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Internet of Things devices appropriation process: The Dynamic Interactions Value Appropriation (DIVA) framework

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Abstract

This research aims at exploring IoT devices appropriation process from a consumer's perspective. Using qualitative interviews on smart watches consumers, we identify four various stages of the appropriation process: symbolic appropriation, exploration, use construction and stabilization. Through the DIVA framework, our results show that the appropriation process is a dynamic phenomenon relying on both specific interactions and value type, linked to IoT devices characteristics. This research gives a better understanding of IoT devices consumers' appropriation process, enabling the identification for companies of variables for actions to improve it.

Keywords: Appropriation, interactions, value, smart watch, Internet of Things

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Abstract

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1. Introduction

According to the IEEE, the world's largest technical professional organization for the advancement of technology, the Internet of Things (IoT) is the inter-networking of physical devices, vehicles (also referred to as “connected devices” and “smart devices”), buildings, and other items, embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The objects have the capacity to communicate with devices and services over the Internet to accomplish objectives (Whitmore et al. 2015). This research aims at explaining the appropriation of such IoT devices from a consumer’s perspective.

Experts report that IoT represents one of the top strategic technology trends expected to shape business opportunities through 2020 (Gartner, 2015). The Ericsson Mobility Report (June 2015) predicts that there will be more than 25 billion connected devices in 2020, and the estimated value of the global Internet of Things market in 2022 is 14.4 trillion dollars (Cisco, 2013). For Newman (2015), *“like any company that blissfully ignored the Internet at the turn of the century, the ones that dismiss the Internet of Things risk getting left behind.”* The predicted high growth of IoT markets directly affects most of companies’ marketing strategies, since most everyday life products can potentially become smart, such as cars, wearable, home, sports or health devices. In these highly connected environments, one important remaining research question relates to the understanding of consumer usages and behavior, as well as the identification of theories explaining its potential changes.

Indeed, as pointed out by Ives et al. (2016), one of the most consistent findings of the information systems literature is that the increasing computational power and connectivity of the IoT have enabled devices and products to shape and reshape, on an ongoing basis, customers’ service expectations. This potential is related to the two dimensions characterizing IoT devices. First, the Internet of Things is *“firmly rooted in tangible objects with their “mind” in the cloud”* (Ives et al., 2016: 281). As explained by the authors, although the objects are physical and resemble common everyday things, they are in fact “augmented” by software capabilities. On this basis, connected devices have four dimensions: a *physical dimension*, the product itself; an *intangible dimension*, the service provided, usually through specific applications; *object-to-object connectivity*; and finally *human-to-human social connectivity*, as every connected object offers the possibility to communicate with other people. Second, every IoT device dimension is characterized by scalability (which may be actual or potential) over time. The device may evolve physically through user personalization

and the associated service through new applications; the object's connectivity with other IoT devices may also increase, leading to the construction of a new connected environment (Hoffman and Novak, 2015).

Regarding those specificities, researchers highlight that there is still a need for investigation about customer perception of IoT technology (Gao and Baj, 2014; Madhani, 2015), and that further research is needed to understand the factors determining customer acceptance (Evanschitzky et al. 2015). This issue relates in particular to wearable technology products, as their adoption rate is relatively low for the moment (Sultan, 2015). In addition, about half of consumers abandon their wearables within the first six months (Ledger, 2014; Levy, 2014). The understanding of what drives adoption and sustained use of such products is therefore a very relevant question (Canhoto and Arp, 2017), since there is little empirical research that investigates this issue and clarifies how the conceptual models are applicable in reality. Besides, successful implementation of IoT technology depends on its continued use (Balaji and Roy, 2017), especially since it evolves rapidly over time, requiring a shift in focus from initial adoption to continued use (*ibid*). Going beyond adoption to investigate the appropriation process is a particularly salient issue, as the factors contributing to initial adoption are distinct from those determining continuing intention of use (Evanschitzky et al., 2015, Canhoto and Arp, 2017). But although several works in literature have investigated appropriation in different contexts — technology (Carroll et al., 2003), service (Mifsud et al., 2015) and consumer experience (Cora and Cavu, 2003) — the appropriation of a smart device has been usually restricted to the use of smart phones.

Therefore, to fill those remaining gaps in the literature, this research investigates the process of the user's IoT appropriation and continuity of use, by explaining the evolution of the use of IoT wearables over time, and the reasons why some customers become really committed to them, while others simply stop using them. By focusing on the user's behavior, the approach adopted differs from those focusing on sociological factors as a way of explaining the adoption and/or appropriation of technological products (i.e. the “social shaping of technology” theory). In fact, most existing academic research on technology appropriation is conducted at group or organizational level (Orlikowski 1992; DeSanctis and Poole 1994; Milesi et al., 2013), and there are few studies that focus on the individual level. In view of this, Balaji and Roy (2017) argue that although many researchers have used technology acceptance models to identify the factors determining customer acceptance of IoT retail technology (e.g. Huang and Liao, 2014; Pantano and Servidio, 2012), there is a need for

systematic research on IoT technology from a customer's perspective. This *user-centric approach* is particularly helpful in investigating the use of wearables which are, unlike other forms of IoT, machine-to-human interfaces (Holdowski et al. 2015). Most health and fitness wearables in fact have open application programming interfaces (APIs), allowing third-party applications to access the data stored in these devices (Ledger, 2014). This ability to integrate devices and third-party applications brings additional benefits and issues for consumers and as such, should be studied from a consumer perspective (Groopman, 2015).

Based on the earlier arguments, the present research aims at explaining and bringing insights into the appropriation process of a wearable device, with an empirical qualitative study on smart watches. The smart watch is one of the most widely used IoT devices and has the specificity to represent a well-known category of product used daily in the "*regular version*". Investigating the appropriation process of such products, which have evolved by integrating a new connectivity dimension, will highlight the specific aspects related to this connectivity. For this purpose, this research relies on the Service-Dominant logic (Vargo and Lush, 2008), which is seen as being more appropriate than traditional approaches for studying customer experience with IoT technology, because of its highly interactive nature. Balji and Roy (2017) argue indeed that customers engage with IoT because of their learning process and their construal of the value co-creation process. Thus, the present study addresses an important literature gap, by developing a model, based on the S-D logic, which explains the appropriation process with IoT wearable technology. The understanding of this kind of process might have a significant impact on managerial practice, as it can provide insights about the actions to be undertaken to guide the consumer in his/her use of IoT devices. On this basis, the research focuses on two main issues:

- Elaborating an actionable framework describing the consumers' appropriation process with regard to IoT wearable devices
- Investigating how the consumer, throughout the appropriation process, creates value in practice, which is considered as a top research priority in marketing (i.e. McColl-Kennedy et al., 2012), and how, in a recursive way, this value contributes to the appropriation process. The objective here is to investigate how the value co-created by the user participates in the device consumer's appropriation. Indeed, although Green and Haddon (2009) present the appropriation as requiring an ongoing participation of the user and representing a continuum gathering together individual experiences, needs, values and

beliefs, there is no empirical investigation gathering together personal experiences, values and the appropriation process.

The paper presents then first, a theoretical background on the concepts of appropriation and value, then the methodology and the results of the DIVA framework proposed to describe the process of IoT device appropriation, followed by a discussion and conclusion.

2. Theoretical background

2.1. Appropriation

Appropriation has been a notable area of research in social science. This concept can be broadly defined as “making something your own”. In the field of technologies, appropriation is often defined as the process through which the user adopts, adapts and incorporates this technology in his/her practice, work or leisure (Bar et al., 2016; Carroll et al. 2003; Dourish, 2003; Waycott, 2005). It may occur when there is no tool that can be used for the required task (Dix, 2007). Adaptive structuration theory (DeSanctis et Poole, 1994) postulates that a technology appropriation embraces multidimensional processes engaging individuals, society and technological devices. New technology may indeed affect human activities by offering new opportunities and resources or constraints. However, this can be changed during the appropriation process: consumers may use the technology in a way and for objectives different from those imagined by the designers. In fact, the literature has shown that people participate actively and significantly in the shaping of technology, by giving meaning to it, and by integrating it into their daily practices and social relationships (Mackay and Gillespie, 1992; Williams and Edge, 1996; Ling, 2004). For Dix (2007), appropriation cannot occur until the individual “tames” the technology, feels himself skilled and comfortable with it and sufficiently manages it. In this regard, appropriation relies on the use of the new technology to satisfy people’s different purposes beyond the initial conception of designers. Through appropriation, users negotiate individually and with others on how to use the technology in their real life according to their needs: “Technology as designed” is transformed into “Technology in use” (Carroll et al., 2003).

Several researchers agree on describing appropriation as having two main dimensions (Brunel et al. 2013): one is praxeological and the other is recursive. The praxeological dimension stems from the fact that appropriation relies on action (physical and psychological); the recursive dimension relies on the fact that the appropriated object contributes to the user’s self-construction. This process can follow different paths (i.e. a regular sequence of

archetypes) (de Vaujany, 2001), summarized (by de Vaujany (2002) into two main ones: equilibrium-based appropriation and improvisation-based appropriation (Orlikowski, 2000). In the first path, routine and stability constitute the basic state of a social-technical system in the appropriation process. In the improvisation path, the system is less stable and the individual (or organization) may use different archetypes to appropriate the technology, which is regularly “re-enacted by the actors”.

Several factors affect the appropriation process: the macro-environment, individual skills and abilities, as well as users’ creativity and knowledge (Isaac et al, 2006). Examining the appropriation process in leisure conditions, Carroll et al. (2003) strive to understand the use of new technology at the individual level. In their study on mobile technology, appropriation begins with an individual’s decision to adopt, and is followed by the individual’s deeper evaluation through use. The authors suggest that technology appropriation involves evaluation by users as they encounter (phase 1), adopt and adapt (phase 2), and integrate (phase 3) a new technology into their daily practices. They also identify three sets of influential factors at each phase of the process, implying either non-appropriation, disappropriation or appropriation of the technology. This study offers an explicit understanding of the process and the factors leading individuals to use a mobile phone in their daily life.

Appropriation thus relies on active interactions between subjects and objects. Yet, the interaction with IoT introduces new challenges because of the objects’ interconnectivity and their autonomous evolution according to exchanged information (Angelini et al., 2018). Then, unlike traditional objects, the interactions with IoT devices are dynamic and occur in a bidirectional way. The IoT device is indeed an active actor per se, and is capable of maintaining a relationship with users (Groopman, 2015). This active-way interaction is more specifically observed when devices take over human-like drives with voice control (Woodside and Sood, 2017). In this case, interactions between consumer and things “*undergo emergence and contribute something greater than the sum of the parts resulting in new consumer experiences embodying design, complexity and anthropomorphism*” (ibid: 106). Then, consumer-product interactions lead to the emergence of a new identity associated with the device, and result in value co-creation (Balaji and Roy, 2017), motivating the adoption and continued use of IoT technology (Vargo and Lush, 2016).

2.2 The importance of value co-creation in the Internet of Things

Perceived value is usually one essential outcome of marketing activity and a primary motivation for customers to enter into a marketing relationship (Babin, et al. 1994). Value perception is for example one of the factors explaining the consumer's intention to use a service in the future (Mencarelli and Rivière, 2014; Parasuraman and Grewal, 2000). Furthermore, perceived value often leads to repeat purchase behavior and has a positive effect on behavioral intentions (Grissmann and Stokburger-Sauer, 2012; Sweeney et al. 2015) and behavioral responses (See-To and Ho, 2014).

Holbrook (2005: 46) defines value as being (1) interactive, (2) relativistic [(a) comparative, (b) personal, and (c) situational], (3) preference, and (4) experience. Interactive customer value means that it involves a relationship between the consumer and the product. It is also relativistic as “(a) it reflects a comparison of one object with another, (b) it differs between one person and the next, and (c) it depends on the situation in which the evaluation occurs”. The value embodies then the consumer preference (i.e. like/dislike; favorable/unfavorable) and is related to the *relevant consumption experience* (involving for example fantasies, feelings, fun) rather than to the object itself. This definition implies that the consumer experience represents the key to generating value perceptions (Grewal et al., 2009).

To understand a user's experience with IoT devices, the Service-Dominant (S-D) logic (Vargo and Lusch, 2008) seems to be particularly appropriate. This paradigm focuses on what goods and services can do for the customer, the experienced customer value, making “*the old dichotomy between goods and service obsolete*” (Edvardsson et al. 2012: 419). Here, “*the focus is not on the service or product, per se, but on the value-creating process and the outcome of that process*” (ibid: 420). Value is therefore co-created with customers, and this co-creation shapes and determines their experience with the service. The notion of “value co-creation” groups together two components (Lusch and Vargo 2006: 284). The first is value-in-use, meaning that “*value can only be created with and determined by the user in the ‘consumption’ process and through use.*” The second is co-production, meaning “*the participation in the creation of the core offering itself. It can occur through shared inventiveness, co-design, or shared production of related goods, and can occur with customers and any other partners in the value network.*”

According to Woodside and Sood (2017), the S-D paradigm in the world of IoT provides a new view of reality for IoT marketing. In their view, each IoT device provides not only a functionality of the “thing” physically and locally, but also “*the service digitally on a global basis through an exchange of knowledge between the consumer-and-object or object-to-*

object” (*ibid*: 101). Woodside and Sood talk about a “thing-as-a-service” (Taas), where the service offerings, unlike in traditional products, “*are the result of ongoing collaboration or co-production with the customers*” (*ibid*: 102). In the same way, Balji and Roy (2017) assert that customers have many opportunities for value co-creation in the context of IoT technology, with a positive effect on the continuance of intentions of use. In this respect, different aspects of consumer experience - ease of use (EU) (Evanschitzky et al., 2015; Gao and Bai, 2014; Pantano and Servidio, 2012), superior functionality (Huang & Liao, 2014), aesthetic appeal (AA) (Bardaki et al., 2012), and presence (PR) (Atzori et al., 2010; Huang and Liao, 2014) - are considered by Balji and Roy (2017) as determinants of value co-creation in the IoT technology context.

2.3 Value dimensions

Investigating the dynamics of value creation requires first defining its dimensions. According to the nature of product characteristics, various types of value dimensions have been identified (Aulia, et al., 2016). In this regard, the lack of agreement about the conceptualization of perceived value indicates that it is a complex construct. Some authors consider the construct to be unidimensional, while others present it as multi-dimensional (i.e. Sanchez-Fernandez and Iniesta-Bonillo, 2007). The majority however agree that perceived value should be considered as a multi-dimensional construct (Aulia et al., 2016). In that respect, several authors propose models to conceptualize the consumer perceived value, stressing different dimensions of it. The best-known model is probably that of Hirschman and Holbrook (1982), which mainly distinguishes between the utilitarian and the experiential hedonic aspects. Based also on a distinction between a utilitarian and hedonic perspective, Sheth et al (1991a; 1991b) have developed, through their consumption theory, a broader theoretical framework about perceived value, which describes five value dimensions. The *functional value* is related to the utilitarian or functional purpose of the product; the *emotional value* concerns the consumer’s feeling aroused by the product use; the *social value* is related to the image obtained from society; the *epistemic value* is driven by curiosity, the search for novelty or the desire for knowledge; finally, the *conditional value* is related to specific situations or circumstances the consumer must face. Expanding his previous work, Holbrook (1996) proposes eight dimensions of consumer value, namely *efficiency value*, *play value*, *excellence value*, *aesthetic value*, *status value*, *ethics value*, *esteem value*, and *spirituality value*. Holbrook’s typology relies on three key dimensions of value: 1) extrinsic versus intrinsic, 2) self-oriented versus other-oriented and 3) active versus reactive. Extrinsic value

sees the product or experience as a means to an end, whereas intrinsic value considers a consumption experience as an end-in-itself. Second, self-oriented value depends on the effect a particular product or experience has on the consumer (how he/she responds to it) and other-oriented value depends on how a product or experience affects others. Third, active value results from the physical or mental manipulation of some product or experience, while reactive value leads to a more distanced admiration or appreciation of an object. The activity dimension reflects the user's ability to engage in value co-creation, as active value implies a heightened collaboration of the consumer, taking the form of cognitive, behavioral or financial investment by the consumer (Mathwick et al. 2001).

Even if this model is considered as being more comprehensive than others (Aulia et al., 2016), certain criticisms have been leveled at its complexity, regarding the operationalization of certain dimensions of value (e.g. ethical value and spiritual value) (Sanchez-Fernandez and Iniesta-Bonillo, 2007). In an integrative approach, Aulia et al. (2016) propose a typology based on consumer needs, categorizing value dimensions into three categories: *product-related value*, *social-related value* and *personal-related value*.

Product-related value encompasses all the benefits that the consumer takes from the product's use, classified in two categories. The first one relates to the product function: it includes the *utilitarian value* (Hirschman and Holbrook, 1982) - or *functional value* (Sheth et al., 1991a) -, reflecting the product's performance and quality (Sweeney and Soutar, 2001), and the *convenience value* (Pura, 2005) - or the ergonomic value (Creusen and Schoomans, 2005) - which reflects the product's ease of use. The second type of benefits relates to the consumer's need for pleasure and is named differently by the authors. For example, Hirschman and Holbrook (1982) and Babin et al. (1994) talk about hedonic value, while Sheth et al. (1991b) talk about emotional value. The social-related value refers to a customer perspective considering that society is the source of value (Aulia et al., 2016). It arises from the consumer feeling of connection to other people (Sheth et al., 1991a). Here, the product is evaluated on how well it can help the customer to be accepted within the society, or on how the product can help to make a good impression on others (Aulia et al., 2016). Finally, the personal-related value is defined by Aulia et al. (2016) as the consumption benefits related to consumers' personal values, which refer to the enduring beliefs that guide the way the people behave in daily life activities (e.g. Rokeach, 1968). This implies making a distinction between "value" and "values", the former as representing a preference judgment and the latter as the criteria by which people make preference judgements (e.g. (Holbrook, 1996)).

The different typologies presented above highlight different value dimensions, related to the product, to the consumer, to the context of the use, contributing to value perception and creation. Considering that this value is evolving and changing in nature and intensity through the consumer-device interactions, it is essential to investigate: 1 - how the ongoing process of value co-creation participates in appropriation of the device; 2 - what are the specificities of value co-creation regarding the characteristics of IoT devices.

3. Methodology

As the main objective of this paper is to better understand the appropriation and value co-creation processes in the new context of IoT devices, the research relies on a qualitative exploratory approach based on interviews with users of different brands of smart watches, followed by an interpretative content analysis. Eighteen participants were recruited through social networks and e-mailing to persons working and studying on the campus, and recruitment was stopped when data saturation was reached. The participants' profiles were diverse in terms of gender, age and social background as well as familiarity with new technologies. In recalling their experiences, users mentioned different factors, actions, reactions and processes which were involved in their smart watch appropriation. Each interview was examined to gain a holistic understanding of the respondent, noting themes in the margin as they emerged (see Thompson & Hirschman, 1995). This thematic codification followed an iterative process until saturation was reached. The development of the coding scheme was guided by three main questions: 1- How is the use of the smart watch changing through time?; 2- What are the changes among users at the cognitive, affective and behavioral level?; and 3- What are the main factors impacting the evolution of appropriation? The coding was enriched incrementally following the reading of the interviews. Three researchers coded the interviews, with an agreement between coders higher than 80%. The analysis followed two steps. The first thematic analysis provided insights about the appropriation process dimensions, and then axial coding enabled the detection of relationships between some important categories (i.e. user expertise and familiarity; buying context) and the appropriation dimensions, revealing factors impacting this process. Appendix 1 presents a summary of the main categories obtained from the analysis with some examples of transcripts.

4. Results analysis

The content analysis highlights the fact that the appropriation process of the smart watch is built throughout different types of interactions, which drive a set of cognitive,

affective and behavioral effects and lead to value creation at different levels. By describing these interactions and their impact on the evolution of smart watch use, four different appropriation stages have been identified: *symbolic appropriation*; *exploration*; *use construction*; and *stabilization*. Yet, the succession of these phases is not linear as the user may move from one phase to another in a transversal way. He/she may be for example in a discovering stage regarding a particular functionality, and in a control stage regarding another. This non-linearity is reinforced by the evolving nature of the smart watch, which offers the opportunity to the user to continually add new applications.

4.1 Interactions are the basis of value creation and the appropriation process

The first finding of the content analysis is that smart watch appropriation relies on ongoing user-device, user-service and object-object interactions. These interactions transform product or service functionalities into affordances, by a progressive integration of each of the four dimensions of an IoT device, namely: the *physical dimension*; *object-to-object connectivity*; the *intangible dimension* (i.e. the provided service); and finally *human-to-human social connectivity* (Ives et al., 2016) (see table 1). Technology affordance (Majchrzak and Markus, 2013) refers to an action potential, that is, what an individual or organization with a particular purpose can do with a technology or information system. According to the Technology Affordances and Constraints Theory – TACT - (Majchrzak and Markus, 2013), technology affordance needs to be related to the concept of technology constraint, referring to ways in which an individual or organization can be held back from accomplishing a particular goal when using a technology. The TACT provides a valuable framework to study technology-involved practices and to understand how and why the same technology can be repurposed by different actors or has different innovation outcomes in different contexts (Nambisan et al., 2017). Table 1 shows how the integration of the different product dimensions, through the user interactions, creates affordances, contributing to evolution of the appropriation process.

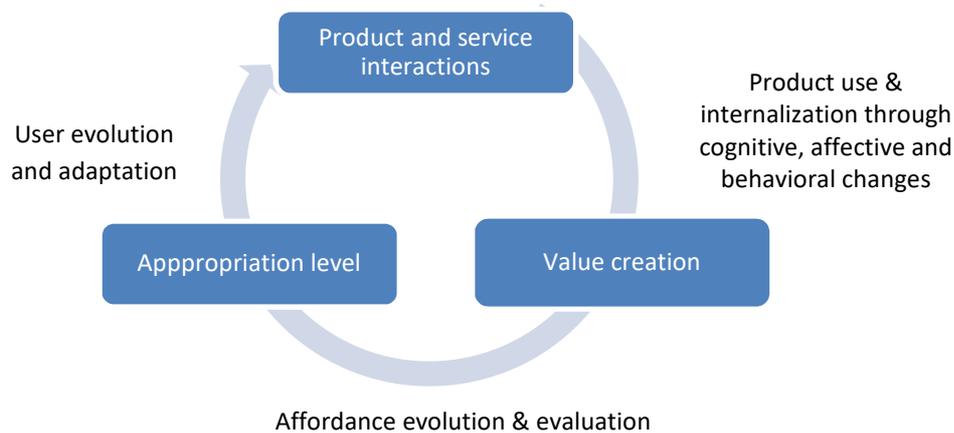
Table 1: Appropriation through progressive integration of the device dimensions.

IoT characteristics	Appropriation phase based on characteristics of integration
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Physical product	Symbolic appropriation & Exploration
Object-to-object connectivity	Exploration
Intangible service	Exploration & Use Construction
Social connectivity	Stabilization

The different interactions with the device lead to a progressive internalization of the product and service capacities (Hoffman and Novak, 2015), through changes induced at a cognitive, affective and behavioral level. This internalization process entails a progressive value creation as well as a continuous evolution and evaluation of the device affordances, and integration of the product and services. The evolving value creation sustains the appropriation process throughout different stages. On a reciprocal basis, and in a recursive way, the appropriation level impacts the user's interactions with the product, as his/her motivations and objectives change, as well as his/her familiarity with the product and insights about its functioning. Indeed, each appropriation stage is characterized by the evolution of the user's capacities in terms of mastery of use and adaptation (i.e. proactive learning), impacting future interactions with the product and service (figure 1).

Figure 1: General process of appropriation through interactions and value creation



Concerning the interaction types, the UX literature identifies four main types of user-product interactions. *Cognitive interactions* focus on the product at hand and result in better product knowledge by users who need help to comprehensively understand how to better use a product (Forlizzi & Battarbee, 2004; Morshedzadeh, Ono, & Watanabe, 2016). *Physical interactions* refer to what users do with a product, namely users' manipulation of the product

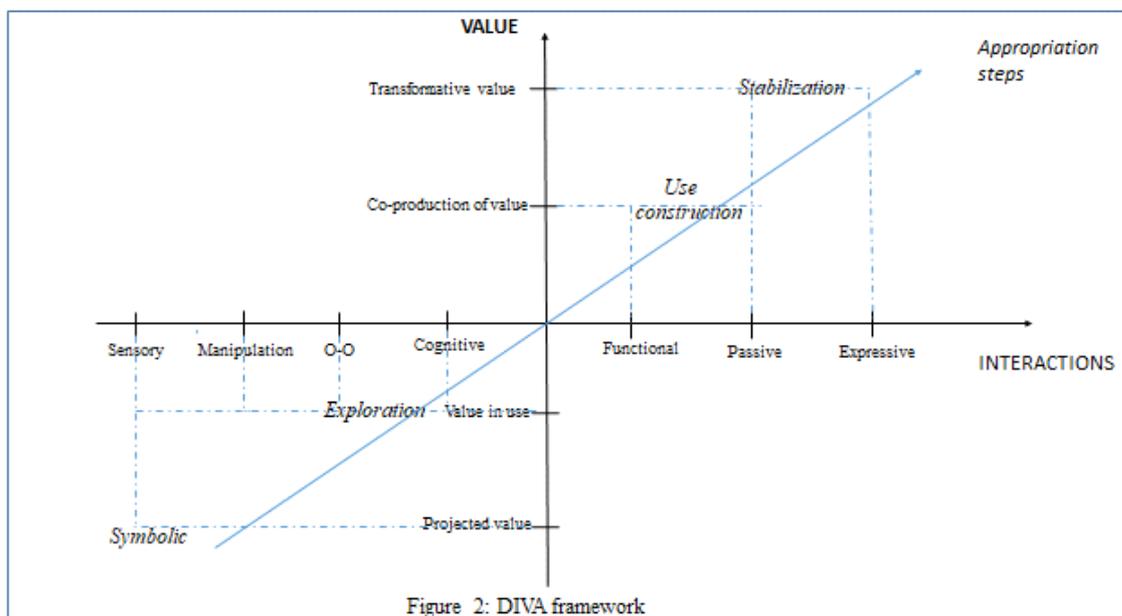
(Morshedzadeh, Ono & Watanabe, 2016). *Functional interactions* signify what users carry out as tasks with the purpose of doing something with a product (Morshedzadeh, Ono & Watanabe, 2016). *Expressive interactions* allow users to form a relationship with a product. In this kind of interaction, users modify, personalize and invest effort to create a better fit between the product and themselves (Forlizzi & Battarbee, 2004; DeLanda 2006; Morshedzadeh, Ono & Watanabe, 2016).

Based on the content analysis, seven types of interactions have been identified, grouped into three main categories. *The first level interactions* initiate contacts with the product and enable the user to discover it. This category includes *manipulation interactions* consisting of handling and manipulating the watch without any specific purpose, just to observe what is going on with it (i.e. press buttons, touch the screen). These product manipulations correspond to the *physical interactions* identified by previous authors. They are usually accompanied by *sensory interactions* which are manipulations focusing on sensorial stimulations and feelings. The main difference between manipulation and sensory interactions is that, during sensory interactions, the user focuses on the sensations produced by the product; he/she evaluates the tactile sensation (i.e. physical comfort, nice feeling) and the visual contact (i.e. design and aesthetic, screen brightness, visual comfort), experiencing and feeling the watch. These sensory interactions relate to the aesthetic dimension of the consumer experience. *The second level interactions* are goal-oriented and include three types of interactions with the product and service. *Cognitive interactions* aim to understand the functioning of the smart watch and applications (i.e. through trials/errors), and so build up knowledge about the product/service. *Functional interactions* aim to do something with the product (i.e. calculate the number of steps, pulses, display specific notifications). *Expressive interactions* create a specific relationship with the watch, mainly through its personalization. *The third level interactions* consist of two new types of interactions which are specific to IoT devices: *passive interactions* and *object-to-object interactions*. The first ones are between the user and the device and the second are device-to device interactions, but both happen without any action from the user. They are related to the characteristics of IoT devices and their capability of identifying, sensing, communicating and computing (Ives et al. 2012). Mainly, the IoT device collects data about the user through a sensor, and communicates these data to the smartphone, providing activity tracking as well as feedback to the user. These interactions initiated by the smart watch itself are central in the appropriation process as they enable the device to deliver and communicate a new value to the user.

The following section describes how the articulation between interactions and value creation participates in grounding the appropriation process.

4.2- The Dynamic Interactions Value Appropriation (DIVA) process

The content analysis highlights that consumers' appropriation of IoT devices is a dynamic process of four stages (symbolic appropriation; exploration; use construction and stabilization). Each appropriation step relies on a combination of interactions and a value creation level, linked to IoT devices characteristics. The Dynamic Interactions Value Appropriation (DIVA) framework, presented in Figure 2, represents the whole process.



The following section describes each of the four stages of the IoT device appropriation process using the DIVA framework.

4.2.1 Symbolic appropriation: appropriating through projecting value

The analysis of responders' narratives about their acquisition experience reveals that, in most cases, the appropriation process starts before acquisition. Brunel et al. (2009) describe this phase as being a “*creative project around the product*” (p.7): the user imagines the use of the product. This projection is symbolic, relying only on mental representations. These representations come from information collected by the individual about the smart watch (utility, images associated with its users) as well as his/her previous experiences with new

technologies. Indeed, some users relate their impressions about smart products to futuristic movies they have seen. For some of them, the connected object in general and the smart watch in particular, is the fulfillment of a fantasy. Like what Paul said: "... *having a watch and making a phone call with as in K 2000, it's a big dream. I think, having a smart watch, many men dig that... talking in a smart watch like this, reminds us of our youth*"

In this phase, the first user-product interactions may happen during a trial in a shop or a showroom or during the first exposition to the product. They are usually sensorial and help the individual to confirm his/her purchase decision. The user feels different, and rather strong, sensations during the interactions with the watch: wearing comfort, tactile sensation, aesthetic evaluation, emotions at seeing the product: "*so I chose a model or two, I tried it but I ... it's just to wear it, to see how it was ...*" (Emma).

These interactions enable the first aesthetic experience with the watch, creating a first emotional tie between the user and the product. The strength of this tie is greater when the smart watch is a gift or if the user is already affectively attached to the brand. During the smart watch selection, some users prefer indeed to take the same brand as their smartphone, either because of a perception of a better compatibility between the two items, or for an affective reason. In the same way, the user's trust towards a brand (usually the phone brand) influences his smart watch choice. The attachment to the smart watch may also be symbolic if the user has "an ideal representation" of the watch.

During this stage, the user seeks information about the watch and this research is impacted by two factors: the user profile (i.e. interest in new technology, expertise), and the objective motivating the smart watch acquisition (i.e. to do sports). The involvement in information search is stronger when the purchase is motivated by a specific context (i.e. resuming sport activities; preparing a marathon). In this case, the criteria for selecting the smart watch are more clear and accurate, focusing mainly on technical characteristics. This leads to the construction of a first knowledge set (i.e. technical characteristics, performances, design) and triggers the first perceived object identity.

Therefore, during the first stage, the user projects a perceived image of the smart watch, which creates expectations about what he/she will do with it after its acquisition. The internalization of these (first) cognitive and affective aspects of the watch induces a *projected value* and then an appropriation that has a symbolic nature.

4.2.2 Exploration: affordances discovery and value-in use

This phase begins after the acquisition, by the first handling of the device to discover it. The user experiences his/her watch in terms of its sensorial aspect and its potential, through manipulation and sensory interactions. This phase focuses also on the general functioning, potential, utility and benefits of the smart watch. For people not having tried it before, it is the first contact with the watch. They first live an aesthetic experience with their own watches. These interactions induce strong positive emotions (e.g. enjoyment, fascination, immersion and, in some cases a sense of strangeness). Stephane reported: "*I felt admiration. I was fascinated by the lighting when I saw the screen turns on*"

The user's profile, especially interest and familiarity with new technologies and expertise, as well as the information collected before the purchase, has an impact on this exploration stage, modulating the learning process and the user's adaptation. Novice users begin by passive handling and observation (e.g. test of the keyboard, keys) to see what is going on with the product. They make these actions without any specific goal, getting curious and excited by these exploratory and discovery-based interactions. On the other hand, users who are more familiar with new technologies primarily use a hedonic approach in their exploration: "*I played with for two hours*" (Jean). Search of pleasure mainly guides this first exploration. Holbrook (1996) explains this first discovery by the primary process thinking (Freud), which involves a task oriented toward hedonic responses.

Furthermore, for consumers who lack knowledge, discoveries occur spontaneously (sometimes, by accident) and the exploration is less focused on a specific objective. By contrast, advanced users control the exploration phase; they touch, manipulate and gradually discover the watch. Manipulation interactions also enable the understanding of the parameter settings to optimize the overall performance of the watch. Then, an active and deeper learning process begins about the functionalities (the physical object) and then the applications (the service). Such learning takes place mainly through an active and goal-oriented manipulation of the watch (trials and errors), focusing on discovering affordances (Gibson, 1979): what the watch can really do, and what it enables the consumer to do. The learning process mainly relies on cognitive interactions, as the user tries to understand the functioning of the IoT device by testing it: "*So during the first days of use, I tried all the features, all the applications to have a good knowledge of my watch*" (Isabelle).

Usually, the user transfers his knowledge about the phone to the smart watch, as many functionalities of the watch are extensions of those of the phone. Therefore, when the smart

watch interface allows the individual to easily make connections between the watch and the phone functionalities, the discovery of the affordances (i.e. the possibilities of the watch to act in the environment) becomes easier and faster. These affordances, as connectivity possibilities, make it possible to understand value-creating interactions in IoT (Ng, 2014). Another finding highlights a new type of learning based on object-to-object (O-O) interactions: here, the user becomes aware of the high smart watch dependency of the phone and the necessity to have connectivity between the devices to deliver services.

This learning during the exploration stage completes the knowledge acquired during the first one (before the acquisition), and can be more or less fast, with a complexity perceived differently according to the user profile or the watch characteristics. Indeed, an ergonomic interface and an intuitive general functioning of the watch facilitate the learning process and create positive emotions during this phase. Conversely, when there is a high number of functionalities or a lack of perceived intuitiveness, the learning needs a lot of time and this may result in a certain feeling of boredom or annoyance. Furthermore, depending on the perceived difficulty, the watch's owner may use outside resources to get the information needed (i.e. user guide, internet forums). He/she also discovers the limits of the watch during this phase and this leads sometimes to a sense of disappointment, especially if any technical problems occur during the first days of use.

At the behavioral level, exploration is mainly characterized by irregular use and an intensive test of the different functionalities and applications to discover, as mentioned before, the full potential of the watch. This is an *extension phase* characterized by the adaptation of the user to the watch, for example to read a text on a small screen, or to organize applications. Progressively, the use of the watch becomes more regular and the user transfers some telephone uses to the watch, such as messages or a wake-up alarm. Thus, the interactions of the capacities (Hoffman and Novak, 2015) of the user and the device during this phase reveal the value of the device: it is the *value in-use*, created through the "consumption" process (Vargo and Lusch, 2006). This value creation is embedded in a process of ongoing evolution of the cognitive, affective and behavioral mechanisms brought into play in the interaction with the device. Once the basic functionalities and applications are understood, the user gives sense to the functionalities with a real added value that he/she can integrate in daily life: "*what could I do with my watch to make my life easier?*" (Emma).

A progressive installation of new applications and a learning of these applications accompany this reflection. The user enters in a new phase.

4.2.3 *The use construction: selecting affordances and co-producing value*

The *use construction* stage of appropriation relies mainly on functionalist and passive interactions, shaping *value co-production*. As the user tests, learns and internalizes the functioning of the watch and its potential, he/she becomes increasingly active in the creation of his/her own “use experience”: he/she gives meaning to his/her use. The consumer has already evaluated the benefit of the main functionalities and applications of the watch, and their value through use becomes more regular while the interactions become mainly functionalist. Furthermore, the context of use becomes more specific and clearer (e.g. for sport practice). The user’s approach is more thoughtful and motivated by a personal interest: he knows more clearly what he needs and what he can do with his watch. It is a *centering phase*: some functionalities and services, considered as not useful, are disused while others are progressively integrated into daily life.

This sorting process is more important when the watch is purchased to achieve a specific objective, such as evaluating sports activities or preparing sports competition. Depending on the user objective, smart watch use may be systematic or contextual. For people who want to monitor their sport activity or who use their smart watch as an extension of their phone (view apps notifications, call and send messages), the use is daily and regular. For people who have a more specific objective (i.e. improving athletic performances), use is contextual (i.e. sport practice).

At this stage, value is co-produced (Vargo and Lusch, 2006) on an ongoing basis. This appropriation phase is also characterized by passive interactions between the user and the smart watch. Passive interactions are defined as the continuous actions initiated by the watch, such as the continuous collection of data by the device about the user activity, without any action by the user, or the sending of feedback to the mobile application. These passive interactions actively contribute to value co-production. The value is also reinforced by the user as he adapts and personalizes the device according to his own needs and objectives, mainly through a targeted installation of new applications (to optimize the functioning of the watch) and a personalization of the interface. The installation of new applications is more focused and objective-oriented than during previous stages, in accordance with the use context and the chosen functionalities: *"when I bought it, there were the basic functions ... and after, during the following days and weeks, I started to add applications"* (Jean).

This ongoing processing of the device and service (installing new applications) fuels a sense of mastery of the watch, giving the user the feeling that he is an active actor in the creation of the “ideal watch”, and that he controls his use. The consumer become aware of this status as value co-producer. The setting of new configurations, as well as a tracking of the updates and new developments of the product, help to improve and optimize the watch configuration. Besides, the progressive control of the watch by the user implies his adaptation to the watch limits (i.e. the screen size, the limits of the voice control functionality) and an innovative use of some functionalities, in particular from the persons who are familiar with new technologies. Value is co-produced through use transformation. Nevertheless, this control feeling may lead to a decrease in use for some persons feeling that they have obtained an exhaustive knowledge of the watch. The watch then becomes less interesting, by losing its initial novelty appeal. This feeling thus depends on the opportunities that the watch offers to the user to personalize and change it.

4.2.4 Stabilization: appropriation and transformative value

During the last phase, interactions are mainly functional, expressive and passive. This stage corresponds to the appropriation state, which includes three dimensions.

- *A cognitive stabilization*: the user has acquired all the necessary knowledge to manage his watch. The device’s physical and technical characteristics, functionalities and affordances, advantages and limits, remain steady for the user. He has a stable perception of the watch’s identity. Product identity corresponds to the functions of the product in use (affordances), as well as the perceived benefit and value; the image the user has about its quality and efficiency; usability, and the status he associates with its users. A cognitive fluency in the watch’s manipulation and value production (through an ongoing integration of new applications) also characterizes this stage. The individual controls and has tamed the watch use and is pro-active in his learning. He feels himself skilled and comfortable with it and is able to manage it adequately, which is a condition for appropriation (Dix, 2007)
- *Affective and relational stabilization*: At the affective level, the relationship between the individual and his watch becomes steady and long lasting. The user is able to position himself with regard to the watch. The analysis enables the identification of three types of relationships:

- An affective relationship: the consumer feels an affective attachment with the watch. For some people, the watch is included in their self-identity,
- A functional relationship: the watch is considered as an effective and helpful tool to attain some objectives,
- A dual relationship: this relationship translates into a dependence on the watch. The user is aware of his needs and the capacities of his watch. He is attached to it for functional motivations but also for subjective and affective reasons.
- *Behavioral stabilization and routinization*: the watch is integrated in the user's daily life. This integration translates into *action routinization*: wearing the watch *automatically*; triggering a functionality *automatically*, etc.

Interactions in this fourth stage of the appropriation process are also expressive as the user adapts and personalizes the watch through the personalization of the interface, or an aesthetic personalization (e.g. a bracelet change). These expressive interactions reinforce the user's relationship with the watch. At this stage, the "actor" role of the watch is more obvious and perceptible for the user. Through passive interactions, namely collecting data and transferring them to the mobile applications, the smart watch influences the user by changing his behavior. This creates collaboration between the device and the user, creating a new type of value: a *transformative value*, as it acts actively on the user's self and changes his habits and activity. This is the recursive dimension (Brunel et al. 2013) of the appropriation process. Indeed, many respondents assert that their watch helped them to improve their health practices (recommended daily activity), and among sportsmen, the use of the smart watch resulted in a performance improvement and a change in training habits. It also induced engagement in social interactions with sports communities to share their results and improve their motivation and performances. In a retrospective way, these habit changes resulted in a stronger need to use the watch, reinforcing the use regularity and the integration of watch use in everyday life.

5. Discussion

This research presents different contributions and theoretical and managerial implications.

5.1 Implications for theory

At the theoretical level, the research first proposes a framework to understand the new phenomenon of consumers' appropriation of IoT devices, which is currently a topic of

particular interest for both academics and managers, in this period of high diffusion of IoT devices on markets. It fits in with the new research perspective asserting that it is fundamental to analyze IoT from a human-centered point view, in order to better meet users' needs and expectations (Angelini et al., 2018). It also extends the previous literature on technology appropriation (e.g. Carroll et al., 2003), by showing that the appropriation of an IoT device is specific as it requires an integration of each of the four dimensions of IoT devices: the physical dimension; object-to-object connectivity; the service provided; and social connectivity. The results show that the integration of each characteristic occurs progressively, through four appropriation phases: symbolic; exploration; use construction; and finally stabilization.

A second result highlights that the appropriation process relies on a dynamic process of interaction-value creation points that are necessary for the regular use and management of the device. It therefore goes beyond previous theoretical frameworks on either interactions (in UX literature) or value creation (Aulia et al., 2016; Vargo and Lush, 2016), by identifying the mix process of both interaction and value as a catalyst of the dynamic appropriation construction. It also provides further insights in addition to the study of Balaji and Roy (2017), identifying the main dimensions of value co-creation and their impact on the continuance of intentions of use, by explaining how the value is concretely co-created by the consumer, through his/her everyday use.

The DIVA framework identifies the types of interactions and creates the value needed to gradually build the appropriation process through different stages. The first symbolic appropriation step begins by mainly sensory interactions and projected value. The second exploration appropriation step relies mainly on manipulation and cognitive interactions related to value in use. Functional and passive interactions, shaping value co-production, contribute to the third use construction step. Finally, passive and expressive interactions, that shape transformative value, constitute the last step of appropriation, stabilization, where the IoT device is used without cognitive effort and becomes part of the user's daily life. By relating different values to different interaction types, the DIVA framework takes into account the high scalability of IoT devices, as well as their tangible and intangible natures, showing clearly the construction and evolution of the appropriation of such devices. It also enables the modeling of how the consumer actively participates, through his/her uses, in the value creation process.

Considering these contributions, this research proposes the new interaction-value framework to analyze the appropriation process, which goes further than previous literature. By qualifying each type of interaction and the associated value, this research offers additional novel insights into traditional human-machine interaction theory, by extending this theory to the human machine interaction-value framework.

5.2 Implications for practice

The DIVA framework proposed to analyze the IoT device appropriation process presents several managerial implications. First, it clarifies the appropriation process, which is a key challenge in IoT markets because the current use aborts after several months. It highlights that marketers need to consider appropriation and not only adoption, which remains however one of the most well-known concepts among managers. Considering the research results, firms should activate specific interaction types over time to support the user's evolution throughout device appropriation (sensory interactions during first symbolic step, manipulation and cognitive during the second exploration step, functional and passive during the third use construction step, passive and expressive for the fourth stabilization step). With regard to value, the DIVA framework is an appropriate tool for firms to think about the four value types highlighted in the appropriation process (projected value, value in use, value co-production, transformative value), and to increase, through specific interactions in each appropriation step, the perceived value. For instance, the device's potential to evolve and develop through time and to be personalized by the consumer, at the aesthetic level or by adding new services (applications), is a very important issue in terms of encouraging value co-production. Specific incentives should also be imagined by managers to motivate the users to engage in the evolution of affordances through specific interactions (e.g. manipulation or cognitive in the exploration phase) in order to improve the value creation process. For instance, a user-friendly interface as well as the possibility to have fun in exploring the device, and to discover new "hidden" functionalities, can positively impact the first steps of the appropriation process; while the possibility of integrating new applications and developing the device affordances can have a positive effect on the later stages.

5.3 Implications for policy

In terms of policy, this research suggests that IoT standards, often limited to technical characteristics such as data quality and device security, should include the interaction-value

framework in the usage defined by companies on IoT markets. IoT standards should therefore define the type of value expected for each of the seven categories of interactions (manipulation, sensory, cognitive, functional, expressive, passive, object-to-object) and should take into account IoT consumer's experience.

This research also provides contributions for potential policies on artificial intelligence which is used for numerous consumers and citizens' services, such as chatbots, recommendation systems, or senior citizens' assistance by robots. The dynamic interaction-value framework presented in this research should be used to better understand consumers and citizens' appropriation of these new services based on artificial intelligence, and to diffuse artificial intelligence technologies among the population.

6. Conclusion

In a highly connected world with an increasing number of connected devices and new IoT environments, this research provides a useful and easy framework for both managers and academics to better understand consumers' usage of IoT devices. It also enables a better understanding of the limits or potential of market development, according to the integration of the appropriation process in marketing strategy. This research also opens up new topics for future potentially necessary studies, to better understand and measure consumer behaviors related to the Internet of Things. The present study investigates the appropriation process in the case of IoT wearable devices, proposing a framework based on interactions and value creation. Future research should investigate this process in other contexts (i.e. smart homes), where the output value relies more on the assemblage between the different devices and users (as actors), rather than on an individual device. Also, further investigations should measure in real time interactions between users and the IoT devices and analyze the impact of the diverse types of interactions on the consumer's behavior. Experiments should be run on specific interactions in each phase of the appropriation process, to select those having the best impact on the distinct types of value. Another interesting question to address relates to the dimensions of the best interaction-value mix for each of the four appropriation stages. Research is also needed on how IoT devices' specificities such as connectivity and data collection should be more integrated in the dynamic interaction-value appropriation (DIVA) process.

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APPENDIX

Appendix 1: coding scheme

	Category: Description	Examples
Perceptions and mental representations: global perceptions of smart watches	<i>Information retrieval and exchange:</i> functioning as based on data recovery and exchange with other devices (the phone)	"It's a watch that collects and gives data and information"
	<i>Dependency on the phone:</i> a functioning depending on continuing interaction with the phone	"... Especially as the smart watch I have had some trouble connecting with my cell phone. And so, a smart watch that is not connected with my mobile phone, because this model relies on the mobile phone, ... I lost all uses. Therefore, apart from giving me the time, it does not serve much "
	<i>A utilitarian value:</i> a utilitarian value related to functionalities, vs social and expressive value (i.e. expressing a social statute)	"..., apart from the display of the exact time, there are additional attributes, that is , its value, especially for men. Uh, maybe it's the same for some women. They consider the watch as jewelry. (...) and the smart watch, in my opinion, it has removed this decorative attribute as jewelry, but it depends on the aesthetic feeling of each person, for me, the smart watch has not anymore decorative attribute as jewelry, the smart watch is rather to meet my needs at the utility level."
	<i>A fantasy dimension:</i> images based on fantasy and imagination	"..., having a watch and making a phone call with as in K 2000, it's a big dream. I think having a smart watch, many men dig that: talking in a smart watch like this, reminds us of our youth"
	<i>Interaction and connectivity:</i> connection with internet and interaction with phone	"A normal watch is just a watch that gives the time, seconds, date, information ... but does not communicate. .. (a smart watch) is a watch that communicates to Internet"
	<i>Scalability:</i> the possibility to evolve through time	"it's not cast in stone in fact, you see, it's not static" "And there are things that are updated, there are softwares that updates regularly, so maybe within a month, it will be possible ! So we never know how far we can go"
Pre-buying stage: symbolic appropriation	1-Factors impacting the purchase	
	<i>Motivation of performance goals:</i> recording and tracking performances	"So, I was browsing sports watches, and as I am running, I do a lot of sport, I wanted something that would allow me to record this activity...count how many kilometers I did, I ran, ... "
	<i>Attitude and familiarity :</i> Interest in new technologies and expertise	" and I'm pretty proud of the technologies and because I like new technologies, I thought, why not a smart watch?"
	<i>Past brand experiences</i>	"I have always had very good experiences using my Apple products"
	<i>Relatives' advices:</i> suggestions provided by a person who owns a smart watch	"I had the opportunity to see a friend in Paris who has had one for longer than me. He told me a bit about what he did with it, how he used it ... etc .if it was useful or not. That's one of the things that made me buy one"
2 - Interactions with the product		

	<i>Watch testing: tests in showrooms, stores or testing a friend's watch</i>	<i>"The advantages of Apple Stores is that you can try. I went there and I said "I'm looking for a watch" and they said "well". And so I tried the watch"</i>
	<i>Sensorial interactions and Aesthetic experience: sensations and experienced feelings</i>	<i>"so I chose a model or two, I tried it all but I ... it's just to wear it, to see how it was ..." "The finishing, which was super pretty"</i>
	<i>Indirect interactions through information seeking: Actions undertaken to have more information about the product functionalities</i>	<i>"I looked for information before and in fact, when I went to buy it, I already knew well how it works..I had documented myself, I had read the documentations and everything before"</i>
Exploration stage	1- First handling	
	<i>first level cognitive interactions: trying to understand the functioning and how to read the data</i>	<i>"As soon as I bought it, I put it, like all products a little technological, it's like a computer, in fact or as a tablet, we try to understand how it works. It is first, anyway, a technological product, it must be understood that there is a mobile application, that the data are transferred from the watch to the mobile application, that's it, so we must understand all that"</i>
	<i>Sensory interactions: feeling the sensations provided by its own watch</i>	<i>"The appearance on the wrist, the physical sensation is rather pleasant"</i>
	<i>Passive manipulation and observation: manipulating the product without to see and observe what is going on</i>	<i>"Overall, the first use is quite interesting, we discover, we look at everything that happens"</i>
	<i>Hedonic discovery: discovering through play and fun</i>	<i>"I played with for two hours"</i>
	<i>Discovery emotions and feelings: emotions induced by trying and manipulating the watch</i>	<i>" I felt admiration. I was fascinated by the lighting when I saw the screen turns on"</i>
	<i>Discovering the watch limits</i>	<i>"I thought, Damn! we can not do that, it's too bad., well, I'll try it another way"</i>
	2- Active learning and functional use	
	<i>Second level cognitive interactions: interactions to understand the functionalities through intensive testing</i>	<i>"So during the first days of use, I tried all the features, all the applications to have a good knowledge of my watch"</i>
	<i>Affordances discovery and Value in-use: discovering the benefits and value of the watch progressively through using it</i>	<i>"what could I do with my watch to make my life easier?" "It's this starting phase, at the beginning, we look at what can the watch brings"</i>
	<i>Object-to-object interactions: awareness of and experiencing the connectivity and interaction between the watch and the phone</i>	<i>"I know my watch is connected to my phone. As I can receive notifications and information constantly, I feel it connected constantly. It's true that it's an inseparable duo with the phone"</i>
	<i>Cognitive evaluation: Evaluation of the learning and exploration stage</i>	<i>"It's really easy, it's very simple" "We understand quickly how it works"</i>

	3- Factors impacting the discovery stage	
	<i>Familiarity:</i> Familiarity with new technologies or others brand's products	<i>"But from the moment we have already used a lot of tactile objects ... so that's ok"</i>
Use construction	<i>Context use:</i> use context and regularity specification	<i>"everyday life no, but for sports yes, ... because I never go to training without my watch..."</i>
	<i>Service and affordances evolution:</i> service evolution through setting up applications	<i>"when I bought it, there were the basic functions ... and after, during the following days and weeks, I started to add applications"</i>
	<i>Ongoing learning:</i> learning how to use new applications	<i>"We always have things to discover. There are always new Android apps on the Market App, so, of course, we always discover"</i>
	<i>Use optimization:</i> optimization of the use through parameter setting and selecting applications	<i>"I tried an application on Android called the Tasker that allows to do actions with the phone (...) and in fact, there is an extension that can interact directly on the watch. For example, on my watch, I added a small button that allows you to lock and unlock the phone remotely. I tried to increase the interactions between the phone and the watch as much as possible"</i>
	<i>Adaptive actions:</i> adaptation of the use to the watch functionalities and limits (i.e. using simple sentences for the voice control)	<i>"That's why I prefer to use short and simple sentences so the watch can transform exactly what I wanted to express in text. I do not want to type words on the watch. so when it has incorrectly transcribed what I wanted to express, I prefer to change and a simpler and shorter expression in voice mode than to modify the text with words that I type by myself"</i>
	<i>Long term benefit evaluation:</i> evaluation of the benefit and value after mastering the watch functionalities	<i>"There is a learning phase, and then, when we understand how it works, either it always adds value every day, or the benefit is not strong enough, which is my case."</i>
	<i>Use evolution:</i> sorting and selecting functionalities to integrate in everyday use while stopping the use of others	<i>"There are many features that I do not use that much (...). I'm even starting to use things that I would not have suspected using before; voice command"</i>
	<i>Passive interactions:</i> relying on the watch to collect data	<i>"I use it for sport, especially it captures the heartbeat. When I do a little fitness she can collect my data "</i> <i>"As soon as I go to the gym I trigger it for this or that machine. That track my physical exercises"</i>
Stabilization	<i>Personalization:</i> aesthetic and functional personalization	<i>"I tried to customize a lot. I bought a watch face that I first tried for free, then I realized it was fine so I bought it"</i> <i>"I managed to shape and customize it as I wanted. For example, if I make a big wrist movement, it will trigger a voice recognition on my phone (...)."</i>
	<i>Use mastering:</i> sense of cognitive and functional mastery	<i>"For now, I feel that I have already mastered all the features"</i> <i>"Yes, I think that today I managed to achieve everything I could do with it"</i>
	<i>Cognitive fluency:</i> learning agility of new applications	<i>"when I download a new application, I see what I can do with it, there is no problem"</i>
	<i>Behavioral change:</i> changes induced in the user behavior	<i>"I entered the game. I even found myself walking to go to swimming course between noon and two so I can"</i>

	by the watch use	<i>reach my 10,000 steps"</i> <i>"It</i>
	<i>Routinization: integration and automatization of the use</i>	<i>"For the moment it's a reflex to put it"</i> <i>"But as soon as I go out, either to play sports or go shopping ... I put the watch. It's systematic"</i>
	<i>Disuse: abandoning the watch use</i>	<i>"As I said earlier, today I use it less and less. Because I understood what I could do with it, so ..."</i>
	<i>Affective relationship: affective connection with the watch</i>	<i>"I think there is an emotional connection now ... no but it is yes yes I am very happy..I like it"</i>
	<i>Self continuity: a sense of the watch as an extension of the self</i>	<i>"Yes, it is already a part of me"</i> <i>"Because if one day I forget to wear my smart watch , I feel uncomfortable all day long. I feel I'm missing something on me. I feel uneasy without my smart watch"</i>
	<i>Functional relationship: a relationship based on a utilitarian value</i>	<i>"Uh, I think for now, my Apple Watch Sport is only a tool for me"</i>
	<i>Sense of need: dependency on the watch</i>	<i>"It is a real need. I need it"</i> <i>"Oh, I would not do without it! if it breaks down I think I redeem myself another one immediately"</i>
	<i>Social interactions: interaction with other users</i>	<i>« Whether connected, etc. that it engenders after ... everything that is behind, to follow his personal activity, to follow the activity compared to others, etc. etc. and to be able to comment ... Finally, I have friends, sometimes when I share, they tell me it was great as a session or when it's not good, they tell here you were not regular. .. it also allows to have advice. »</i>