzerland and China with current users of fitness and medical wearables at first to ensure the relevance and objectivity of the questions. Questionnaire was translated from English language into Chinese and German respectively to avoid selection bias (that only English speaking Chinese or Swiss could answer the questions). A pilot study was conducted with Chinese and Swiss separately to ensure the suitability and proper understanding of the questionnaire. The respondents with Chinese nationalities at birth and living in China as well as Swiss nationalities at birth living in Switzerland are selected exclusively at last in order to keep the country variable clearly distinguished according to national cultural values. SPSS is employed for model testing and data analysis, and the criterion of objectivity, reliability and validity are followed all along the empirical research process. The process is illustrated in Figure 11 from design of written questionnaire until data analysis.

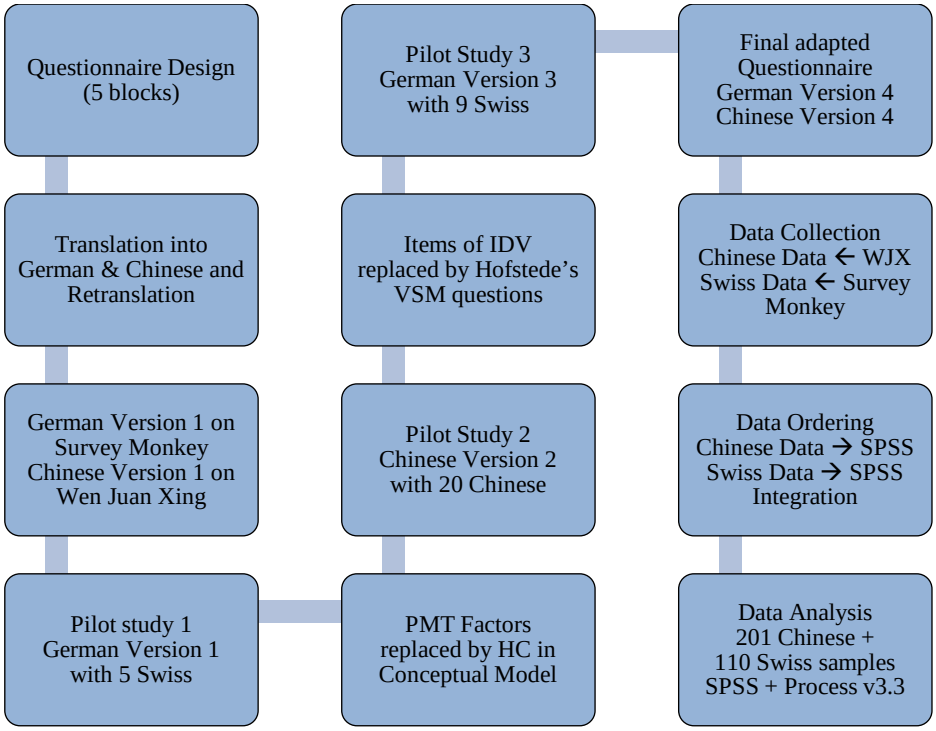

Figure 11: Illustration research process

4.1. Smartwatch as research example

As introduced in Section 2.1.1, there are many types of healthcare wearables, which are segmented into fitness/consumer-grade and medical-grade devices by complexity and accuracy of measured health vitals or if they are used in clinical settings (Young, 2018). The healthcare wearables are also segmented into home healthcare, sports & fitness, and remote patient monitoring by application in accordance with Report Buyer (2018). Therefore, the distinction of healthcare wearables is not clearly defined and there are plenty of devices with similar and different features. In order to establish a common understanding among the current and potential consumers of wearables and ensure the comparability of the responses from both countries, one type of wearables is defined for the survey. The smartwatches are selected as the representative healthcare wearables, because they combine the features of consumer and medical-grade devices, and are the most purchased wearables worldwide currently as well as in the near future. Some smartwatches can diagnose diseases such as arrhythmia or seizure, which have received approval from FDA. More detailed information about smartwatches are described in Section 2.1.2.

4.2. Questionnaire

To reach a large number of participants from China and Switzerland for answering the research questions, a written questionnaire is developed based on the proposed research model and literature reviewed.

At the beginning of the questionnaire, a short introduction of the study objective, research person, exclusive usage of the data for the study and the anonymity of the participants are provide. Afterwards, a brief description of the most popular functions of smartwatches in fitness and medical area is indicated as follows:

“A smartwatch provides many features, including tracking sports activities, sleep patterns, measuring calories burned, and monitoring heart rate, measuring blood pressure and ECG, and reminding function. Developers are already working on future smartwatches that will allow measurements of other health indicators, such as blood sugar levels.

Most smartwatches can send and receive text messages through social media, share weather information, list stock quotes, and view maps and directions.

Smartwatches rely on compatible smartphones to view and analyze real-time or historical data over a Bluetooth connection.”

An illustration of current used smartwatches placed in questionnaire is exhibited in Figure 12.

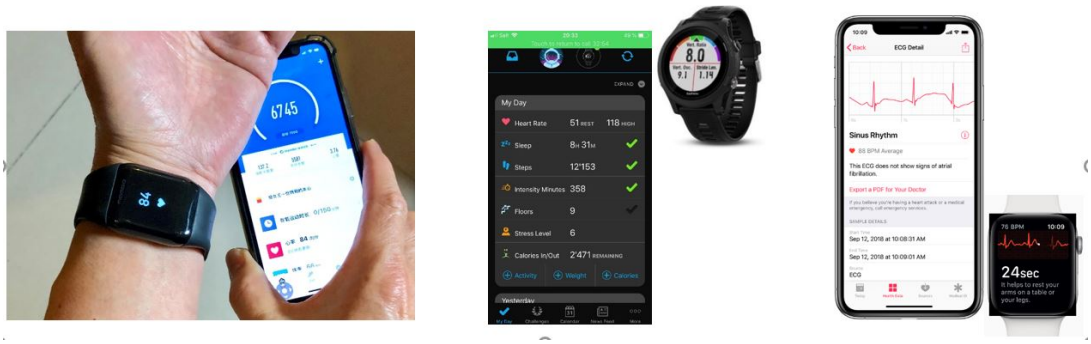

Figure 12: Example of smartwatches with compatible apps and smartphones

The survey questions are categorized into five blocks to ensure a logical and plausible structure. First block: demographic and personal information. The important country variables (nationality at birth and residence country) are placed at the beginning of the questionnaire, and the sensitive ones such as age, education and income are placed at

the very end. Second block: experiences of using smartwatches. If the respondents have used smartwatches, how often and what functions they have used; if not, they skip the questions regarding the type of applications and frequency of use, and jump directly to the questions in the third block. Third block: questions regarding independent variables in the conceptual model – factors predicted to influence the intention of smartwatches usage. Fourth block, questions regarding dependent variable in the conceptual model – behavior intention to adopt smartwatches. If the respondents have the intention to use or increase using smartwatches, what functions they are likely to use in the future. Fifth block, questions regarding cultural value orientation. In this study, only the questions in connection with one of the cultural dimensions – individualism versus collectivism are devised, as this dimension displays one of the most evident differences between Chinese and Swiss culture. The respondents are given opportunity at the end of the questionnaire to put in their additional remarks on wearables voluntarily.

The measurement items for the third and fourth block of questions are depicted in Table 8. To reach reliability and validity of the construct, several items are formulated to measure the same variable. Through this, it can be seen how consistent respondent's reply are and whether the characteristic or opinion being measured indeed a consistent feature is (van Thiel, 2014, p. 80). The questions for independent variables PE, HM, EE, FC, SI, PPR and the dependent variable BI are adapted from Gao et al. (2015), the questions for independent variable HC is adapted from Michaelidou & Hassan (2008). Five-point Likert scale is employed to measure the items. For each item, the respondents indicate to what extent they agree with the statement: "strongly disagree – disagree – neutral – agree – strongly agree" corresponds the number "1 to 5" respectively; or how likely they intend to adopt the smartwatches: "very unlikely – unlikely – neutral – likely – very likely" corresponds the number "1 to 5" respectively.

Construct	**Items**	**Measurement Items**
Performance expectancy (PE)	**PE1**	I find the Smartwatch useful in my daily life.
	PE2	Using a smartwatch helps me to achieve health-related goals faster.
	PE3	Using a smartwatch helps me in my daily health check.
Hedonic motivation (HM)	**HM1**	Using Smartwatch is fun.
	HM2	Using Smartwatch is enjoyable.
	HM3	Using Smartwatch is entertaining.

Functional congruence (FC)	**FC1**	Smartwatches are expected to be comfortable.
	FC2	Smartwatches are expected to be fashionable.
	FC3	Smartwatches are expected to be priced appropriately considering their quality.
Effort expectancy (EE)	**EE1**	Learning how to use a technical device like a smartwatch is easy for me.
	EE2	I find technical devices like smartwatches easy to use.
	EE3	It is easy for me to become skillful at using technical devices like smartwatches.
Social Influence (SI)	**SI1**	People who are important to me would think that I should use Smartwatch.
	SI2	People who influence me would think that I should use Smartwatch.
	SI3	People whose opinions are valued to me would cause me to use Smartwatch.
Health Consciousness (HC)	**HC1**	I reflect about my health a lot.
	HC2	I am usually aware of my health condition.
	HC3	I am alert to changes in my health.
	HC4	I take responsibility for the state of my health.
Perceived privacy risk (PPR)	**PPR1**	It would be risky to disclose my personal health information to others.
	PPR2	There would be high potential for loss associated with disclosing my personal health information to others.
	PPR3	There would be too much uncertainty associated with giving my personal health information to others.
Behavioral intention (BI)	**BI1**	I intend to use smartwatch for my healthcare in the future.
	BI2	I intend to use smartwatch at every possible opportunity in the future.
	BI3	I plan to increase my use of smartwatch in the future.

Table 8: Measurement items of conceptual model in survey

The questions regarding cultural value dimension represented by “Individualism” in the fifth block are adopted from Hofstede & Minskov’s (2013) “Values Survey Module 2013 Questionnaire” (Table 9). These questions are not adjusted to the situation of using wearables, because the cultural values should be general and not correlated with any other variables in connection with the usage of smartwatches

Q-No.	Questions	
Q1	Please think of an ideal job, disregarding your present job, if you have one. In choosing an ideal job, how important would it be to you to ...	have sufficient time for your personal or home life
Q4		have security of employment
Q6		do work that is interesting
Q9		have a job respected by your family and friends

Table 9: Questions measuring "Individualism" (Hofstede & Minskov, 2013)

The question number (Q1, Q4, Q6 & Q9) correspond deliberately Hofstede & Minskov's (2013) questionnaire and index formula for Individualism. The respondents can circle one answer for each of the question, which measured by five-point scale as well. In this case, the scores to measure the answers is slightly different from the questions of block 3 and 4. They are as follows: 1 = of utmost importance; 2 = very important; 3 = of moderate importance; 4 = of little importance; 5 = of very little or no importance. The calculation of Individualism Index follows Hofstede & Minskov's formula, which is discussed in section 5.2 with reference to data analysis.

While formulating questions in the written questionnaire, the following guidelines of van Thiel's (2014, p.79) are followed:

- Devise clear-out and unambiguous items.
- The questionnaire should contain no leading questions or statements, which steer the respondent towards a particularly reply.
- Use the same answer categories as much as possible for all items in the questionnaire.
- Make sure that the answer categories are exhaustive, and describe as complete a range as possible.

The written questionnaire is then translated from English into German and Chinese language. The translated versions are corrected by more than two native speakers in each language, and are re-translated to guarantee the reliability. The German language is used for the Swiss, as only the culture of German speaking Switzerland is considered in this study as mentioned in section 2.3.2.

The on-line survey platform "Survey Monkey" is used in the beginning for design the questionnaire in German and Chinese separately. Several designs were tested to ensure the clear and inviting layout. However, it turned out at the stage of pilot study, that

Chinese in mainland China could hardly open the link or it took more than one minute to open one page (with one question) of Survey Monkey. Firewall and website censorship could be the reason for slowing performance. Thus, the author decided to switch the questionnaire in Chinese to a Chinese survey platform. “Wen Jun Xing” was eventually chosen due to the easy operation, the abundant design possibility and the popularity.

4.3. Pilot study

Testing the questionnaire is an important stage of the research: a pilot study can contribute in several ways to the reliability and validity of the questionnaire (van Thiel, 2014, p. 82). Three rounds of pilot studies were conducted in this study, because the measured items are all non-observable variables, different understandings occur due to language barriers (English, German and Chinese) and distant cultural backgrounds. The importance of pilot for empirical work was confirmed later in this study.

The first round of pilot study was conducted at the beginning with five Swiss natives based on the first version of concept model and questionnaire. The first version of questionnaire was adapted from the original WTAH model of Gao et. al (2015), with the revised variables of PMT as the measurement of health behavior, which influence the usage intention of wearables.

The variable and questions adapted from PMT of Gao et al. (2015) is listed in Table 10.

Construct	Items	Measurement Items
Self-Efficacy (SE)	**SE1**	It is easy for me to self-monitor my physical conditions by using a smartwatch.
	SE2	I have the capability to use a Smartwatch to self-monitor my physical conditions.
	SE3	I am able to use a Smartwatch to self-monitor my physical conditions without much effort.
Perceived vulnerability (PV)		Please answer the following questions in terms of these problems: having little knowledge about self-care; monitoring personal daily health indicators; and suffering certain medical diseases.
	PV1	I am at risk for suffering certain medical diseases.
	PV2	It is likely that I will suffer certain medical diseases.
	PV3	It is possible for me to suffer certain medical diseases.
Perceived severity (PS)		Please answer the following questions in terms of these problems: having little knowledge about self-care; monitoring

		personal daily health indicators; and suffering certain medical diseases.
	PS1	If I suffered certain medical diseases, it would be severe.
	PS2	If I suffered certain medical diseases, it would be serious.
	PS3	If I suffered certain medical diseases, the consequence would be significant.

Table 10: Discarded variables of PMT

As stated in Section 2.2.3, self-efficacy is the belief in one's ability to use smartwatches to monitor and improve the health condition. Perceived vulnerability refers to the possibility that one will experience threat of certain diseases, while perceived severity represents the extent of threat of certain diseases. During the first round of pilot study, several test-respondents mentioned that they could not tell the differences between the questions regarding effort expectancy and self-efficacy (explanations of variables indicated in Table 3 in Section 2.2.5). Furthermore, they reported having difficulties in answering the questions regarding perceived vulnerability and perceived severity, even the assumption of pre-conditions (having little knowledge about self-care; monitoring personal daily health indicators; and suffering certain medical diseases) are given before the questions. The respondents without certain diseases reported they could not answer these questions with five different scales. This is the main reason for which these three variables of PMT are replaced through health consciousness (details about HC see Section 0).

Few Swiss respondents mentioned that they are not comfortable to fill in the question of income, even this question is displayed in intervals and no individual information can be tracked. That is why the option of “no information” was added to the questions regarding “income” and “education”.

In the first round of pilot study, three items regarding “social influence” arose also queries. Few Swiss test respondents reported that it was difficult for them to distinguish “people who are important to me” and “people who influence me”. Because of this, the author changed the items with clear definitions of three groups of people who would assert influence – they were “family members and close friends”, “colleagues and peers” and “professionals incl. physicians” respectively. Nevertheless, these changes were reversed later similar to the original questions again, after considering the requirement on internal consistency reliability of the multiple items measuring one latent variable.

Afterwards, the revised conceptual model and questions in Chinese were tested again with 20 Chinese respondents. In the second round of pilot study, it appeared the first version of questions regarding individualism and collectivism might not lead to the expected results. All the Chinese test-respondents fell in the pattern of individualist, which is opposite to the cultural theories of culture scholars. The reasons might be that the adapted measurement items for the variable "individualism" from Wu et al. (2001) are all positively formulated, which led the respondents not to differentiate their real or ideal circumstances. As a result, the original questions from "Values Survey Module 2013 Questionnaire" of Hofstede & Mikov (2013) was used in the third round of pilot study to replace the cultural items used in the first and second round of pilot study (Table 11).

Construct	Items	Measurement Items
Individualism (IDV)	**IDV1**	Having sufficient time left for my personal or family is important.
	IDV2	Having challenging tasks to do, from which I can get a personal sense of accomplishment is important.
	IDV3	Fully use my skills and abilities on the job is important.
	IDV4	Working in a large and prestigious organization is important.

Table 11: Discarded items in pilot study measuring Individualism (Wu, Taylor, & Chen, 2001, p. 327)

At last, a third round of pilot study with the final conceptual model (Figure 10) and questions (Table 8) was conducted again with nine Swiss respondents.

Additionally in these three rounds of pilot study, the questions are adjusted in both languages a few times to ascertain all items are formulated clearly, they are in logic sequences, the questions are applicable to the everyday lives of the respondents, and they are relatively easy to answer. The time for answering the questionnaires and the compatibility of operating systems, especially later for data collection were tested as well during the pilot study.

The translation process was quite a complex during the period of pilot study. For one English expression, there are several different phrases in German and Chinese language and vice versa. Therefore, it is challenging to formulate corresponding multiple-items in German and Chinese, which must be identical from each other, but clear distinguished among the items within one construct (representing one variable) in the same language.

Excursion: Cultural difference between Swiss and Chinese respondents

Cultural differences have been shown in the using and interpretation of language itself. While German speaking Swiss are very exact and specific with the formulation of certain sentences by taking questions quite literally, Chinese were much easier with the ambiguity in the language and were relative quick and intuitive to comprehend the questions and provide answers. This phenomenon reflects high uncertainty avoidance of Swiss comparing low uncertainty avoidance Chinese (Hofstede, 2019), or specific value of Swiss versus diffuse value of Chinese (Trompenaars & Hampden-Turner, 1998).

4.4. Data collection

Both finalized questionnaires using web-based survey tool were distributed randomly to author's acquaintances in China and Switzerland through snowball sampling method. Snowball sampling is a kind of convenience sampling technique, which do not require random selection step. Researcher could have their convenience to select respondents that are most readily available, no matter what characteristics they are or other settled conditions, when the sample size reach the required size, the procedure of sampling is completed (Tansey, 2007, p. 18)

The German version compiled in "Survey Monkey" was distributed to Swiss in German speaking region by e-mail, accompanied by a text of introduction and request to extend the survey further to their colleagues and friends. The questionnaire were distributed in diverse industry and service companies, fitness centers, leisure and sport clubs as well as in neighborhood.

The Chinese version designed in "Wen Juan Xing" was distributed to Chinese in mainland China by e-mail and social media platform "WeChat" with introduction and simple requirements to spread the survey. The respondents are from more than 23 of 32 provinces and municipalities of mainland China (except Hong Kong and Macau). Figure 13 depicts the number of respondents from different provinces of mainland China respectively. This function is provided by Chinese survey platform "Wen Juan Xing" but not by "Survey Monkey", thus no similar graphic for Swiss respondents can be provided.

Both variables of “nationality at birth” and “country of residence” are asked at the beginning of the questionnaire to especially ensure that there are no Chinese living in Switzerland and no Swiss living in “China” are included in the valid samples, so that the country variable represent distinguished national culture, which meets the requirement of reliability.

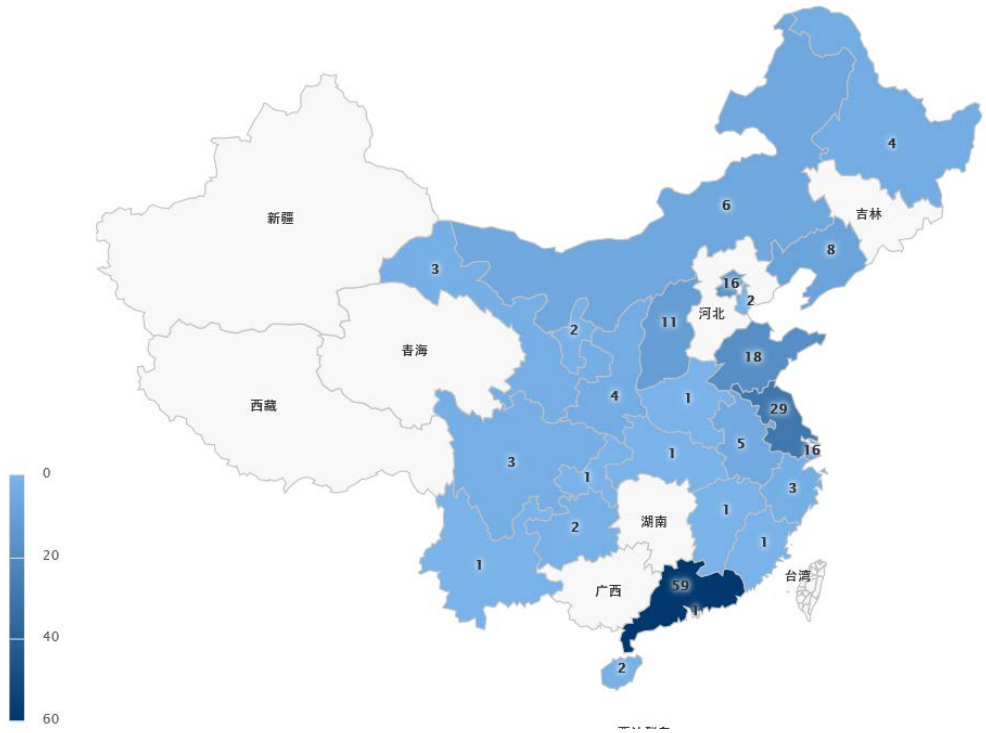

Figure 13: Geographic distribution of Chinese respondents from mainland China

In this study, the users and non-users of healthcare wearables are included in the collected samples. Through this, the different perceptions and attitudes of both groups – users with high propensity of intention and non-users with low propensity of intention are considered.

Excursion: Cultural difference between Swiss and Chinese respondents

The responding process of Chinese and Swiss manifested another cultural difference. The number of Swiss respondents to the survey were very few at the beginning, but have increased continuously until three weeks after the e-mail was sent. The number of Chinese respondents increased suddenly at the first hours and reached the peak two days after sending out the questionnaire. Then there were no increase anymore if the author would not launch another round of requirement. This phenomenon shows clearly the difference between monochronic

value of Swiss, who plan their activities sequentially and act according to agenda; and the polychronic value of Chinese, who prefer to conduct different issues at the same time, and adjust the activities spontaneously in accordance with perceived priorities (Hall & Hall, 1987, p. 13). For this reason, the usage of social media like WeChat even for survey is very popular in China, through which Chinese can react quickly and provide answer instinctively.

The collected samples are the responses to the survey from 2nd to 24th April 2019. Until the evening of 24. April 2019, 153 samples are collected from Switzerland, and 203 samples are collected from mainland China.

4.5. Data ordering

The Data from both survey platforms can be downloaded directly and saved in SPSS-compatible files. However, they are two separate dataset in two different structures and languages, which need to be integrated into one dataset manually.

First, the dataset in German was edited. Thirteen incomplete samples from Switzerland were deleted from the dataset. In the tab of “variable view” in SPSS the useless columns were deleted, then the variable name, type, decimals, and variable label etc. were edited in line with the questionnaire and requirements on data. The missing value were defined as “-77”, which are excluded from data analysis. Afterwards, the data matrix in the first tab in SPSS can be used as the standard to integrate the dataset in Chinese.

In the second step, the language and encoding of SPSS setting was changed temporarily into Chinese, so as the Chinese data could be opened correctly (otherwise there were only garbled characters). The variables and codes in the “variable view” of Chinese dataset were adapted and translated according to the German data structure. During the inspection of data through comparing the codes and the descriptive texts (string variables), the author found that the codes of cultural value dimension “Individualism/Collectivism” were inversely downloaded from the Chinese survey platform. Thus, the code of cultural value dimension of Chinese dataset had to be converted at first with opposite sequence.

After the revision of the dataset in Chinese, both dataset can be jointed together with the “variable name” in German dataset as the merger criteria.

As questionnaires in both languages adopted exactly the same structure with the same scale and coding, most of the variables are correct after the fusion of two dataset. There were only minor adaptions had to be brought afterwards. For example, the value for the third country in Survey Monkey was defaulted as "0", but the value for the third country in Wen Juan Xing was defaulted as "-3". In this case, a new variable named "Country Variable" was created through "code conversion" in SPSS based on the variables "nationality at birth" and "country of residence", with "0" represent "Chinese", "1" represent "Swiss" and "-77" represents "other countries". Through definition of missing values"-77", 2 samples from China and 30 samples from Switzerland with other nationalities are excluded from data analysis. The purpose is to ensure the clear distinguish of national culture as described before.

4.6. Data analysis

In this section, the data analysis techniques are described, and the results are presented in Chapter 5.

The data analysis techniques can be generally divided into two groups: descriptive and inferential statistical techniques. Descriptive statistics concentrates on a number of characteristics of the variables in the dataset, and the relations that exist between these variables. Cross-tabulation and correlation are two main descriptive techniques. They are particularly suitable to nominal and ordinal data, or making the first exploration of the data (van Thiel, 2014, p. 126). Inferential statistics, also referred to as explanatory statistics sometimes, focus on whether the relations between two variables are systematic or "real", which can be used to ascertain if the hypothesized relations are indeed present (confirmatory analysis) in deductive research. This type of analysis is based on the principles of probability theory. The representative inferential techniques are t-test, ANOVA test, regression analysis, variance analysis and factor analysis. The data for inferential statistics must have been measured at minimally the ordinal level, which should meet additional requirements of that particular inferential technique, besides that the variables are distributed normally (van Thiel, 2014, p. 126).

In this study, the descriptive statistics are used to describe the sample characteristics, the cultural values (individualism/collectivism) of Chinese and Swiss, the usage patterns of smartwatches and the different usage intention according to gender, age, and education

and income groups. Inferential statistics are used to explain the relations between the independent, dependent and moderating variables of the conceptual model, test the hypotheses and compare the different perceptions between Chinese and Swiss. For this part, the multivariate regression, moderated-mediation-analysis and t-test via SPSS and Process is employed. The reliability and validity of measurement model is examined before the inferential analysis.

5. Results and Discussions

In this chapter, results are analyzed in SPSS arranged in the following sequence: sample characteristics, cultural value difference between Chinese and Swiss, usage patterns of smartwatches, evaluation of measurement model, hypothesis testing, moderating effect of country variable, intended application fields of healthcare wearables in the future, moderating effect of control variable, and additional remarks of respondents. The related theories are discussed accompanying the results in each section. The quality criterion – objectivity, reliability and validity are explained along with the process of data analysis.

5.1. Sample characteristics

Among 343 completed samples, 201 are Chinese with residence in China, 110 are Swiss with residence in Switzerland, and 32 with other nationalities (2 living in China and 30 in Switzerland). These 32 respondents with other nationalities are excluded in the data analysis, as this paper examined the influence of cultural factors on the intention to adopt healthcare wearables based on the distinguished national culture of China and Switzerland. This results a full sample with 311 respondents.

The sample characteristics with 201 valid respondents of China and 110 valid respondents of Switzerland are displayed in Table 12:

		China (n=201)		Switzerland (n=110)	
Variable	**Category**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Gender	Male	89	44.3	52	47.3
	Female	112	55.7	58	52.7
Age	16-25	8	4.0	10	9.1
	26-40	72	35.8	33	30.0
	41-55	56	27.9	33	30.0
	56-70	38	18.9	29	26.4
	> 70	27	13.4	4	3.6
	Missing Value			1	0.9
Monthly Income in CHF	< 500	16	8.0	2	1.8
	501 – 1500	100	49.8	4	3.6
	1501 – 3000	36	17.9	7	6.4

	3001 – 5000	20	10.0	19	17.3
	> 5001	7	3.5	60	54.5
	No information	22	10.9	17	15.5
	Missing Value			1	0.9
Highest Education	Apprenticeship	10	5.0	30	27.3
	Senior high school	12	6.0	5	4.5
	College	27	13.4	25	22.7
	University (of Applied Science) and above	143	71.1	43	39.1
	No information	9	4.5	6	5.5
	Missing Value			1	0.9

Table 12: Sample characteristics displayed by China/Switzerland

From the figures in the above table, conclusion can be drawn that the demographic distribution of Chinese and Swiss respondents are balanced and representative. The distribution of gender and age groups of both countries are comparable. Most Chinese respondents' income lies in the range of CHF 501 – 1500 and most Swiss in the range of above CHF 5001, which are completely in line with the known country economic comparisons. The majority of Chinese respondents (143) own the highest completed education of university and above. Even most of Swiss respondents (43) in this study own the degree of university (incl. universities of applied sciences) and above as well, there are quite amount of Swiss (30) have the highest completed education of apprenticeship, which responds truly the education systems of both countries.

5.2. Cultural value difference between Chinese and Swiss

The cultural differences between China and Switzerland was empirically examined in this study through one of the cultural dimensions individualism versus collectivism. Questions listed in Table 9 in Section 4.2. and the calculation methods are derived from Hofstede & Minskov's (2013) "Values Survey Module (VSM) 2013 Questionnaire" and the corresponding manual.

Hofstede & Minskov (2013) described in their manual: "Individualism is the opposite of collectivism. Individualism stands for a society in which the ties between individuals are loose: a person is expected to look after himself or herself and his or her immediate family only. Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which continue to protect them throughout their lifetime in exchange for unquestioning loyalty".

The Individualism (IDV) index formula is as follows:

$$IDV = 35(m04 – m01) + 35(m09 – m06) + C(ic)$$

in which m01 is the mean score for question 01, etc.

The index normally has a range of about 100 points between strongly collectivist and strongly individualist countries. C(ic) is a constant (positive or negative) that depends on the nature of the samples, which can be chosen by the user to shift his/her IDV scores to values between 0 and 100.

Hofstede & Minskov (2013) emphasized further that the dimensions measured by their VSM are based on country-level correlations, between mean scores of country samples. For the same two questions, country-level can be very different from individual-level correlations, between the answers by the individuals within the country samples. Individual-level correlations produce dimensions of personality; country-level correlations produce dimensions of national culture (Hofstede & Minkov, 2013, p. 3). As an individual, a person can express how he or she feels about the values in a particular national society, but that would still be a function of his/her personality and not necessarily reflect his or her national culture. Because of this, the VSM 2013 cannot be scored at the individual level.

In this study, the different national culture of Chinese and Swiss is confirmed through written questionnaire described in Section 4.2. The samples size of both groups (201 Chinese and 109 Swiss) are much higher than the required minimum samples of 50 by VSM manual. Therefore, the measurement is reliable and the results are externally valid.

A new variable “IDV” is built based on the above mentioned index formula at first for each individual sample. Then the mean value of all Chinese and Swiss respondents are calculated and compared directly in SPSS. The results displayed in Table 13 show that the mean IDV value of Chinese is 4.00 comparing the value of Swiss, which is 46.24.

Variable	Category	Valid Sample	Mean	Std. Error of Mean
Individualism	China	201	4.00	2.860
	Switzerland	109	46.24	5.893

Table 13: Mean value of individualism

If a constant C(ic) equals 20 added to this calculated mean, a value of 24.0 for Chinese and 66.24 for Swiss are resulted. This matches almost exactly the original Hofstede’s

values of IDV (20 vs. 68), which confirm empirically that Chinese are collectivist and Swiss are individualist. Only the distance between Chinese and Swiss IDV values is slightly shortened, which can probably attribute to the cultural transition.

The graphics comparing the IDV values of Chinese and Swiss are displayed in Figure 14. It can be seen from the graphic that the values of respondents of both countries are normally distributed, and the mean values are clearly distinguished from each other.

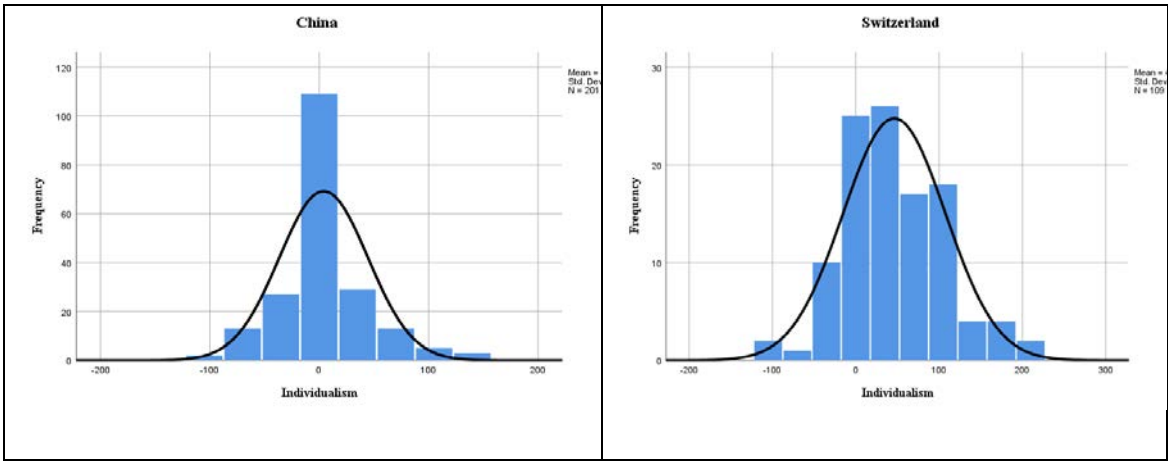

Figure 14: Distribution of individualistic value of Chinese and Swiss

5.3. Usage pattern of smartwatches

The respondents' experiences of using smartwatches are demonstrated in Table 14 and Figure 13. Among 201 Chinese respondents, 91 (45.3%) have experiences of using smartwatches (44 using currently and 47 abandoned). This result is quite similar to the rate stated by Mintel research (2017) in Section 2.1.3 about Chinese urban consumers (42%). Among 110 Swiss respondents, 43 (39.1%) have experiences of using smartwatches (35 using currently and 8 abandoned). The percentage of Swiss users is much higher in this study than the rate indicated by Seiler & Hüttermann in Section 2.1.4 (26%). This could attribute to that, the respondents of this study consist diverse age groups of Swiss in contrast to the samples of Seiler & Hüttermann's study, who are mainly young Swiss students. Furthermore, the questionnaire in Switzerland was deliberately distributed to some sport clubs and fitness centers in order to obtain representative opinions of current smartwatch users.

		China (n=201)		Switzerland (n=110)	
Variable	**Category**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Experience Using Smart-watches	Yes, I am currently using a smartwatch.	47	23.4	35	31.8
	Yes, but I do not use it anymore.	44	21.9	8	7.3
	No, I've never used a smartwatch	110	54.7	67	60.9

Table 14: Experience using smartwatches Chinese vs. Swiss

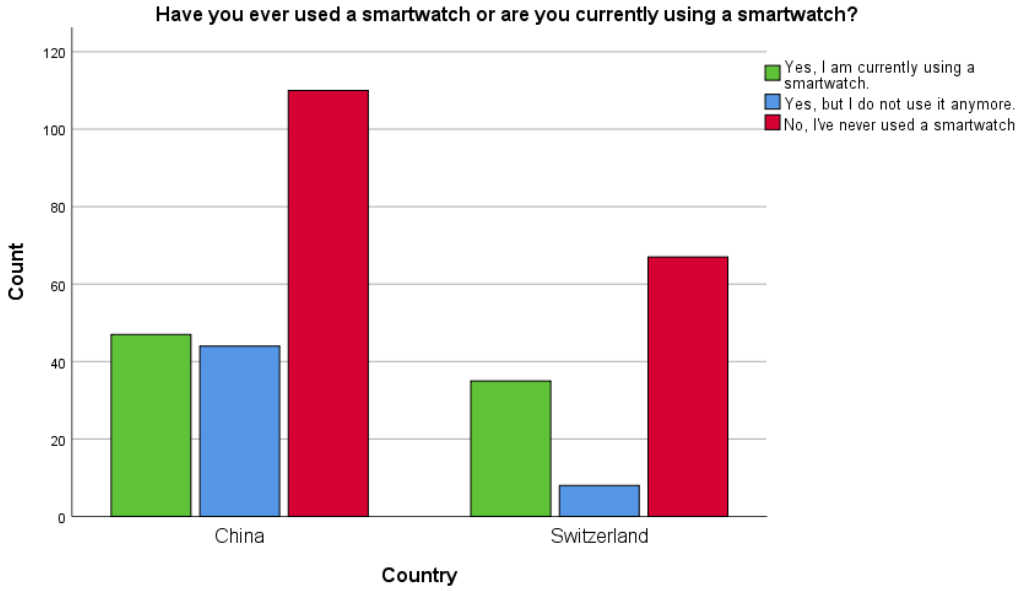

Figure 15: Experiences using smartwatches Chinese vs. Swiss

Regarding the usage frequency, 51% of Chinese and 62.8% of Swiss users apply the smartwatches daily; 15.4% of Chinese and 2.3% (1 person) of Swiss users apply the smartwatches only once a few months or even rarely (Table 15). For these groups of users, the questions arise for what reason they adopt smartwatches.

		China (n=201)		Switzerland (n=110)	
Variable	**Category**	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Usage Frequency	Daily	51	56.0	27	62.8
	Several times a week	21	23.1	12	27.9
	Every few weeks	5	5.5	3	7.0
	Once a few months or more rarely	14	15.4	1	2.3

Table 15: Frequency using smartwatches Chinese vs. Swiss

The applications types of the current and previous smartwatch consumers are displayed in Table 16. The most popular functions of smartwatch for Chinese (87.9%) and Swiss (95.3%) are sport activities (step and distance counts etc.), following that is heartrate monitoring of Chinese (67%) and Swiss (60.5%), than sleep monitoring of Chinese (50.5%) and Swiss (44.2%). There are distinguished differences between some types of application between Chinese and Swiss consumers, e.g. 44% of Chinese measure calorie consumption comparing 12%; 33% Chinese measure blood pressure, comparing 2.3% of Swiss (1 person); 17.6% of Chinese measure ECG, but no Swiss do it. These differences could attribute on one hand to different functions of smartwatches in Chinese and Swiss markets respectively; on the other hand, to the health behavior and cultural background. It shows that Chinese have more propensity then Swiss to use smartwatches to monitor or measure medical-related data, and they are interested to try new functions (medical functions of smartwatches are quite novel as described in section 2.1.3). Regarding "Measurement other health indicators", several Chinese mentioned that they measure glucose level, blood oxygen as well as fatigue degree; One Swiss user mentioned additionally that he/she measures stress-level.

		China (n=201)		Switzerland (n=110)	
Variable	**Category**	**Frequency**	**Percent * (%)**	**Frequency**	**Percent * (%)**
Type of Appli-cations	Sport activities	80	87.9	41	95.3
	Sleep monitoring	46	50.5	19	44.2
	Calorie consumption measurement	44	48.4	12	27.9
	Heart rate monitoring	61	67.0	26	60.5
	ECG measurement	16	17.6	0	0.0
	Blood pressure monitor	30	33.0	1	2.3
	Measurement other health indicators	6	6.6	3	7.0
	Total current and previous user	91	100	43	100

Table 16: Type of applications Chinese vs. Swiss

***** Percentage of total current and previous smartwatch users

The types of applications divided by Chinese and Swiss is exhibited in Figure 16.

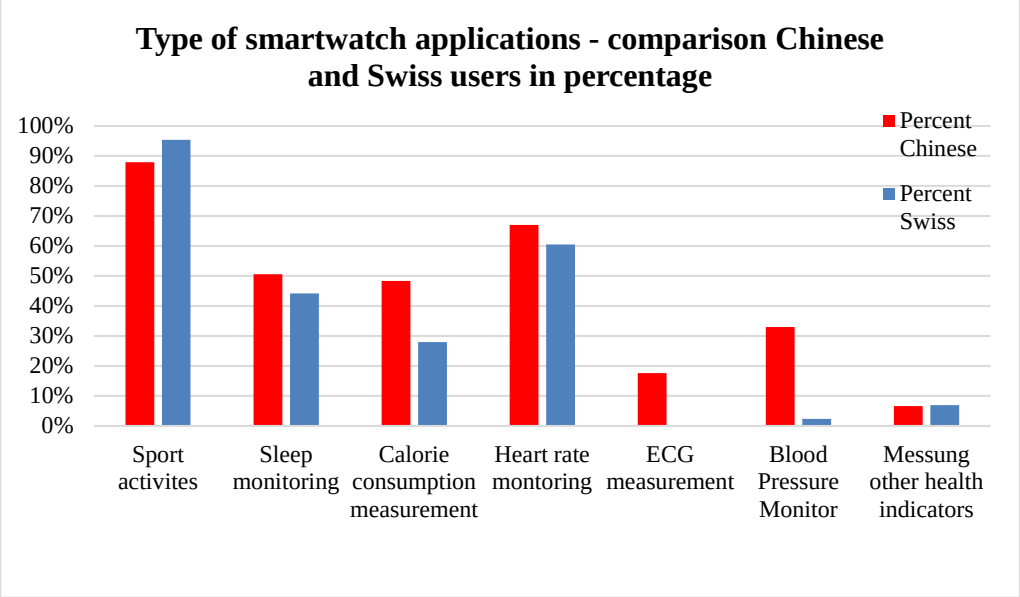

Figure 16: Type of applications Chinese vs. Swiss in percentage

5.4. Evaluation of measurement model

Before testing the hypotheses, the quality of a measurement model is evaluated by its validity and reliability. The validity of the model, which includes the content validity and construct validity is first considered. Content validity measures the degree that how much the measurements can represent the corresponding construct (Gao et al., 2015, p.1712). Since all items were adapted from previous published studies, the conceptual model of this study owns a satisfactory content validity. Construct validity is tested by examining the convergent validity and discriminant validity. The degree to which the measurements are related to the measured construct is known as convergent validity and the extent to which the item does not reflect other constructs is referred as discriminant validity (Gao et al., 2015, p.1712). The conceptual model of this study is adapted from Gao's et al. (2015) integrated framework of WTAH. In their empirical study, all the loadings reflected convergent validity and discriminant validity of the constructs were confirmed. Therefore, the construct validity of this conceptual model is deemed as satisfactory.

The internal consistency reliability was chosen to check the reliability of the measurement model, which is determined by the values of Cronbach's Alpha. It measures how consistently the research participants responded to the multiple items measuring each variable. Particularly, when composite measurements are used, the internal consistency reliability is checked to test for the consistency with which the

multiple items are measuring the same construct (Cho et al., 2014, p.863). In Table 17, all the Cronbach's alpha scores for this study are presented.

Variable Items (Construct)		Full sample (n=311)	China (n=201)	Switzerland (n=110)
PE1, PE2, PE3	Performance Expectance	0.855	0.884	0.799
HM1, HM2, HM3	Hedonic motivation	0.865	0.860	0.876
FC1, FC2, FC3	Functional congruence	0.694	0.775	0.506
EE1, EE2, EE3	Effort expectancy	0.903	0.926	0.867
SI1, SI2, SI3	Social Influence	0.906	0.913	0.777
HC1, HC2, HC3, HC4	Health Consciousness	0.853	0.889	0.777
PPR1, PPR2, PPR3,	Perceived privacy risk	0.840	0.866	0.798
BI1, BI2, BI3	Behavioral intention	0.923	0.907	0.866

Table 17: Cronbach's Alpha Values

The value of Cronbach's Alpha should be higher than 0.7. All constructs except FC – functional congruence of "Full Sample" and FC "Switzerland" are higher than the recommended threshold. Since the value of FC "Full Sample" is 0.694, which almost meets the requirement of threshold, no changes conducted regarding the concept model of this study.

The value of FC is low comparing the other variables could be explained by the relative inconsistency of three items representing this variable. As indicated in Table 8 (measurement items of construct model), the three questions are related to perceived comfort, fashion and price-quality ratio of using smartwatches respectively, which are apart from each other from the natural meanings and scope of the definitions. Gao et al. (2015) adopted them in their study of wearable technology acceptance in healthcare, which is a complete modification from original variable "facilitating conditions" of model UTAUT2. For this reason, the variable FC and related questions need to be carefully applied in the future study.

5.5. Evaluation of structural model and hypothesis testing

On account of results Cronbach's Alpha analysis, conclusion can be drawn that the reliability of all the variables are reached. Then the arithmetic mean of three items of

each construct (Table 8) are calculated. The calculated arithmetic mean are the final values of all independent and dependent variables (PE, HM, FC, EE, SI, HC, PPR, and BI), which are added in the data matrix in SPSS.

5.5.1. Regression analysis

In this section, the hypothesis H1 – H7 are tested through multivariate regression analysis in SPSS. Multivariate regression analysis tests whether the relation between more than one independent variables and the dependent variable is linear. A positive linear relation means an increase in the independent variable leads to an increase in the dependent variable (van Thiel, 2014, p. 130). In the conceptual model, the independent variables (predictors) are performance expectancy, hedonic motivation, effort expectancy, functional congruence, social influence, health consciousness, perceived privacy risk; dependent variable (outcome): behavior intention to adopt wearables. Descriptive statistical results confirms that all the independent and dependent variables are normally distributed, which meets the pre-requisitions of linear regression.

In Table 18 of model summary, the adjusted coefficient of determination R2 shows a value of 0.615 (percentage of explained variance), which indicates that the conceptual model predictions the real data points well (goodness of fit).

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.790	.624	.615	. 673584

Table 18: Multivariate Regression Model Summary

The following scatterplot (Figure 17) indicates the correlation between all predictors and the behavior intention to adopt smartwatches is linear.

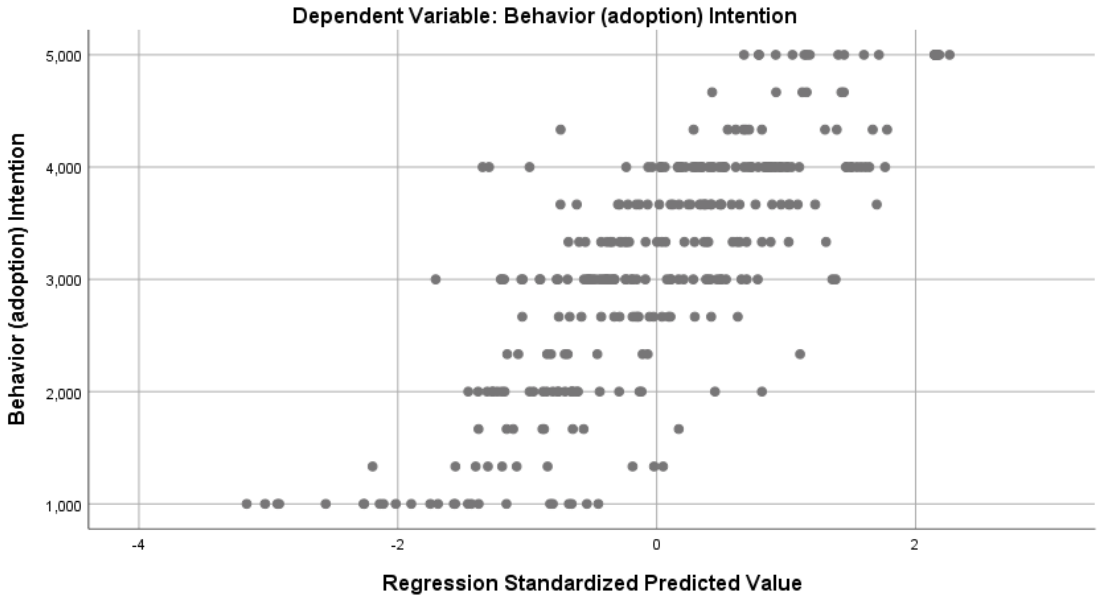

Figure 17: Scatterplot with predictors and behavior intention to adopt variables

The results of multivariate regression analysis is displayed in Table 19.

	Hypothesis Path	Unstandardized Coefficients		Standardized Coefficients	t	P-value	Result
		Beta	SE	Beta			
	Constant	-.460	.326		-1.411	.159	
H1	PE → BI	.480	.071	.357***	6.780	.000	supported
H2	HM → BI	.147	.071	.103*	2.061	.040	supported
H3	EE → BI	.111	.055	.082*	2.041	.042	supported
H4	FC → BI	-.093	.080	-.058 ^{ns}	-1.155	.249	Not supported
H5	SI → BI	.519	.048	.473***	10.785	.000	supported
H6	HC → BI	-.063	.074	-.034 ^{ns}	-.854	.394	Not supported
H7	PPR → BI	-.016	.044	-.013 ^{ns}	-.356	.722	Not supported

Table 19: Results of regression analysis

Although some researchers argue that standard p-values can be insufficiently precise indicators of statistical significance, particularly if their values are given only in grouped levels (Hoem, 2008, p.439), the conventional significance level is still followed with asterisks beside parameter: *=p<0.05 (moderate significant), **=p<0.01 (strong significant), ***=p<0.005(very strong significant),; ^{ns}=p>0.05 (non-significant) in this

study. Nonetheless, some literature explains that with a p-value between 0.05 and 0.1, there are still weak evidence that the null-hypothesis does not hold (Massey University, 2019)

In view of the significance level of "standard coefficients" in the above table, the hypotheses **H1, H2, H4 and H5 are supported** by the statistical results. Among all factors that affect consumers' intention to adopt smartwatches, social influence (β=0.473; $p<0.001$) and performance expectancy (β=0.357; $p<0.001$) are the most significant predictors, which positively influence the user intention. Hedonic motivation (β=0.103; $p<0.05$) and effort expectancy (β=0.082; $p<0.05$) influence the user intention also positively. However, the influence of effort expectancy is so weak, which could almost be ignored. The influences of functional congruence, health consciousness, and perceived privacy risk, however, are not significant for the entire respondents. Thus, the **hypotheses H4, H6 and H7 are discarded** in this study. Nevertheless, there could be differences between respondents from China and Switzerland, which are further analyzed through moderating effect of country variable.

5.5.2. Moderating analysis

In this section, the hypotheses H8a and H8b are tested through moderating effect of country variables (interaction between country variables and predictors) in an add-on "PROCESS version 3" of Hayes in SPSS. The moderating effect deals with the question of whether the relationship between an independent variable and a dependent variable is affected by a third variable – the moderator. A moderator can be both dichotomous and continuous (Regorz Statistik, 2019). In this study, the country "China/Switzerland" is a dichotomous variable.

In the previous section 5.5.1 of regression analysis, it shows that the relationships between the dependent variable (BI) and the independent variables (PE, HM, EE, SI etc.) are linear. In this case, the dependent variable may change when the value of the moderator variable changes. The following equation is used to explain this effect:

$$Y = \alpha + \beta_1 X + \beta_2 Z + \beta_3 X * Z + \varepsilon$$

In this equation, X is an independent variable, Y is a dependent variable, and Z is the moderator variable that affects the relationship of X and Y. If the interaction between the independent variable and moderator variable (X*Z) is not statistically significant,

then Z is not a moderator variable, it is just an independent variable. If is statistically significant, then Z will be a moderator variable, and thus moderation is supported (Statistics Solutions, 2019).

The test results are summarized in Table 20, where the country variable CN stands for China, and CH stands for Switzerland. The "Effect" is the conditional effects (coefficient) of the focal predictor at values of the moderator (country variable). LLCI stands for lower limit of confidence interval and ULCI stands for upper limit of confidence interval.

Interaction	Model Sig.	Coun-try	Effect	Std. Error	t	P-Value	LLCI 95%	ULCI 95%
PE x CN-CH	.0656(*)	CN	.6746***	.0628	10.7367	.0000	.5510	.7982
		CH	.8654***	.0819	10.5658	.0000	.7042	1.0265
HM x CN-CH	.1899	CN						
		CH						
FC x CN-CH	.1278	CN						
		CH						
EE x CN-CH	.7720	CN						
		CH						
SI x CN-CH	.5707	CN						
		CH						
HC x CN-CH	.0001***	CN	.6058***	.0973	6.2278	.0000	.4144	.7972
		CH	-.1428	.1604	-.8899	.3742	-.4585	-.4585
PPR x CN-CH	.0042*	CN	.0542	.0682	.7949	.4273	-.0800	.1885
		CH	-.2926***	.0989	-2.9582	.0033	-.4872	-.0980

Table 20: Results of moderating effect by country variable

Conclusions can be drawn from the figures of "Model Sig." that the moderation effect of country variables (China vs. Switzerland) for the relationship of the conceptual model is significant with the predictors performance expectancy (p=0.0656, weak evidence), health consciousness (p=0.0001) and perceived privacy risk (p=0.0042);

With the involvement of country variables, the influence of performance expectancy for the user intention of Chinese respondents (β=0.6746; p<0.001) has increased, and the influence of performance expectancy for the user intention of Swiss respondents (β=0.8654; p<0.001) has increased as well comparing coefficients of full samples. PE has become the most determined predictor for the user intention of both groups, and the

impact of PE on BI of Swiss is greater than Chinese, which means PE is a more important influence factor for Swiss to adopt wearables then Chinese.

With the involvement of country variables, the influence of perceived privacy risk for the user intention of Chinese respondents remain insignificant. Thus, PPR would not likely be a predictor, which influence the intention of Chinese to adopt healthcare wearables. However, it shows clearly the negative influence of PPR for the user intention of Swiss respondents (β=-0.2926; $p<0.005$).

Based on the above explanations, the hypothesis **H8b – Performance expectancy, perceived privacy risk have greater impact on intention to adopt wearable devices of Swiss than Chinese is validated**.

With the involvement of country variables, the influence of health consciousness for the user intention of Chinese respondents (β=0.6058; $p<0.001$) is positive and strong; the influence of health consciousness for the user intention of Swiss respondents, however, remain insignificant. Therefore, HC would not likely be a predictor for Swiss to have intention to adopt healthcare wearables. Based on this, the hypothesis **H8a is partially validated: Health consciousness have greater impact on intention to adopt wearable devices of Chinese than Swiss.**

The other parts of hypotheses in **H8a i.e. "Hedonic motivation, effort expectance, functional congruence, and social influence have greater impact on intention to adopt wearable devices of Chinese than Swiss" is not supported** by the moderating analysis, as the figures "Model Sig." in Table 20 does not display the model significance of these interactions. That is to say, the country differences based on national culture do not affect the relationships between HM, EE, FC, SI and BI.

In this study, health consciousness was defined as the extent to which a person's awareness and activity to improve his/her health condition. Therefore, a positive association between HC and behavior intention to adopt wearables were assumed naturally. However, HC is proved not likely to be a predictor for the intention of Swiss to adopt healthcare wearables in contrast to Chinese according to the above explanation. Further reviewed literatures show that people with higher HC may possess robust routine habits of managing their own health. For this reason, HC is also often positively related to participation in a range of health activities (e.g. exercising, walking, health

information seeking). It is well known that sports prevail in Switzerland. Swiss individuals with high HC might have been already allocating significant resources – time, energy, and money into various health activities, which would lead them to devalue the usefulness of healthcare wearables (Cho et al., 2014, p. 866).

From the perspective of research model, some studies placed HC at different positions in the models of information technology acceptance. Jayanti & Burns (998, p. 11) proposed HC influences preventive health behaviors positively and achieved statistical significance. However, their proposal of HC affecting response efficacy positively did not achieve statistical significance. Chen & Lin (2018) proposed HC as predictors to affect perceived ease of use and perceived usefulness in their study by incorporating HC into technology readiness and acceptance model (TRAM) to predict app download and usage intentions, of which the result was confirmed. Cho et al. (2014, p. 862) proposed HC as a predictor positively affected the perceived usefulness of health apps but did not confirm the hypothesis statistically. Thus, the conclusion can be drawn that HC might be an antecedent influencing other predictors such as PE, EE or SI, which should be examined in future research.

The author hypothesized in H8a that social influence has greater impact on intention to adopt wearable devices of Chinese than Swiss, mainly because Chinese are collectivist and Swiss are individualist as empirically confirmed in section 5.2. Chinese might attach more importance to others' opinion than Swiss. However, further research reveals other aspects of cultural values, which was not considered by the author before. Zakour (2004) argued that the social influence exerted by important persons are much more important in determining IT use in cultures seeking to avoid uncertainty than in cultures comfortable with uncertainty. Actually, in order to deal with uncertainty and ambiguity, individuals in strong uncertainty avoidance cultures like Swiss are very concerned by the establishment of rules. Therefore, the subjective norms will be more important as guidance to behavior of Swiss than for individuals in weak uncertainty avoidance cultures like Chinese, who rely more on their proper competence to evaluate a situation (Zakour, 2004, p. 159). Therefore, Swiss are likely to be influenced more by the opinions of professionals such as physicians and specialist who symbolize the rules, while Chinese rely more on people around them. Based on this, it can be well explained that the moderating effect of country variable are not significant with the relationship between SI and BI.

Until now, the first research question of this study "What are the influential factors on the behavior intention to adopt wearables" is answered through multivariate regression and moderating analysis based on reliable and valid research model.

5.5.3. T-Test on variables between Chinese and Swiss respondents

A t-test measures whether the difference found between two scores (e.g. two group of respondents) is systematic and unlikely to be caused by random factors such as coincidental circumstances, interference by other variables, or a wrongly constructed sample (van Thiel, 2014, p. 128). A t-test is conducted in this study to compare different perceptions of Chinese and Swiss respondents in all aspects of the conceptual model.

Vari-able	Coun-try	N	Mean	Std. Dev.	Δ Mean	t-Value	LLCI 95%	ULCI 95%	P-Value
PE	CN	201	3.74	0.763	0.484***	5.275	0.303	0.665	0.000
	CH	110	3.26	0.793					
HM	CN	201	3.47	0.730	0.097^{ns}	1.071	-0.081	0.275	0.285
	CH	110	3.38	0.820					
FC	CN	201	3.50	0.700	0.168*	2.172	0.016	0.320	0.031
	CH	110	3.34	0.623					
EE	CN	201	3.84	0.771	0.215*	2.217	0.024	0.407	0.028
	CH	110	3.63	0.843					
SI	CN	201	3.44	0.842	1.136***	11.557	0.943	1.330	0.000
	CH	110	2.30	0.804					
HC	CN	201	3.99	0.612	-0.108^{ns}	-1.670	-0.235	0.019	0.096
	CH	110	4.10	0.502					
PPR	CN	201	3.40	0.913	0.018^{ns}	0.172	-0.186	0.222	0.864
	CH	110	3.38	0.853					
BI	CN	201	3.59	0.799	1.301***	12.307	1.093	1.509	0.000
	CH	110	2.29	1.039					
IDV	CN	201	4.00	40.543	-42.234***	-7.255	-53.688	-30.779	0.000
	CH	109	46.24	61.528					

Table 21: T-test comparing perceptions of Chinese and Swiss

The different responses of Chinese and Swiss respondents toward the variables PE, SI, BI as well as cultural dimension IDV are very significant ($p<0.005$). This indicates that Chinese have higher performance expectancy on smartwatches then Swiss, and are influenced more by their social environment. The distinguished cultural values

regarding IDV was explained in section 5.2. The moderate significant difference on FC and EE confirms that Chinese are slightly more in favor of smartwatches because they are fashionable/trendy and easy to use; differences between Chinese and Swiss toward HM, HC and PPR are not significant. Both groups have quite high health consciousness; perceive relative high privacy risk using smartwatches and have relative high hedonic motivation. However, the difference toward HC should be analyzed more closely through other statistical method, as the significant level is less than 0.1, which is deemed as weak significant in some studies.

From the significant differences between Chinese and Swiss in BI, it can be concluded that Chinese have clearly much more intention to use smartwatches then Swiss. Besides the possible influential cultural values mentioned in Section 2.3.2 and 3.3, Zakour (2004) explained another possible reason could be that individuals in high uncertainty avoidance cultures such as Swiss are uncomfortable with ambiguous and uncertain situations. Since using wearables does not allow the social presence, it could accentuate the feeling of uncertainty; Swiss in high uncertainty avoidance cultures will be less oriented to use wearables than Chinese in low uncertainty avoidance cultures (Zakour, 2004, p. 158). Furthermore, the different relationship with the environment indicated in Table 5 (Nardon, 2006) could be a further explanation to this difference. Swiss holds "Mastery" value toward environment/surroundings, which causes them to stick with their own belief and habits perceived as effective and valuable. Chinese are more in "Harmony" with the environment/surroundings, which means that they are more flexible to alter the opinions to adapt to the circumstances around. In view of this explanation, Chinese tend to be more easily attracted by novel technical products then Swiss, when they are reckoned as trendy and fashionable or useful.

5.6. Intended type of applications in the future

As additional information to behavior intention to adopt healthcare wearables, the type of applications are likely to be used in the future comparing Chinese and Swiss is displayed in Table 21. It shows through the comparison of mean values (t-test) that there are significant differences in all fields of smartwatch applications between Chinese and Swiss in the future. In average, Chinese consumers have much higher intention in all fields of application then Swiss, especially in the fields related to measurement of important health vitals, such as glucose, ECG and blood pressure etc.

These differences can be related to high health consciousness of Chinese in the circumstances of their social healthcare system, as well as their culture values of low uncertainty avoidance in contrast to Swiss.

	Country	N	Mean	SD	SE	P-Value
Sport activities	CN	199	4.30	.717	.051	0.000
	CH	109	3.66	1.321	.127	
Sleep monitoring	CN	200	4.11	.831	.059	0.000
	CH	107	2.90	1.400	.135	
Calorie consumption measurement	CN	196	4.21	.746	.053	0.000
	CH	108	3.12	1.386	.133	
Heart rate monitoring	CN	200	4.26	.777	.055	0.000
	CH	108	3.45	1.241	.119	
ECG measurement	CN	198	4.10	.837	.059	0.000
	CH	105	2.91	1.110	.108	
Glucose level measurement	CN	198	4.09	.832	.059	0.000
	CH	106	2.65	1.113	.108	
Blood pressure monitor	CN	200	4.23	.766	.054	0.000
	CH	107	3.04	1.189	.115	
Mood monitoring	CN	199	3.92	.926	.066	0.003
	CH	106	2.11	1.063	.103	

Table 22: Intended fields of application in the future

5.7. Moderating role of control variable

In the original UTATU2 model, the control variable such as age and gender as well as individual experiences are placed as moderator, which influence the relationships between predictors and behavior intention. This is not the research focus of this study, but the author checked the moderator effect of age instead of country variable. Unfortunately, the moderating role of age is not confirmed in this study with full samples. Results displayed in the following graphic (Figure 18) through cross-tabulation analysis, that there are no obvious difference in intention to adopt smartwatches among different age groups of Chinese respondents; there are yet slight declining tendency with Swiss respondents as of age group 26-40.

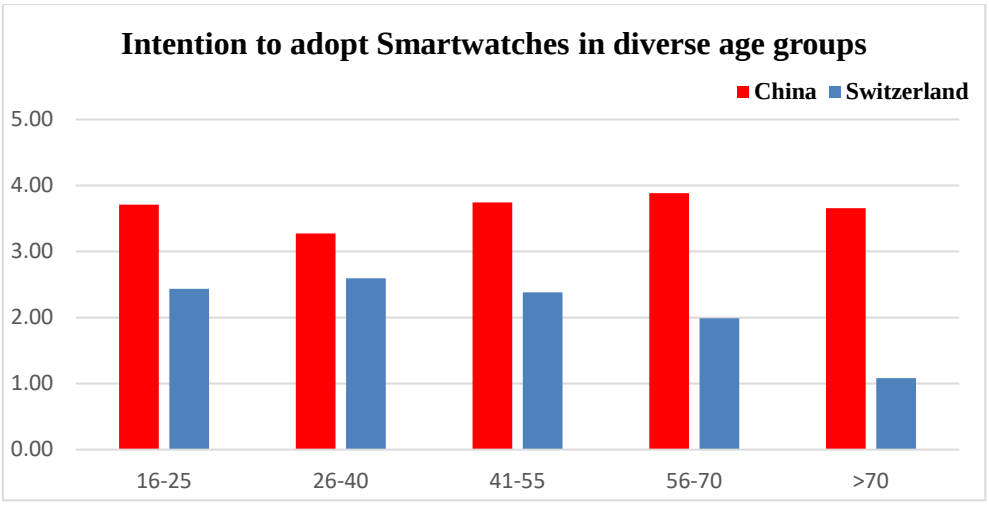

Figure 18: Behavior intention to adopt smartwatches in age groups

It is anyhow an interesting topic in future research to look more closely the influence on the conceptual model with control variables as covariate to country variable. It may be more important for an understanding of demographic behavior or other phenomena to know whether the inclusion of a categorical covariate in its entirety contributes significantly to an improvement of the model than to know the significance indicators of each of its levels (Hoem, 2008).

5.8. Additional remarks of Chinese and Swiss respondents

At the end of the questionnaire, the survey respondents are asked to provide further comments voluntarily on smartwatches. Twenty-five valid items from Chinese respondents, seven from Swiss and four from other nationalities living in Switzerland are collected (in Appendix C). People's comments of both countries confirmed additionally the perception and behavior differences based on varied cultural values explained in the previous sections.

Most comments from Chinese respondents manifest open and optimistic perceptions toward smartwatches. They expressed curiosity in future functional possibilities and positive intention to use them. Many Chinese demonstrated interests in monitoring accurate health vitals. Some mentioned that the design of smartwatches do not meet the aesthetical requirements, which are not fashionable and sometimes even dull. Some said low battery life and price quality issues of smartwatch are challenging. Few worried about the negative health impact by radiation while wearing smartwatches continuously. One person expressed importance of data protection when using smartwatches. These

comments reflect the survey results of Wen et al. (2017) in Section 2.1.3 with more than 2000 Chinese.

The comments of Swiss respondents and others nationalities living in Switzerland, (mostly Germans and Austrians) issued slightly conservative or even pessimistic tone toward smartwatches. For examples, most of them mentioned that smartwatches are redundant, as health could also be achieved though quietness and leisure, not only by performance measured in data. One said he/she would only use a smartwatch if he/she would suffer from a certain disease. Some Swiss and other nationalities living in Switzerland expressed they do not want to be dependent on a technical device as a principle. They would not enable the state, insurance or vendors to collect their personal data, to supervise them or even take use of their data for commercial purposes. One person mentioned that a readable manual is essential for using smartwatches, which is not the case with one Xiaomi product. Two brought up issues that multifunctional smartwatches are practical support for work or sport. These comments cannot be found in Seiler & Hüttermann's (2015) survey with young Swiss users of fitness trackers described in Section 2.1.4.

To summarize, the above additional comments reflected lively what the quantitative approach displayed, that Chinese have much higher intention to adopt wearables then Swiss. Chinese care more about healthcare functionality, fashion trends and practical utility of smartwatches; whereas Swiss care more about privacy data protection, and insist on the established lifestyle and principles. The differences have been explained in Section 5.5.2 and 5.5.3 on the basis of cultural value dimensions.

Until now, the second research question "What are the perceptions of Chinese and Swiss consumers toward wearables" and the third research question "How do cultural values influence the differences between Chinese and Swiss" are answered through moderating analysis, t-test, additional comments of survey respondents as well as the related explanation with cultural value dimensions based on reviewed literatures.

6. Conclusions and Implications

6.1. Conclusions

Base on the empirical study with Chinese and Swiss respondents, diverse factors are evidently proved to influence people's behavior intention to adopt wearables, and there are clearly different perceptions and intentions toward wearables between Chinese and Swiss consumers. These differences can be explained through varied national cultures distinguished by cultural value dimensions.

Among the influential factors, performance expectancy, hedonic motivation, effort expectancy and social influence affect behavior intention positively, which support the hypotheses H1, H2, H3 and H5 respectively. Functional congruence, health consciousness, perceived privacy risk do not affect BI significantly, which discard the hypotheses H4, H6 and H7. Nevertheless, moderating analysis with country variable (China vs. Switzerland) indicates HC is an important predictors affecting BI of Chinese positively, but do not have effect on BI of Swiss; PPR is a significant factor affecting BI of Swiss negatively, but do not affect BI of Chinese. PE is a key factor affecting BI of both Chinese and Swiss positively, but the influence degree of Swiss is higher than Chinese. Country variable is, however, not a moderator that differentiate the influence degree of HM, FC, EE, SI toward BI between Chinese and Swiss. These results confirms hypothesis H8a, and partially confirms hypothesis H8b. Chinese display significantly higher BI than Swiss consumers, which related to their higher value on PE, FC, EE, and SI then Swiss.

These results can be explained by different cultural values or healthcare systems between Chinese and Swiss, which are summarized in Table 22 (CN→China; CH→Switzerland).

Chinese value of collectivist and Swiss value of individualist are confirmed empirically in this study. As collectivist, Chinese search for information and support on wearables from people around them, attach more importance on others' opinions, and assimilate their peers. This explains higher values of FC, EE and SI of Chinese than Swiss. Chinese holding low uncertainty avoidance and "harmony" values toward surroundings embrace normally new technology and believe in its effectiveness, this cause them to have higher PE toward wearables than Swiss.

Variables	Values Comparison	Influence degree of Moderator	Explained cultural dimensions / social systems
PE	CN > CH	CN < CH	CN: low IDV; low UAI; “Harmony” CH: high IDV; high UAI; “Mastery”
FC	CN > CH		CN: low IDV; CH: high IDV
EE	CN > CH		CN: low IDV; low UAI; CH: high IDV; high UAI
SI	CN > CH		CN: low IDV; low UAI; high PDI CH: high IDV; high UAI; low PDI
BI	CN > CH		CN: low IDV; low UAI; “Harmony” CH: high IDV; high UAI; “Mastery”
HC		CN sig. CH non	CN: lack developed healthcare system CH: importance on sport activities
PPR		CN non CH sig.	CN: low UAI; “Harmony” CH: high UAI; “Mastery”

Table 23: Influential cultural values on differences between Chinese and Swiss

Swiss have significantly lower BI then Chinese, which can be explained by their high value of uncertainty avoidance and “mastery” relationship to surroundings (in contrast to Chinese). Using wearables reduce physical social presence thus increase the uncertainty. As a novel technology, the side effect, functionality and measurement accuracy are quite uncertain; this would reduce the intention of Swiss to adopt the wearables. Furthermore, the “mastery” value of Swiss toward environment/surrounding cause them stick with their habits and perceived correctness, which prevent them from trying new devices. This is confirmed by additional comments from Swiss in this survey described in Section 5.8.

Although the values of health consciousness are high for both Chinese and Swiss respondents, but it was not validated as a predictor, which influence the intention to use wearables generally. The reason probably lies in that Swiss spend already more time on sport or wellness activities to enhance their health condition, no more interest or time left to adopt a wearable for health purposes. This is confirmed by Seiler & Hüttermann (2015), that 51% of non-users (74% of full samples) in their study expressed no need to adopt fitness wearables. On the contrary, health conscious Chinese prefer to use wearables to help them enhancing the health condition, probably because that the health system of China is quite under developed, and Chinese are open for diverse possibilities. Thus, HC is a predictor to influence the user intention of Chinese, which is proved by moderating analysis.

The values of perceived privacy risk are relative high for both Chinese and Swiss, but through moderating analysis, it is only validated that PPR negatively influence the intention to use wearables of Swiss, but not Chinese. The live examples can be seen in the additional comments of Swiss in Section 5.8. This difference can be directly explained by high UAI and “mastery” value of Swiss versus low UAI and “harmony” value of Chinese.

The impact degree of social influence on intention to adopt wearables was not distinguished through moderating analysis of country variable, even Chinese manifest significantly higher value toward SI, which is the largest surprise at first glance. With further analysis of different value dimensions, it appears that in-group members would influence Chinese more due to values of collectivist or high power distance, but professionals would influence Swiss more due to values of high uncertainty avoidance. Therefore, the impact cannot be distinguished at an aggregated level.

6.2. Implications

Wearables play an increasing important role in our lives. Healthcare wearables along with mobile apps and sensor technologies provide possibilities to track health vitals and offer predictive diagnosis. This allows patients and healthcare professionals to identify early disease signals or prevent exacerbations, which shift interventions toward personalized medicine. Moreover, by generating continuous data in real time, wearables enable timely therapeutic adjustments, tracking of outcomes to validate health policy or reimbursement decisions, provide incentives for lifestyle changes to enhance health condition of people, thus reduce overall healthcare costs. Private data protection is an essential issue along with the development and application of wearable technology.

There are great opportunities for global firms of multifarious wearables to target consumers worldwide. Nonetheless, people in various countries distinguished by national culture would hold different perceptions toward wearables and intentions to adopt wearables. It is important for the global managers to realize these differences, understand the causes behind, then develop and market the wearables accordingly.

This study provides practical knowledge for global wearables vendors and insurers on influential factors for people’s intention to adopt wearables, explains their different perceptions and attitudes toward wearables, and explores the effect of national cultural

on the differences by means of Chinese and Swiss consumers and potential consumers. For example, for Switzerland with cultural value of individualism and high uncertainty avoidance, the positive opinions of professionals such as physicians toward wearables, the evident measurement accuracy and the clear data protection regulations would make Swiss consumers feel comfortable with wearables. For China with cultural value of collectivism and high power distance, the opinions and engagement of working unit of Chinese (e.g. employers' social benefit), the functional health apps (e.g. operated in WeChat) providing feasible healthcare advices in connection with real time data and promoting social interactions would inspire Chinese to adopt wearables.

Further, this study is one of the first to investigate intention to adopt healthcare wearables from a cross-cultural perspective. It provides theoretical foundation in terms of conceptual model and survey methodology for the future research in similar settings with other countries/cultures. However, many limitations appear during the research process, which is elaborated in next chapter with indication of future research direction.

7. Limitations and Future Research Direction

Limitation appearing in this study are listed in the following aspects:

7.1. Variables of conceptual model

Functional congruence was proved not being a very valid variable for the structure model. It holds three items that related to comfort, fashion and price-quality-ratio respectively. It lacks of consistency among these items, which was shown through Cronbach's value of 0.694 (slightly below 0.7). Although intuitively all these items related closely with the user intention, but it was neither confirmed by regression analysis nor by moderating affect. Therefore, the items of FC should be reorganized and reconsidered in the future research.

Social influence related to user's decision-making influenced by others' perceptions. These "others" include closed ones such as family members and friends, important persons like employer or peers around, professionals like physicians and technical specialists. The influence by different groups reflect total different cultural values of people. Therefore, it makes sense for future research in this regard to differentiate various influential groups.

Health consciousness related to many different concepts from health awareness, health concern to health activities. It influence users' perception and intention of wearables multilaterally. Thus, the author doubts if it is a perfect consideration to put HC at the position of predictors to the user intention. It might be one of pre-determining factors for other variables such as PE, EE etc. as investigated by some studies with controversy results (section 3.1). Therefore, HC should be examined in the future in different model structures.

Country variable based on national culture was examined in this study primarily as moderating variable, which affect the relationship between predictors and outcomes (behavior intention to adopt wearables). Through the above conclusion, it can be seen concretely that cultural values influence many aspects, from perception, attitude, to intention, further to action. Thus, the country/cultural variables might be predetermining factors for other predictors as well. In the further research, the roles and distinction of

cultural variables should be considered clearly at the beginning for the future study, and examined in different model structures as well.

The control variables such gender, age, education and income might be of influence on people's answering pattern (van Thiel, 2014, p. 81), which means they can interfere with the effect of user's intention to adopt wearables. The control variables as well as experiences were not considered in this study. The effect of control variables as moderator alone or as covariate with other moderators such as country/culture should be analyzed in the future.

7.2. Measuring cultural differences

Converting cultural differences into numeric scores is an imprecise science (Nardon, 2006). Cultures by definition are qualitative, not quantitative, and attempts to attach numbers to various cultures only invite errors and misunderstandings (although there are numeric scores suggested by the various models e.g., Hofstede, Trompenaars, GLOBE). Moreover, cultures are not monolithic; each culture consists of people who are different in many ways even if central tendencies can be differentiated between various nationalities (Nardon, 2006). In this study, quantitative approach is employed to test the cultural value of "individualism", which confirmed the country scores of China and Switzerland according to Hofstede (2013). However, moderating role of the cultural value "individualism" itself did not function due to abovementioned reasons. Thus, explanation of cultural value differences on different perception and intention between Chinese and Swiss are followed theoretically, which leaves much to be desired.

7.3. Survey methodology

In this study, written questionnaire was used to collect information from (potential) users of wearables. Van Thiel (2014) argues that standard questionnaire render a certain superficiality to the information gathered. Usually, a world of Information lies hidden behind the data collected in a survey (van Thiel, 2014, p. 75) Additionally, the questionnaire was not designed separately for users and non-users of wearables, and was not distinguished between different types of devices, such as consumer-grade and medical grade wearables in this study. Using smartwatches as examples of healthcare wearables might lead the respondents pay more attention to the fitness than medical functions. Even some of the hypotheses were confirmed, it lacks of specific information

on certain types of users or devices. Quantitative approach is applied to examine the research model of this study. Some experts argue that qualitative survey might achieve more information to answer how and why. Thus, expert or focus group interview could be especially conducted in future research regarding a certain type of medical-grade wearables to gain more specific and detailed information.

Furthermore, using two different platforms for conducting survey in German and Chinese causes much more work to integrate data, which are not totally in the same format. Future survey should avoid this by using one reliable survey platform for survey in different countries.

7.4. Reliability and validity of the survey

The criterion of objectivity, reliability and validity of this study are followed and reached during the whole process of research – from questionnaire design, translation, pilot study, samples collection/inclusion, measurement of the model to the statistical data analysis, further to the interpretation of the results. However, the results cannot be generalized to other countries, as the survey is only conducted in China and Switzerland, and the cultural dimensions are only used to explain the difference between Chinese and Swiss theoretically. That is to say, the external validity of the study is limited. Therefore, it makes more sense later on to apply cultural values directly in the quantitative analysis. For this purpose, the effective methods to obtain qualified scores of cultural values need to be further explored.

To summary, future research on healthcare wearables can focus on examining attitudes and behaviors of one specific group of consumers/patients, or consumers' perception toward one specific application fields. For this, the users of that specific application fields need to be enrolled, and qualitative approach like interview or focus group can be applied at the beginning to gain more in-depth information. More suitable models with proper variables can be examined in future research of wearables. Different consumers' perceptions of other countries can be investigated with similar model, but applying more qualified scores of cultural values for quantitative approach.

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9. Appendix

A. Questionnaire in German published on Survey Monkey

B. Questionnaire in Chinese published on Wen Jun Xing

C. Additional comments of survey respondents

D. Dataset in SPSS (separate file)

Appendix A: Questionnaire in German

Einstellung und Nutzungsabsicht von Smartwatches

Vielen Dank, dass Sie an dieser Umfrage teilnehmen.
Viele Faktoren beeinflussen die Entscheidung, eine Smartwatch zu verwenden oder darauf zu verzichten. Im Rahmen meiner Masterarbeit und Forschungsaktivität an der ZHAW School of Management and Law möchte ich den Einfluss der nationalen Kultur (China und Schweiz) sowie der individuellen Wertorientierungen am Beispiel in der Nutzung einer Smartwatch untersuchen. Diese Online-Befragung wird in der Schweiz und in China gleichzeitig durchgeführt.

Die Umfrage beansprucht ca. 10 Minuten Ihrer geschätzten Zeit.

Hinweis zum Datenschutz

Diese Umfrage dient ausschliesslich als Basis für eine wissenschaftliche Arbeit. Ihre Angaben werden anonymisiert erfasst und jederzeit vertraulich behandelt. Lediglich die aggregierten Daten werden in dieser Untersuchung analysiert. Es sind keine Rückschlüsse auf einzelne Personen möglich.

Für die Aussagekraft der Studie ist Ihre wertvolle Teilnahme von grosser Bedeutung. Bitte beantworten Sie alle Fragen bis zum Ende der Umfrage, auch wenn Sie in näherer Zukunft nicht beabsichtigen, eine Smartwatch zu verwenden.

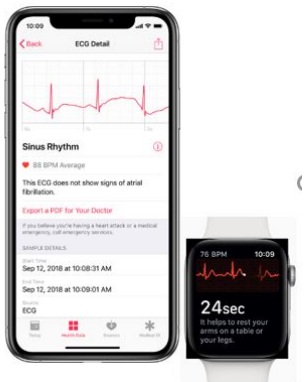
Herzlichen Dank für Ihre Unterstützung!

Eine Smartwatch bietet viele Funktionen inklusiv das Verfolgen von Sportaktivitäten, dem Schlafverhalten, die Messung des Kalorienverbrauchs，das Überwachen der Herzfrequenz, die Messung des Blutdrucks und des EKGs sowie eine Erinnerungsfunktion. Entwickler arbeiten bereits an zukünftigen Smartwatches, die Messungen von weiteren Gesundheitsindikatoren wie den Blutzuckerspiegel ermöglichen werden.

Die meisten Smartwatches können über soziale Medien Textnachrichten senden und empfangen, Wetterinformationen mitteilen, Aktienkurse auflisten sowie Karten und Wegbeschreibungen anzeigen.

Smartwatches sind in der Regel auf kompatible Smartphones angewiesen, um Echtzeit- oder historische Daten über eine Bluetooth-Verbindung anzeigen und analysieren zu können.

Anwendungsbeispiel von Smartwatches



1. Sie wohnen in

- ◯ China
- ◯ Schweiz
- ◯ Anderes Land

2. Ihre Nationalität ist

- ◯ China
- ◯ Schweiz
- ◯ Anderes Land

3. Ihr Geschlecht ist

- ◯ männlich
- ◯ weiblich

4. Haben Sie bereits einmal eine Smartwatch verwendet oder verwenden Sie derzeit eine Smartwatch?

- ◯ Ja, ich verwende derzeit eine Smartwatch.
- ◯ Ja, ich benutze sie aber nicht mehr.
- ◯ Nein, ich habe noch nie eine Smartwatch benutzt.

5. Falls Sie eine Smartwatch verwenden, wie oft verwenden Sie sie derzeit oder haben Sie sie bisher verwendet?

- ◯ Täglich
- ◯ Mehrere Male pro Woche
- ◯ Alle paar Wochen einmal
- ◯ Einmal in ein paar Monaten oder seltener

6. Welche Funktionen verwenden Sie oder haben Sie verwendet?

- [ ] Sportaktivitäten
- [ ] Schlafüberwachung
- [ ] Kalorienverbrauchsmessung
- [ ] Herzfrequenzmessung
- [ ] EKG-Messung
- [ ] Blutdruckmessung
- [ ] Messung anderer Gesundheitsindikatoren, bitte angeben:

7. Wie nützlich finden Sie eine Smartwatch?
Inwieweit stimmen Sie den untenstehenden Aussagen zu, auch wenn Sie keine Smartwatch besitzen?

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Ich finde die Smartwatch im täglichen Leben nützlich.	○	○	○	○	○
Die Verwendung einer Smartwatch hilft dabei, gesundheitsbezogene Ziele schneller zu erreichen.	○	○	○	○	○
Die Verwendung einer Smartwatch hilft mir bei meiner täglichen Gesundheitskontrolle.	○	○	○	○	○

8. Was halten Sie von der Anwendung einer Smartwatch?
Inwieweit stimmen Sie den untenstehenden Aussagen zu, auch wenn Sie keine Smartwatch besitzen?

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Die Verwendung einer Smartwatch macht Spass.	○	○	○	○	○
Die Verwendung einer Smartwatch ist angenehm.	○	○	○	○	○
Die Verwendung einer Smartwatch ist unterhaltsam.	○	○	○	○	○

9. Sind für Sie folgende Eigenschaften von Smartwatches von Bedeutung?
Inwieweit stimmen Sie den untenstehenden Aussagen zu, auch wenn Sie keine Smartwatch besitzen?

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Ich bin der Meinung, dass Smartwatches komfortabel sind.	○	○	○	○	○
Ich bin der Meinung, dass Smartwatches modisch sind.	○	○	○	○	○
Ich bin der Meinung, dass der Preis einer Smartwatch auch deren Qualität entspricht.	○	○	○	○	○

10. Wie leicht können Sie ein technisches Gerät wie eine Smartwatch bedienen?
Inwieweit stimmen Sie den untenstehenden Aussagen zu?

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Die Funktionalitäten eines technischen Gerätes wie eine Smartwatch sind für mich leicht erlernbar.	○	○	○	○	○
Technische Geräte wie Smartwatches sind für mich immer einfach zu bedienen.	○	○	○	○	○
Ich bin geschickt im Umgang mit technischen Geräten wie Smartwatches.	○	○	○	○	○

11. Wie wichtig ist die Meinung oder das Verhalten von anderen Leuten für Sie?
Wählen Sie bitte die auf Sie zutreffende Aussage.

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Leute, die mir wichtig sind, meinen, dass ich eine Smartwatch verwenden sollte.	○	○	○	○	○
Leute, die mich beeinflussen, meinen, dass ich eine Smartwatch verwenden sollte.	○	○	○	○	○
Leute, deren Meinung ich schätze, könnten mich dazu bringen, eine Smartwatch zu verwenden.	○	○	○	○	○

12. Sind Sie mit den folgenden Aussagen betreffend Ihrem Gesundheitsbewusstsein einverstanden?
Wählen Sie bitte die auf Sie zutreffende Aussage.

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Ich denke viel über meine Gesundheit nach.	○	○	○	○	○
Normalerweise kenne ich meinen Gesundheitszustand.	○	○	○	○	○
Ich achte auf Veränderungen in meiner Gesundheit.	○	○	○	○	○
Ich übernehme Verantwortung für meine Gesundheit.	○	○	○	○	○

13. Ihre persönlichen Gesundheitsdaten könnten von Smartwatch-Anbietern verwendet werden. Inwieweit stimmen Sie den untenstehenden Aussagen zu?

	Überhaupt nicht einverstanden	Nicht einverstanden	Neutral	Einverstanden	Vollständig einverstanden
Ich denke, das Risiko, dass andere meine privaten Informationen erhalten werden, ist gross.	○	○	○	○	○
Ich denke, dass das Offenlegen meiner Gesundheitsinformationen mir schaden würde.	○	○	○	○	○
Es bestünde zu viel Unsicherheit, wenn ich meine Gesundheitsinformationen weitergeben würde.	○	○	○	○	○

14. Werden Sie in Zukunft eine Smartwatch benutzen?
Inwieweit stimmen Sie den untenstehenden Aussagen zu?

	Sehr unwahrscheinlich	unwahrscheinlich	Neutral	wahrscheinlich	sehr wahrscheinlich
Ich beabsichtige, in Zukunft für **meine Gesundheit** eine Smartwatch einzusetzen.	○	○	○	○	○
Ich beabsichtige, in Zukunft **bei jeder Gelegenheit** eine Smartwatch einzusetzen.	○	○	○	○	○
Ich habe vor, in Zukunft meine Verwendung von Smartwatch **zu erhöhen**.	○	○	○	○	○

15. Welche Funktionen einer Smartwatch würden Sie in Zukunft nutzen?

	Sehr unwahrscheinlich	unwahrscheinlich	Neutral	wahrscheinlich	sehr wahrscheinlich
Sportaktivitäten	◯	◯	◯	◯	◯
Schlafüberwachung	◯	◯	◯	◯	◯
Kalorienverbrauchsmessung	◯	◯	◯	◯	◯
Herzfrequenzmessung	◯	◯	◯	◯	◯
EKG-Messung	◯	◯	◯	◯	◯
Blutzuckerspiegel Messung	◯	◯	◯	◯	◯
Blutdruckmessung	◯	◯	◯	◯	◯
Stimmungsüberwachung	◯	◯	◯	◯	◯

Messung anderer Gesundheitsindikatoren, bitte angeben

16. Folgende Fragen betreffen nicht die Nutzung einer Smartwatch.

Bitte denken Sie an eine ideale berufliche Tätigkeit. Dabei können Sie Ihre gegenwärtige Arbeitstätigkeit ausser Acht lassen, falls Sie berufstätig sind.
Wie wichtig ist es bei der Auswahl einer beruflichen Tätigkeit für Sie:

	gering wichtig oder unwichtig	weniger wichtig	ziemlich wichtig	sehr wichtig	von höchster Wichtigkeit
Genügend Zeit für sich persönlich oder für Ihr Privatleben zu haben.	◯	◯	◯	◯	◯
Einen sicheren Arbeitsplatz zu haben.	◯	◯	◯	◯	◯
Eine interessante Tätigkeit auszuüben.	◯	◯	◯	◯	◯
Eine Arbeit zu haben, die von der Familie und von Freunden respektiert wird.	◯	◯	◯	◯	◯

17. Sie sind im Alter von

- ◯ 16-25
- ◯ 26-40
- ◯ 41-55
- ◯ 56-70
- ◯ Über 70

18. Ihre höchste absolvierte Ausbildung ist

- ◯ Berufslehre
- ◯ Gymnasium
- ◯ Höhere Fachschule
- ◯ Fachhochschule/Universität
- ◯ Keine Angabe

19. Ihr monatliches Einkommen in CHF

- ◯ < 500
- ◯ 501 – 1500
- ◯ 1501 – 3000
- ◯ 3001 – 5000
- ◯ > 5001
- ◯ Keine Angabe

20. Falls Sie noch ergänzende Informationen zur Verwendung von Smartwatches mitteilen möchten:

Herzlichen Dank für Ihre Geduld und Ihre wertvolle Teilnahme!

Appendix B: Questionnaire in Chinese

智能手表使用意向在线调研

衷心感谢您的参与！

许多因素决定了您是否想要使用或不想使用智能手表。作为在瑞士苏黎世应用科技大学经济管理与法律学院（ZHAW
SML）的科研活动的一部分，我将以智能手表为例调研文化（中国与瑞士）以及个人价值取向是否会以不同程度方式影响电子佩戴设备的使用意向。该网上调研将同时在瑞士和中国进行。

本调研预计需要占用您约10分钟的宝贵时间。

关于隐私的说明

该调研仅作为一项科学工作的基础。您的回答将通过网上问卷匿名收集，始终保密。使用该调研方式没有追溯个人相关信息的可能，而且只有聚合数据将用于本课题研究。

您宝贵的参与对研究的有效性非常重要。即使您不打算在不久的将来使用智能手表，也敬请回答所有必答的问题。

再次感谢您的支持！

关于智能手表的重要信息

智能手表具有许多医疗保健相关的功能，其中包括跟踪您的体育活动、睡眠模式，测量热量消耗，监控心率、测量血压、心电图以及相关提醒功能。未来的智能手表可以测量其他健康指标，例如血糖水平等。

大多数智能手表还可通过社交媒体发送和接收短信，显示天气信息，列出股票价格以及显示地图和方向。

智能手表通常依靠兼容的智能手机通过蓝牙连接显示并分析实时和历史数据。

使用示例：

1. 您居住在: [单选题] *

○中国 ○瑞士 ○其他国家 _____

2. 您的国籍: [单选题] *

○中国 ○瑞士 ○其他国家 _____

3. 您的性别: [单选题] *

○男 ○女

4. 您是否使用过或正在使用智能手表？[单选题] *

○是的，现在仍在使用。

○是的，但现在不用了。

○没有用过。(请跳至第7题)

5. 如果您使用（过）智能手表，您目前或曾经多久使用一次智能手表？[单选题]

○每天

○一周几次

○每隔几周

○几个月或更长时间

6. 如果您使用（过）智能手表，您都使用哪些功能？[多选题]

□体育活动

□睡眠监测

□卡路里消耗测量

□心率监测

□心电图测量

□血压的监测

□监测其他健康指标，请注明：_____

7. 您觉得智能手表有多大用处？请针对如下说法选择您同意的程度:[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
我觉得智能手表在日常生活中很有用。	○	○	○	○	○
使用智能手表可以帮助我更快地实现保健的目标。	○	○	○	○	○
使用智能手表可以改善我日常健康监测的质量。	○	○	○	○	○

8. 您对智能手表的使用有何看法？请针对如下说法选择您同意的程度:[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
使用智能手表很好玩。	○	○	○	○	○
使用智能手表令人愉快。	○	○	○	○	○
使用智能手表很有娱乐性。	○	○	○	○	○

9. 智能手表的以下特性对您重要吗? 请针对如下说法选择您同意的程度:[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
我认为佩戴智能手表很舒适。	○	○	○	○	○
我认为智能手表很时尚。	○	○	○	○	○
我认为智能手表的性价比很合适。	○	○	○	○	○

10. 您觉得自己可以轻松使用类似智能手表的技术设备吗?

请针对如下说法选择您同意的程度:[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
类似智能手表的技术设备的功能对我来说很容易学。	○	○	○	○	○
我觉得类似智能手表的技术设备很容易用。	○	○	○	○	○
我很快就能熟练使用类似智能手表	○	○	○	○	○

的技术设备。					

11. 其他人的观点或行为对您来说重要吗？请针对以下说法选择您的观点：[矩阵量表题] *

	很不可能	不可能	不确定	可能	很可能
对我很重要的人会认为我应该使用智能手表。	○	○	○	○	○
影响我的人会认为我应该使用智能手表。	○	○	○	○	○
我重视其观点的人可能会让我使用智能手表。	○	○	○	○	○

12. 您是否同意以下关于自己健康意识的陈述？请针对如下说法选择您同意的程度：[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
我经常思考自己的健康状况。	○	○	○	○	○
通常我了解自己的健康状况。	○	○	○	○	○

我注意自己健康的变化。	○	○	○	○	○
我对自己的健康负责。	○	○	○	○	○

13.

关于您个人的健康信息能被智能手表供应商获取使用，您的态度是？请针对如下说法选择您同意的程度：[矩阵量表题] *

	很不同意	不同意	一般	同意	很同意
我认为我的隐私信息被他人获取的风险是很大的。	○	○	○	○	○
我认为披露我的健康信息会给我带来很大损失。	○	○	○	○	○
提供个人健康信息会造成我无法控制的后果。	○	○	○	○	○

14. **将来您会使用智能手表吗？请针对如下说法选择您同意的程度：[矩阵量表题]** *

	很不同意	不同意	一般	同意	很同意

我打算将来为了我的健康使用智能手表。	○	○	○	○	○
我打算在未来的每个机会都使用智能手表。	○	○	○	○	○
我打算将来增加对智能手表的使用。	○	○	○	○	○

15. 您将来可能会使用智能手表的哪些功能？[矩阵量表题]

	很不可能	不可能	不确定	可能	很可能
体育活动	○	○	○	○	○
睡眠监测	○	○	○	○	○
卡路里消耗监测	○	○	○	○	○
心率监测	○	○	○	○	○
心电图测量	○	○	○	○	○
血糖的监测	○	○	○	○	○
血压的监测	○	○	○	○	○
心情监测	○	○	○	○	○
监测其他健	○	○	○	○	○

康指标					

16. 以下问题与智能手表的使用无关。

在不考虑当前工作的情况下（如果您在职的话），请您设想一个理想的工作。在选择理想工作时，下列各项对您的重要程度是：[矩阵量表题] *

	不重要或完全不重要	不太重要	一般重要	很重要	最重要
为个人或家庭生活留有充足的时间。	○	○	○	○	○
工作稳定有保障。	○	○	○	○	○
有趣的工作内容。	○	○	○	○	○
该工作受到您的朋友和家人的尊重。	○	○	○	○	○

17. 您所属的年龄段为[单选题] *

○16~25岁

○26~40岁

○41~55岁

○56~70岁

○70岁以上

18. 文化程度[单选题] *

○中专

○高中

○大专

○大学以上

○无可奉告

19. 您的月收入额为[单选题] *

○3000元及以下

○3001~9000元

○9001~18000元

○18001~30000元

○30001元以上

○无可奉告

20. 如果你愿意补充关于使用智能手表的信息，请填写：[填空题]

_____

Appendix C

Additional comments from survey respondents on smartwatches

Remarks of Chinese respondents:

1. 应该比较准确测量血压和血糖

   Blood pressure and blood sugar could be measured accurately.
2. 智能手表技术发展很快，希望能有更多的实用功能方便生活有益健康。

   The technology of smartwatches is developing rapidly; hope to have more practical functions to make life healthier.
3. 功能基本一致，但针对女性和男性不同需求，应该有不同的划分。女性的配搭服装或者个别场合不适用，是否外形上要思考

   The functions are basically the same, but there should be different segmentations for different needs of women and men. It is not applicable for women's clothing matching for different occasions. The shape should be considered.
4. 外观不够美观

   The appearance is not attractive enough.
5. 舒适

   Comfortable.
6. 容易过时

   Easy to be out of fashion.
7. 产品还不够普及

   The product is not popular enough.
8. 没有使用过智能手表，但是觉得市场上的智能手表无论是外观上还是应用上没有惊喜感

   I have never used a smartwatch, but I feel there is no surprise either in the appearance or functionality of smartwatches on the market.
9. 智能手表的使用寿命应该比较长，价格比较适中。

   The service life of smartwatches should be long and the price is moderate.
10. 个人信息和健康检测结果的保密非常重要

    The confidentiality of personal information and health test results is very important.

11. 以后我会使用

I will use it later.

12. 提高性价比

Improve price performance ratio.

13. 辐射问题。佩戴增加时尚感。能不能脱离手机记录。续航问题。性价比问题

Radiation issues; adding a sense of style; can it function without phone record; battery problem; cost-effectiveness problem.

14. 智能手表测量数据应准确可靠，使用简单方便才能去购买

Data measurement of smartwatches should be accurate and reliable. It should be easy to use then I will purchase.

15. 希望能有定位功能

I hope to have a navigation function.

16. 至今还没用过智能手表，不知道怎么填写

I have not used a smart watch yet, I do not know how to fill it out.

17. 我很关注智能手表对健康指标的监测功能

I am interested in the monitoring function of smartwatches on health indicators.

18. 我非常想使用智能手表，不知价格多少？

I really want to use a smart watch. I don't know how much it costs?

19. 智能手表耗电量太大，需要每天充电，不方便

Smartwatches consume too much power and need to be recharged every day.

20. 希望大力普及

Hope it can be vigorously popularized.

21. 正在研究智能手表的功能应用和价格。会首选苹果的，主要是一直用苹果手机，方便。

I am studying the functional application and price of smartwatches. Apple will be the first choice, because I mainly use Apple phones, convenient.

22. 简单轻便易掌握

Simple and easy to master.

23. 我在期待智能手表给我的生活带来变化

I am looking forward to the changes that my smartwatch will bring to my life.

24. 担心有辐射，有反作用

Worried about radiation, counterproductive.

25. 对健康的监测和提醒

    Health monitoring and reminders

Remarks of Swiss respondents:

1. Mir ist noch wichtig, dass ich nicht in eine Abhängigkeit solcher technischen Geräte gelange.
2. Ich finde eine Smartwatch völlig überflüssig. Ich würde nie persönliche Daten preisgeben. Das geht einfach niemand etwas an, d.h. die Anbieter sollen kein "Geld" damit machen können.
3. Datenschutz, keine Überwachung Staat sowie Versicherungen
4. Ich würde die Smartwach verwenden, wenn ich eine bestimmte Krankheit hätte, z.B. Herzkrankheit oder Diabetes. Dies kann ich zum jetzigen Zeitpunkt nicht beurteilen, da ich gesund bin.
5. Ich bin Geschäftsführer und brauche die Swatch ausschliesslich zum Arbeiten, d.h. ich kann erkennen wer mich anruft ohne jedes Mal das Mobile herausnehmen zu müssen. Wenn ich aus Beruflichen Gründen kein Mobile bräuchte, dann hätte ich höchstens ein KlappHandy. Freundliche Grüsse
6. Für mich war auch noch ausschlaggebend das die Uhr die Anzahl L?ngen im Hallenbad zählt und bei Biketouren die Richtungswechsel angeben kann :-)
7. Da Datenlecks laufen aufgedeckt werden, finde ich, dass jeder Mensch sehr zurückhaltend mit der freiwilligen Uebermittlung seiner Daten, sei es gesundheitlich, wie auch alle andern Daten, sein sollte! Die Sammelwut der Behörden, Krankenkassen etc. wird durch kleine, unbedeutende "Goodies" dem breiten Publikum schmackhaft gemacht. Die Smartwatch ist m.E. der erste Schritt zum persönlichen, eingepflanzten Chip. Hoffe, ich irre mich....

Remarks of respondents of other nationalities living in Switzerland:

1. Gesundheit ist auch von Ruhe und Musse abhängig, nicht nur "Leistungsdaten". Wie kann eine Smartwatch beispielsweise Aktivitäten beim Yoga messen?
2. Eine Smartwatch für <25€ Casio CA-53W-1 "Back to the Future"
3. Jede Smartwatch sollte ein Manual besitzen, das jeder lesen kann. Negativ Beispiel: xiaomi mi band 3
4. Smartwatches sind überflüssig. Ich ziehe die Benutzung meines Gehirns vor.