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TOWARD A THRESHOLD MODEL OF CONSUMER AUTONOMY FOR HUMAN-SMART SYSTEM INTERACTIONS: A QUALITATIVE STUDY

Original Research

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Abstract

As a consequence of digitalization, several consumer products and services are already functioning as artificial intelligence empowered systems, such as virtual assistants, smart homes and other Internet-of-Things services. These intelligent systems are gradually obtaining agency, autonomy and authority by which can have complex interactions with their environment. In the interaction between these systems and their human consumers the question of the need for consumer autonomy also arises. This research assesses the possible factors determining consumer autonomy, and decision mechanisms influencing the need for more or less individual autonomy in the consumers' interactions with an intelligent system. Qualitative methodology is used based on the multistage interpretation of six in-depth clinical interviews. Results seem to confirm some facilitating and inhibiting factors of the need for consumer autonomy. The main result consists of the evidence regarding the presence of continuous evaluation and decision-making mechanism of consumers about their need for autonomy in the interaction with an intelligent system.

INTRODUCTION

The digitalization phenomena resulting from the information revolution not only profoundly affect today's consumers but also provide radically new perspectives for meeting their needs.
Considering that almost all consumer products and services can be digitized or at least provided with a digital component (eg. smart home appliances with sensors or even online banking) (Fehér, 2016; Novak & Hoffman, 2016; Ng & Wakenshaw, 2017; Verhoef et al., 2017), it can be reasonably assumed that the consumer of the future will get more involved with digital technology. On the other hand, manufacturers and service providers will be more interested in using digital technology to continuously optimize the user experience and value creation (Agarwal, Gans & Goldfarb, 2018; Jarek & Mazurek, 2019).
The effects of this phenomenon can already be experienced when one thinks of her/his everyday systems that surround almost everyone and become more and more intelligent: Google's search algorithm, Amazon's Alexa virtual assistant, smart fitness devices, self-driving cars, or even one's vacuum cleaner communicating with a smartphone. In the near future, a lot of innovative products, services and technologies will gradually become part of the so-called Internet of Things (IoT) ecosystem, and in many cases will be managed by some type of artificial intelligence. These complex services will potentially become an integral part of consumers' everyday lives, either as a system or a system of systems (Hoffman & Novak, 2015b).
User acceptance and experience related to these complex systems already raises several relevant questions, which is the primary reason to investigate this topic in this paper.

LITERATURE REVIEW

Definitions

In this research, by 'intelligent systems' one should understand agents or groups of agents which are based on digital technology. These agents are created / operated by software and hardware components, which have agency, autonomy and authority (Verhoef et al., 2017). Because of their ability to interact with people and other agents, these can actively affect their environment and vice versa. They also may have their own (programmed and/or learned) goals. Because of their autonomy, they can operate without human intervention and interact freely with other agents depending on their own goals. They can have control over their response to stimuli from other agents and humans (Hoffman & Novak, 2018). As the technology of artificial intelligence evolves, these three qualities (agency, autonomy and authority) are becoming increasingly spectacular in terms of the quality and variety of human interactions.
In fact, in the case of the Internet of Things, the scientific community is talking about a multitude of intelligent systems and people-to-people interactions (Ng & Wakenshaw, 2017) that place these systems in a circle that has so far only included only human-to-human services (Vargo & Lusch, 2017). Intelligent systems are adopting an increasing number of capabilities that can make them essential players in many areas.
Based on the literature available to us, it is no exaggeration that certain social scientists already talk about human-machine assemblages, which can have the potential to become much more than the simple sum of their parts (DeLanda, 2006; Novak & Hoffman, 2019).
Beyond the hype-like representation of this subject in the mass media, the question arises that if these intelligent systems can gradually replace a growing number of human capabilities, where can the human-system boundary be drawn?
This question is interesting primarily because many manufacturers begin injecting human characteristics into these purely digital systems (eg. digital assistants with human-like voices, humanoid robots, naturally sounding chatbots, etc.). These systems are already considered almost as human actors by some users and based on some of their services 'they' are perceived as 'almost human' (Nass et al., 1993; Friedman & Nissenbaum, 1997; Hoffman & Novak, 2015a).

Human - Intelligent system interaction

As these systems become more and more complex, the interaction between them and humans becomes more diverse and has huge value creation potential for the future. This is why the first attempts to model human - intelligent system interaction already appeared in the marketing literature.
Such is the assemblage theory, in which the individual (subject) and the intelligent system (object) can fall into four types of interaction. Interaction types are based on the individual's experiences and his\her ongoing evaluation of the intelligent system (Hoffman & Novak, 2015a). The assemblage theory assumes that the intelligent system also has an experience of interacting with human beings and that capability is part of the so-called intelligent system. This experience can trigger expansion and retraction behaviours, just like in the case of human actors interacting with intelligent systems. An actor can have enabling and constraining experiences in interaction with the other actor. For instance, the expansion/extension dimensions refer to the fact that one actor of the interaction can take advantage of the functionalities provided by the other actor. The restriction and

reduction dimensions refer to the opposite, namely one actor constrains itself in these interactions (Hoffman & Novak, 2015b; Hoffman, Novak, & Kang, 2016; Hoffman & Novak, 2018).

Another attempt to model the interaction between humans and intelligent systems is the so-called POP framework (Verhoef et al., 2017). The model divides actors into three categories: people, devices, and the physical environment. Interaction between the three elements is facilitated by digital technology, which also allows for intensive data traffic between the elements. All three elements can be active or passive participants in these interactions (Verhoef et al., 2017).

The picture is somewhat obscured by the fact that interaction with intelligent systems changes the general perception about the intelligent system which becomes more than a set of functionalities. For instance, a smart thermostat might mean a little more than a thermostat in the classic sense. The human connecting to such a system may extend authority over the system and that may alter the perception of the system as a whole (Belk, 2013; Belk, 2018; Verhoef et al., 2017). So, just as brands that are endowed with subjective characteristics to feel more usable, intelligent systems can also be perceived as something more than a set of services.

Considering that in the medium and long term it is realistic to deploy intelligent systems in areas that were previously exclusively human activities, the phenomenon of humans maintaining, gaining, and regaining control over some activities becomes more and more prevalent.

Consumer autonomy

The most commonly used term for this endeavour is autonomy, self-determination, or free will. This concept means the ability to preserve one's subjective state and to maintain a state of being under the influence of one's own aspirations, emotions, conditions, and attributes (André et al., 2018).

Consumer autonomy has many benefits, from preserving and protecting identity to maintaining the impression that one has free will. Furthermore, autonomy is the basis of human individuality and contributes greatly to the development of a personal sense of ethics and the maintenance of self-control (Mele, 1995; Friedman & Nissenbaum, 1997; André et al., 2018). It is also related to the concept of possession (Lawless and Sofge, 2017) and contributes significantly to the creation of wealth (Moller, Ryan, & Deci, 2006; Deci & Ryan, 2009).

When individual autonomy is reduced, there is discomfort, loss of control, and inertia (Deci & Ryan, 2009; Schweitzer & Van den Hende, 2016).

Thus, as it was presented, the process of interaction between the individual and the intelligent system is subject to a complex interaction process and to the individual's need for autonomy. It is not simply an acceptance/rejection decision; hence one cannot use the Technology Acceptance Model (TAM). Intelligent systems are continuously evolving; therefore the relationship with them is evolving, as well. Furthermore, the interaction literature does not attempt to answer what mechanisms trigger the increase or decrease in the need for individual autonomy when interacting with intelligent systems.

Therefore, there are still many unexplored parts of how individuals make continuous evaluative decisions about the boundaries of their autonomy (André et al., 2018). During the decision-making process, the individual constantly weighs the costs and benefits of giving up autonomy and then determines the trade-off based on this (André et al., 2018).

Factors influencing the need for autonomy

This autonomy trade-off decision-making scheme is potentially influenced by many external factors, such as past and present experience (Novak & Hoffman, 2019), and a number of individual characteristics, such as willingness to reject technology, group norms (Rothensee, 2008; Hsu & Lin, 2018; Karahoca, Karahoca & Aksöz, 2018), self-confidence, perceived value, perceived usefulness, perceived enjoyment (André et al., 2018).

In addition to custom variables, contextual variables that affect the individual in use are also external influences. These include trust, competence, risk management ability (André et al., 2018; Lunardo & Saintives, 2019), the pervasiveness of the system (Pellegrino, 2006; Karaiskos, 2009), system embeddedness, and presence (ubiquity) (Pellegrino, 2006; Kourouthanassis, Giaglis & Karaiskos, 2010), type (e.g., ambient or industrial) (Yasar, Malik & Shakshuki, 2016). Which individual or contextual variable has a real impact on the need for autonomy is greatly influenced by the situation (Ng & Wakenshaw, 2017) and the type of system (Gao & Bai, 2014).

In addition to the above-mentioned variables that influence interaction, and the need for autonomy, the mechanisms of the internal decision-making process also greatly influence interaction. For example, the occasional increase and decrease in the need for autonomy can be evaluated not only consciously but also implicitly by the nervous system. System 1 described in the theory of dual decision making (Kahneman, 2001), which is responsible for quick, heuristic-based, often unconscious decisions, and System 2, that is, for rational, logical, conscious decisions is likely to be present in decisions regarding the need for autonomy.

Decision threshold models that have been extensively tested in basic biological problem solving have decades of history (Curley et al., 2018). The decision threshold models explain the process by which the nervous system collects information about a given problem at different rates, and then, once the information reaches a certain threshold, the decision is made. The threshold is related to the concept of satisficing (Cartwright, 2011; Just, 2013). One type of the decision threshold models are the so-called diffusion threshold models (Ratcliff et al., 2016), which, although derived from decision theory and cognitive neuroscience, are increasingly used to explain economic decision phenomena and the setting of particular decision thresholds (Ratcliff et al., 2016).

As the author mentioned at the beginning, the use of intelligent systems is becoming more and more common with the spreading of digitalization, and the interaction with these systems is becoming more and more complex. As a growing number of activities can be outsourced to these systems, the issue of defining an individual system frontier is expected to arise. The need for individual autonomy will greatly contribute to the extent to which different intelligent systems are present in people's daily lives, how similar they are to humans, how information-hungry they are, and how far "decision-making" will extend? Social scientists (Bostrom, 2015), physicists (Russell, Dewey, & Tegmark, 2016; Verhoef et al., 2017) also deal intensively with these issues. Therefore, the author believes that the topic is not only timely, but there is an urgent need to build explanatory models to set the ground for future research.

Therefore, the purpose of this qualitative analysis is the attempt to model the fundamental association between the possible constructs within this topic. The author wants to clarify the goals of the next round of research, help to clear the boundaries of the phenomenon, help determine its possible variables, and the interaction between its components.

The novelty and complexity of the topic made it clear from the start that in the first phase, a qualitative research methodology should be used.

RESEARCH QUESTIONS AND METHODOLOGY

Defining the central phenomenon of the research

As presented in the introduction, digital technology solutions are increasingly approaching the point where most human skills can be outsourced and automated. In almost all human needs that can be converted into binary code, the presence of various artificial intelligence-based solutions is already easy to implement (Brynjolfsson & McAfee, 2014; Bostrom, 2015; Tegmark, 2018). Aside from the social and economic implications of the phenomenon, there is already a positive attitude at the individual level towards these solutions (e.g. general consumer satisfaction regarding Amazon Echo and Google Home), as well as concerns about the perspectives (e.g. automated weapons such as killer drones). On the one hand, artificial intelligence is a too broad and nebulous concept (Tegmark, 2018). On top of that, science fiction and pop-culture also greatly influence and shape the impressions of the public about A.I. (Fehér, 2016). But one can acknowledge that consumers have already been given the opportunity to interact with various intelligent systems. The phenomenon of consumer interaction with increasingly intelligent systems is expected to reach mainstream over the next five-ten years and, like internet use (Russell, Dewey, & Tegmark, 2016).

Resistance to smart products is also a phenomenon (Mani & Chouk, 2017), which can have many roots, from poor user experience to the need for autonomy (Hoffman and Novak, 2015a; André et al., 2018). In the short and medium-term, the individual's need for autonomy will be increasingly exposed to the pervasiveness of intelligent systems, meaning that as these systems become more pervasive in consumers' lives, consumers would want to seek to set the right balance between in control of AI-based solutions.

These phenomena are already occurring, such as rethinking time spent on social networking, reactions to self-driving cars, limiting Amazon's Alexa, or, conversely, setting up a smart home, connecting a plethora of smart devices to the phone, and so on.

In summary, the central phenomenon is that at the individual level, there is a constantly changing level of demand for its own autonomy. This need for autonomy is fundamentally determined by the capabilities, benefits, and other features of the intelligent system(s). The increase in the need for autonomy involves retraction, that is, one wants to regain control, to return to the "manual pilot", and to decrease its effects on one's live.

Research questions

Following the outline of the central phenomenon, the following main questions of this study can be formulated:

1. What are the factors determining the development of the need for consumer autonomy regarding the use of intelligent systems?
2. How does the consumer evaluate his/her the need for individual autonomy in interaction with an intelligent system?

Description of methodology

As presented in the central phenomenon, the researchers of this field are dealing with a novel problem regarding the complex interaction with intelligent systems.

For this, the qualitative research methodology has been used, based on the grounded theory approach of Glaser (1998) to extract primary insights for the next stages of the research.

The method of conducting in-depth interviews was chosen, because of their potential to explore deeper layers of a topic in a relatively short period of time (Denzin & Lincoln, 2000).

The abundant information obtained during the in-depth interviews provided us with very relevant insights. The following parts describe the method characteristics (Table 1), the processing and the presentation of the data.

Before designing the guideline for the interviews, it was assumed that (1) it is very important to start the conversation from the same level as quickly and efficiently as possible, and (2) to minimize the chances of "adventures" towards other topics.

The interview guideline (see Appendix 1) was constructed using the well-known ladder technique (Denzin & Lincoln, 2000; Malhotra, Birks, & Wills, 2012) to delve deeper into the content of each statement in specific situations.

The first question was icebreaking because it gave the respondents the level at which the researchers started the topic. The following questions went deeper and deeper into the topic. For each answer different question paths became possible. These junctions offered the possibility for improvised inquiries, or simply triggering confirmation.

The sample consisted of six individuals aged 29 to 39, three females and three males. All of them have a university degree and live in Romania. Five are from Cluj-Napoca, one from Gheorgheni. In terms of occupation, the distribution was as follows: one programmer, one theatre professional, two marketing professionals, one psychotherapist, and one entrepreneur. They are all at some level of digital embeddedness, though one person systematically tries to minimize everyday digital technology usage.

After obtaining the transcripts of the interviews, the data following the steps recommended by the methodology literature (Denzin & Lincoln, 2000; Horváth & Mitev, 2015) was processed, namely, data preparation, coding, recoding, and establishing hypothetical relations between the constructs which have been found.

GENERAL RESULTS

After re-reading the transcript of the interviews, the research team began to code the text-based content in order to extract primary, and then, secondary meaning. The memos related to the researcher's insights in the course of the coding process were also written down.

The following principles guided us: (1) what are the main motives of the respondent when answering the questions, and (2) what implicit meaning/motive is there behind each explicit answer?

Next, the codes have been named and categorized. Afterwards, the code structure was reviewed several times, and some of the codes have been merged and separated into separate codes. In the following paragraphs, it will be presented the main findings categorized by the discussion themes. Representative quotes confirming the main findings are also included.

Wiredness: usage frequency. All respondents described themselves as using at least a smartphone, but using a laptop and other related devices both in their private life and at work was considered normal. Virtually all of them were and are almost constantly connected to the Internet.

"It's an integral part of my everyday life. Even at night, while sleeping, I consciously use different tools to measure sleep quality and determine the optimal waking time (applications, Garmin smartwatch). 90% of my work is done online: I use smart systems with AI organically included (Google products, social media, project management apps, image editing programs, etc.) ". - E.L. marketing manager, 29 years old, male.

Facilitators of using intelligent systems. The next big category was the category of codes describing facilitating factors of usage, where codes describing positive opinions about intelligent systems have been collected, and factors contributing to their acceptance, and perceptions of friendliness.

One interesting insight was that everyone agreed about the fundamental usefulness of digital technology and intelligent systems. For example, B.V., a 29-year-old theatre professional said that "It's okay to help people with such things (that automate tasks - author) because this way we can save more time for doing tasks that are more important in life." L.E., a marketing manager, considers the advent of intelligent systems an "another exciting revolution."

In the 'facilitators' category the codes related to outsourcing, automation and convenience were important, as well. "Suddenly I was thinking of washing clothes, washing up the dishes, and cleaning," said M.I., a 31-year-old marketer, asking what areas would she automate with the help of a smart system. "Almost half of my time is repetitive, and after a while, it doesn't require much creativity or thinking. I would automate all of these tasks […] and outsource almost everything except my health

(which maybe I would also outsource to an AI application). “(L.E.)

Inhibitors of using intelligent systems. The category of inhibitors sums up the codes that describe the negative opinions and barriers of acceptance, the unfriendly, scary, possibly creepy nature of intelligent systems. This category of codes contained twice as much content as the previous category.
Reflecting on the present and the future of intelligent systems the respondents stated the following perceived characteristics of these systems: (1) possible malfunction resulting from system and other kind of failure by which it could get uncontrollable, (2), the danger of addiction, while subcategory (3) contained the perceived risk resulted from manipulation, the possible aggression, and the so-called “uncanny” feeling. The term ‘uncanny’ refers to the odd feeling resulting from the perception of a smart system as presenting frightfully humane characteristics.
Most of the interviewees talked about possible system bugs by which the perceived control of the human users on these systems can end with significant material and psychological costs for the users. Others go one step further: "For example, a smart home can malfunction at any time, and if you can no longer control it, it might be able to do anything ..." (B.V.).
Some of the respondents see the root causes of disliking smart systems in their human-ish characteristics e.g. "... to me, it's creepy when I see a robot with a human face, but maybe because of their similarity to humans can be misleading to some, and it can alienate us from being more human. (Sz.S. psychotherapist, 37 years old, female).
Others think that this whole technology is still underdeveloped, e.g. “[...] I think it's too early to put too many human attributes into AI solutions. The technology is not yet there to give a purely authentic human interaction experience. For me, Sophia, the robot, is still not too trustworthy (smiling)” (Z. S., programmer, 30 years old, male).

Mechanisms and boundaries of interaction. The authors of the study named one of the code categories as ‘mechanisms’ in which all codes that represent opinions about the perceived / real mechanisms of individual - intelligent system interaction have been included. This category represented meanings regarding perceived / real human-smart system boundaries (the main topic of the research), the acceptance mechanisms of these systems and some of their contributing factors, balance between advantages and disadvantages, and fantasies about the future.

The most important code in this category was the ‘boundaries’ code, which is often related to another code, namely ‘weighting decision alternatives’.
There are basically two categories of content that can be used to draw boundaries. On the one hand, there are those people who are fundamentally puzzled by the task of drawing clear lines in the interaction and trust with a smart system. These people are weighing the pros, cons of such an interaction, and they typically refrain from drawing clear human boundaries with an intelligent system. For instance, "[...] I can't really determine such a point [of setting clear boundaries]. Boundaries change in different areas of our lives. What I do not consider acceptable, for example, is when a particular app or AI-based system collects more information than it needs.”(L.E., marketing professional, 30 years old) His second sentence resonates with fears regarding possible attempts to breach privacy. Another individual sets the boundaries taking into account the context of the interaction: "... it depends on how close you want to get, and whether you are using it in your private life or at work" (B.V.) Another answer with a similar meaning was the following: "... There are illness symptoms in healthcare that you are forced to share with your doctor, but you do not want other parties to use that information, possibly against you. In my opinion, secure and reliable data management will be a burning issue in the future. ”(L.E.)
On the other hand, there are those who have a stronger opinion and are less confused. M.I., for instance, "[...] we have to give up our comfort in order to preserve our private sphere! I don't think it's normal for a device to constantly watch us for 0-24 hours. If someone in the communist era would have said to us that in 30 years ‘we would voluntarily pay for something to intercept us 24/7, we would consider the guy stupid.' (M.I.)
An important insight regarding this category of codes was that the perceived interaction with intelligent systems was viewed by most of the respondents as a process in which different external and internal triggers can happen which modify the boundaries of interaction between the system and its human user.

Perceived system properties. A category for codes representing text content about perceived properties of intelligent systems has also been set up. This included lay definitions of artificial intelligence and Internet-of-Things related technology, but also the general societal view about certain anthropomorphic (human) properties of these systems. Here, some interviewees detailed their beliefs and knowledge on the different types of A.I., others were primarily concerned with the potential human characteristics of some A.I. based systems.

Manifesting attitudes regarding the human appearance of perceived intelligent systems contained every extreme. Positive opinion: "Human appearance is friendlier and more familiar to us, humans..." (L.E.). Indifferent opinion: "I do not know how important human-ish appearance is for me." (S.Sz.). Negative opinion: "[...] Isn't there another solution? Why is it so important to develop a human-looking experience [for these systems]? Why not animal looking? Why always humans??"(B.V.)

Being human. One last and very important code category was the category of "being human", containing the codes that are related to the topic of conversation about human existence, its limits, its meaning.

The interviewees asserted their emotions and opinions in a heterogeneous way since in some cases optimism and in other cases fear was also present. The concern about the future of the relationship between human and machine was prevalent, but the attitudes accompanying this concern were rather pragmatic and not emotional, however somewhat melancholic.

The importance of defending the boundaries of the human condition, a general need for autonomy and for maintaining self-control in the age of automation was a recurrent theme.

An opinion synthesizing the essence of the general approach would be the following: "On the one hand, I think that technology helps mankind a lot, it increases efficiency, communication opportunities, and so on. For instance, it can save lives. On the other hand, it also reminds us that the deeper our relationship with everything that is artificial intelligence, the more we move away from that which is human, that which is humane. We move away from everything based on emotions. Emotions make us very human. "(Sz.S.)

DISCUSSION

Codes and meanings

In the table (Table 2) below, a synthesis of the data collected from the six in-depth interviews is offered. This phase is already the result of the multistage coding process based on the grounded theory research methodology (Denzin & Lincoln, 2000; Horváth & Mitev, 2015).

The interpretation was based on the above mentioned multistage coding approach and based on research memos written in the course of conducting the interviews.

Given the peculiarities of qualitative research methodology, the multistage interpretation and recategorization can result in insights regarding possible variables and possible relationships between them.

Possible variables and relations

Based on the categories and codes and their multistage interpretations, there were subtracted possible, still unvalidated variables and there were sketched some approximate relations between them (Figure 1).

Conclusions, further research directions and managerial implications

In the course of this research, there were collected and summarized data which could be used more thorough research in this subject.

Based on the preliminary research questions, it can be concluded that several possible facilitating and inhibiting factors contribute to the process of evaluating the interaction with intelligent systems by consumers. Among these, there were found some which are directly or indirectly related to factors found in previous research. For example, trust (André et al., 2018), and experience (Novak & Hoffman, 2019). Other factors suggested by the literature cannot be confirmed at this phase of the research.

The most important contribution of the paper can be considered the empirical evidence that suggests the existence of a mechanism which continuously evaluates the trade-off between the positive and negative aspects of interacting with an intelligent system. Based on this research, it is plausible to say that most consumers do not simply accept or reject a technology, as the TAM model suggested for 20 years, but in the course of interaction, they continuously evaluate and decide about the boundaries of their need for less or more autonomy. An untrustworthy system can trigger the expansion of consumer autonomy, as stated by Hoffman & Novak (2018), on the other hand an extremely helpful system which offers a good user experience can trigger the consumer to give up some aspects of his/her autonomy. Needing more or less autonomy can be attributed to reaching certain thresholds which convince the consumer that the system may not be, e.g. trustworthy enough.

The context (as seen on Figure 1) is also important regarding the inputs, mechanisms and outputs of the system because in a personal home context data privacy breach counts as a greater problem from the point of view of the consumer than in a workplace context.

Since this research is only a first step, there are several research directions such as extracting possible variables which can be tested with quantitative methodology, as well. Experiments can also be designed in which the mechanisms of the evaluative decision-making process are assessed.

Regarding the managerial implications, there are some points that can be taken into consideration by managers and marketing professionals:

Evidence suggests that intelligent systems can be extremely beneficial and can create considerable value, but (human) consumers tend to have a need for setting boundaries based on various factors. These boundaries have the function to protect their human condition, their free will, and autonomy for doing and deciding on their own.

It can also be concluded that anthropomorphic features for intelligent systems, such as human voice, look and other traits, might be met with a considerable amount of rejection by consumers. Some consumers want an intelligent system to remain an intelligent computer and not a human-looking/acting machine.

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Table 1
Basic parameters of the qualitative research

Parameter	Characteristic
Type of in-depth interview	Semi-structured in-depth interview medium: internet and personal format: text-based dialogue, verbal dialogue
Sampling method	Convenience sampling Interviewed individuals were known to the researcher The main idea was to have a heterogeneous sample, with professionals and non-professionals, as well.
Dime frame of data gathering	May 7-16, 2019
Number of processed interviews	6 interviews
Processing technology	QDA Miner Lite 2.0.6. software (Provalis, 2007), MS Excel, A3 size paper sheets, stationery

Source: own edit

Table 2
The interpretation of in-depth interviews

Code category	Code	Interpretation
Wiredness / digital technology use	usage rate	Generation X and Y respondents acknowledge that digital technology is omnipresent in many areas of their lives and are well informed about developments regarding innovative technologies. They see the relationship between themselves and technology in a pragmatic way.
Facilitators of intelligent system use	optimism	In this context, optimism means a general satisfaction about the presence and availability of intelligent system technologies, but every interviewee emphasized that keeping the next generation (the children of interviewees) alerted about the risks is important, as well. The code appears for more than one surveyed person. Pure optimism appears only in one interviewee who views the AI age as a "nice-new world".
	comfort	Comfort is one of the common indicators of the benefits of intelligent systems. Every interviewee emphasized that the usage of such a system would be perceived as offering comfort.
	outsourcing of tasks	Outsourcing individual human activities to an intelligent system are one of the key perceived benefits, according to respondents. Typically, the greatest need was expressed for outsourcing activities that are not pleasant to people, and which do not contribute directly to self-fulfilment.
	usefulness	A more general concept than the two above. It was understood to be the perceived utility offered by intelligent systems in general.

Inhibitors of intelligent system use	possibility of error	An intelligent system can produce errors: either because it is poorly designed in the first place, or because an unexpected failure occurs. The assumption is that human-designed systems can fail.
	fear	An intelligent system learns (operates) autonomously under specific circumstances and constraints. Thinking about the systems of the future, it is thought by the interviewees that in certain areas of life it will transcend human abilities, which can be daunting on many levels. For some interviewees, intelligent systems endowed with human qualities are frightening.
	danger	Because AI has an autonomous ability to act, people may not be able to evaluate what and why is it acting in a certain manner.
	constraint	One does not necessarily choose to use an intelligent system of its own free will but is forced to do so by external factors (employer, government, etc.).
	dependence	A given intelligent system will be able to provide a level of user experience and problem-solving efficiency that makes the individual addicted. This aspect was presented by some interviewees in an analogy with social media addiction.
	manipulation	A self-evolving AI-based intelligent system could manipulate people. Intelligent systems designers are trying to manipulate people profiting of the extremely efficient functionalities of the system.
	uncanny feeling	A weird, creepy, alien feeling to think that a "non-human", a "non-living being" behaves like a human. Giving human qualities to something not human “is not a good idea”.
	aggression	The perceived manipulation by the intelligent system is interpreted as an intrusion and a form of aggression by some respondents.
Mechanisms and boundaries	boundaries	This code collected views and attitudes about where should be the boundary set between human control and intelligent system control. Where should the boundary of personal autonomy be? Where should the boundaries of intelligent system acceptance be? There was a general view among the respondents that respect for privacy was a compulsory condition. Some asserted that this privacy can be traded away in turn for some very useful features of the intelligent system (trade-off). Others were less prone to compromise and stated that home is a somewhat ‘sacred place’ and intelligent systems should be kept out of it.
	deliberation, dilemma	There are a number of advantages and disadvantages to consider when deciding on use. Some asserted that this privacy can be traded away in turn for some very useful features of the intelligent system (trade-off).
	reasons for acceptance	The useful functions, the convenience provided by an intelligent system, and the outsourcing of activities that are (not) worthy/pleasant for a human being. The acceptance of such a ubiquitous intelligent system can help humans to foster their creative potential, self-actualization.

	impact of human emotions on acceptance	The capabilities of such a system are upsetting for some of the interviewees. Emotions are typically human.
	The fantasy world and pop culture references	Advanced intelligent systems are perceived as close to some well-known characters of science fiction literature and pop culture. E.g. Terminator, SkyNet, Hal 9000, characters from Ex Machina, Black Mirror and so on.
	Human characteristics	Some respondents argued that people are sometimes irrational, people's decision-making can be helped by such systems, and people need help to make better decisions.
	Critical thinking	Humanity's good chance of defending against a potentially malevolous superintelligence of the future is to develop critical thinking skills.
Perceived characteristics of intelligent systems	definitions of artificial intelligence (AI)	Non-formal definitions in the respondents' own words, centred on three elements: automated, capable of learning, and 'more than human'.
	opinions on anthropomorphism	In the case of most respondents, the final argument was that there is no need for human/anthropomorphic characteristics in the case of intelligent systems. Respondents would rather engage in interactions with a computer which looks and behaves like one. One interviewee stated that human look might be a good idea, but technology is not yet there for it to be enjoyable or useful.
	responsibility of AI	An interviewee pointed out that people tend to be irrational and sometimes do not know what they want, so the responsibility of AI-based intelligent systems is that they need to make the right decisions to eliminate people's mistakes.
	indication of the purpose of intelligent systems	An AI is perceived as a neutral entity. It will do what it's predefined goals dictate. Its goals are set by people, so it is crucial to program the right goals into the system.
	The diverse nature of AI applications	Views about recognizing that many types of AI exist as a basis for many products and services. Several interviewees also linked it to IoT-based services.
Being human	loss of being human	The concern is that with the advancement of digital technology, and more specifically, AI, some characteristically human traits and qualities may be lost because people gradually outsource them, hence then forget them.
	respect for the human condition	Some respondents stated that people should enjoy the presence of their emotions and should love the human condition because this is how they can preserve who they truly are.
	uniqueness	The view that human decisions are difficult to categorize, each person is unique.
	boundaries of being human	Views about where being human ends and non-human begins. Mostly asserted as lay philosophical wordings by some respondents.
	futuristic visions	Extremely polarized visions about the future of human - intelligent system relationship. One interviewee was optimistic, others were neutral (cautious) or rather pessimistic. Some stated that "we have already crossed the border and there is no way back", regarding giving up some aspects of our human capabilities by outsourcing them to intelligent digital technology.
	defiance	Respondents acknowledge that a smart body weight scale may tell a lot about one's body, but none of the interviewees uses such a scale since an 'unintelligent scale' would do the job

		perfectly.
	irony	"Yet again, something smarter than humans." "Amazon Alexa is rather funny than useful."

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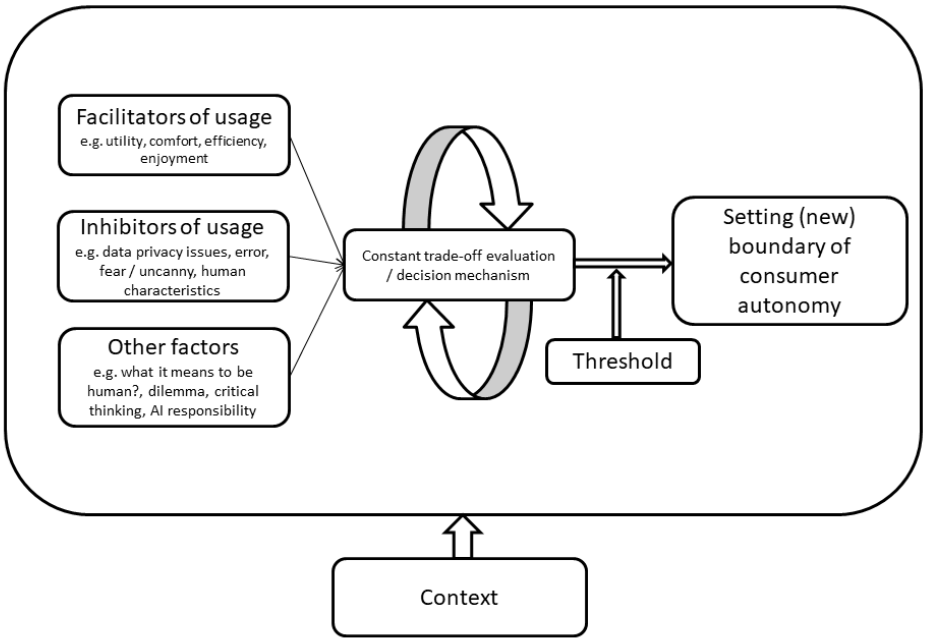

Figure 1
Possible relationships between the extracted categories of codes.
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APPENDIX

Appendix A - Interview guideline

1. To what extent is digital technology part of your daily life?
2. What activities do you have that you would like to outsource, automate, if any?
3. What do you think and feel when you hear the term "artificial intelligence"?
4. In the near future, our smart products and systems will become even more intelligent. There are more and more solutions which you can outsource to. These cutting edge, A.I. based systems can take over a lot of your daily, repetitive tasks, they can take more responsibility and do a good job. In your opinion, where is the limit of this 'intelligence outsourcing' for you? How much should we let these intelligent systems into our lives?
5. What is the situation that would make you feel intruded by an A.I. based application and why?
6. Suppose in 20 years there will be much more advanced A.I. based solutions and most people would use them just as today we use smartphones. What would you advise your child in 20 years time?
7. To what extent is it OK for an A.I. based system to have human qualities, characteristics, appearance?