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DESIGN RESEARCH IN THE DIGITAL ERA

Opportunities and implications
Notes on Doctoral Research in Design 2020



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Ethics and social awareness

Personal Interaction Design. Introducing into the Design Process the Discussion on the Consequences of the Use of Personal Information

Laura Varisco

Department of Design, Politecnico di Milano

Abstract

Sensors and devices which gather personal data have become pervasive, and so have the digital solutions which use these data to tailor and improve services for users. The collection, storing, use and sharing of these data, however, raise concerns about possible future consequences. Thus, management of personal data has become a critical task for the design practice. This chapter illustrates the basic knowledge and tools that brought about the definition of the Impact Anticipation Method as an outcome of the PhD research. It helps designers consider the impact of the use of personal information that goes beyond the broadly considered problem of privacy. It aims to elicit awareness in designers about the data implied and data flows of the designed solution, about the involved and possible actors that acquire value through the use of personal data, and the possible positive and negative consequences of its use. It considers impacts on the aspects of self-awareness, action performance, interpersonal relationships, and social agency.

Personal data as a source of value within services

Many products on the market rely on personal data to provide various services with different purposes, such as security and safety, medical monitoring, fitness tracking and intelligent personal agents (Neff and Nafus, 2016). Personal data can be considered as a by-product of digital devices (Schneier, 2016) and information on the web. Digital devices create data about the individual and provide much information regarding body parameters and body behaviours, actions performed in space, interactions with digital interfaces

and with surrounding people, and so forth. Personal information extracted from data is creating value not only for individuals, but also for companies that use the information to provide meaningful services. The collection and use of data even enable the creation of innovative new services and systems, and of new modalities for interaction (Balsalobre-Fernández *et al.*, 2017; Rashidi and Cook, 2009; Pillan and Colombo, 2017). Furthermore, the interactions among networks allow the user to search and investigate about other people through their information. The connection to the Internet enables the creation of data about actions performed on the web and communication with others through portals, websites, apps and messaging. Computers surround people's daily activities acting as enablers, facilitators, and companions. The creation of services that rely on the use of personal information is a complex chain of value creation that starts from the human element. People are surrounded by technologies that are capable of gathering information about them, such as cameras, scanners and a huge amount of other different sensors. People are giving away data that belong to them to receive services and insights. The same data are so not only collected, but also processed, stored, sent to the cloud and other services. Providing their data to these services that convert it to information, people are consciously and, often, unconsciously exposing themselves. In this context, the objective of the research is to understand how it is possible to elicit critical thinking in design processes, raising awareness about opportunities and problems related to the use of personal information in interactive digital solutions.

Awareness and Function

The practice of tracking personal data is able to increase self-knowledge through the analysis of personal traces (tracked data) and the derived information (Ferraris, 2009; Buckland, 2017). Reading visualization of personal information, the user increases his/her knowledge about activities performed, about personal preferences and trends, and about body behaviours. Digital technologies and precise sensors are now able to detect and make explicit even very precise and detailed information that was not previously available. Self-tracking is also able to promote behaviour change in a goal-oriented approach (Lupton, 2016; Young, 2013), also through the comparison and sharing of personal data with other people, which improves personal knowledge of the individual, alone and among other people, engaging them in a goal-oriented community. Current service solutions use personal data not only to provide awareness on the extracted information and knowledge, but

also often provide an additional service value through functions shaped to fit the analysis of the user's information (Bogers, Frens, van Kollenburg, Deckers and Hummels, 2016). Private and public companies, governments, and other actors have the power to collect data and use it to enable service functions, to personalize the user experience, to create legitimacy through identity verification, to provide access and authentication, to create new services and to improve already existing services (Joinson *et al.*, 2010). Modern connected home appliances allow remote control, use behaviour analysis, and collect users' preferences to enable service proactivity (Pillan and Colombo, 2017). Connected wearables, portable devices and integrated services provide information every time and everywhere about everything and, more importantly, about everybody. Consumer electronic devices can create service value through the use of personal information for personal purposes (reaching personal goals, monitoring health parameters, and so on; Purpura *et al.*, 2011; Balsalobre-Fernández *et al.*, 2017). Devices and the environment are providing services that lower effort, as well as insights, suggestions and help to manage daily life tasks. The digital solution becomes an everyday companion for the user; the proactive system is a digital symbiont that knows its owner, and acts and reacts accordingly.

A revised DIKW model

Considering data as “symbols that represent the properties of objects and events and their environment” (Ackoff, 1989; in this research, the person is considered as a carrier of properties), we know that data “are useless until they are in a usable (i.e. relevant) form” (Ackoff, 1989). Data is provided by the user or automatically gathered from the system, which collects it mostly in real time. Data is created, collected, and then processed to be useful. Information represents the properties of objects and events, but in their processed and more useful form. The difference between data and information is functional. The added function of information is in its being interpreted from raw material to something that is filtered, elaborated, and selected so as to be understandable and analysable by an analytical processor. The processing of data is the elaboration that creates the signifier for the elements in the form of information. When data is processed and merged to create information, it becomes valuable and has meaning (Boyd and Crawford, 2011; Rowley, 2007). Then, the application of the information through analysis leads to knowledge and understanding as interpreted information according to statistics, rules and reference knowledge (such as research findings and

results). Wisdom is a type of knowledge that includes a deep understanding for its proper applications to a given situation, which results in the evaluation and judgment of how to act. Wisdom is recognized as a virtue (Jifa, 2012). Humans create wisdom when they evaluate knowledge according to personal ethics, values and culture. Consistency with elements and definitions from the DIKW model (Ackoff, 1989) is a conventional reference for information organization, and Fig 1 proposes the linear reshape of the model that consider Frické’s critique to the pyramidal model (Frické, 2009). Furthermore, the revised model considers the whole process as open to both a build-up approach and a design-down approach. In a build-up approach, the creation of wisdom derives from inferences that extract opportunities from the roots (properties). This approach is consistent with current trends in the regulation of data protection, such as the European GDPR (IT Governance Privacy Team, 2017). The purpose of the data use is the element that determines the inferences of the steps. Although this approach is compatible with a higher level of control by the user upon data sharing and management, the principle of “data minimization” reduces the possibilities of discovering opportunities through the embrace of complexity of phenomena. With a design-down approach, the inferences start from the given situation and lead to the discovery of opportunities through the seeking of answers from the top (Frické, 2009) which is extended to the whole process and focuses on the start from the need of a clear understanding of tactical objectives (Marr, 2015). The revised model generally frames the process of the DIKW model offered by the combination of technologies (devices, algorithms, AI) and human processing (reading and interpreting information, evaluating and judging knowledge).

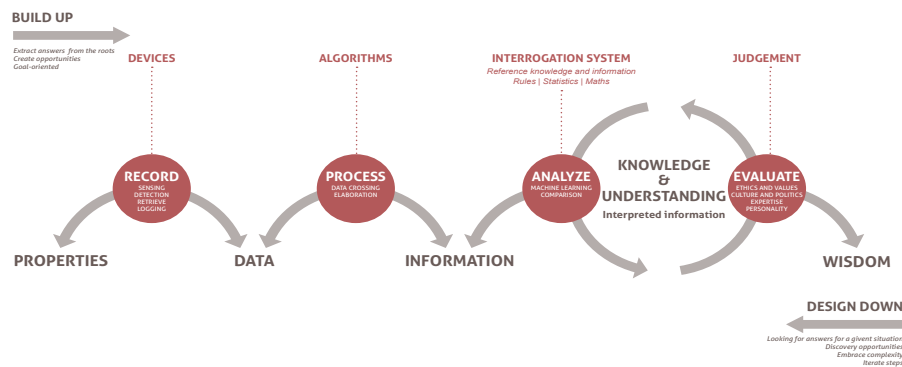


Fig. 1 – Revised DIKW model.

Impacts of the use of personal information

Active and passive, aware and unaware tracking and use of data has impacts on different layers of the individual identity and everyday life.

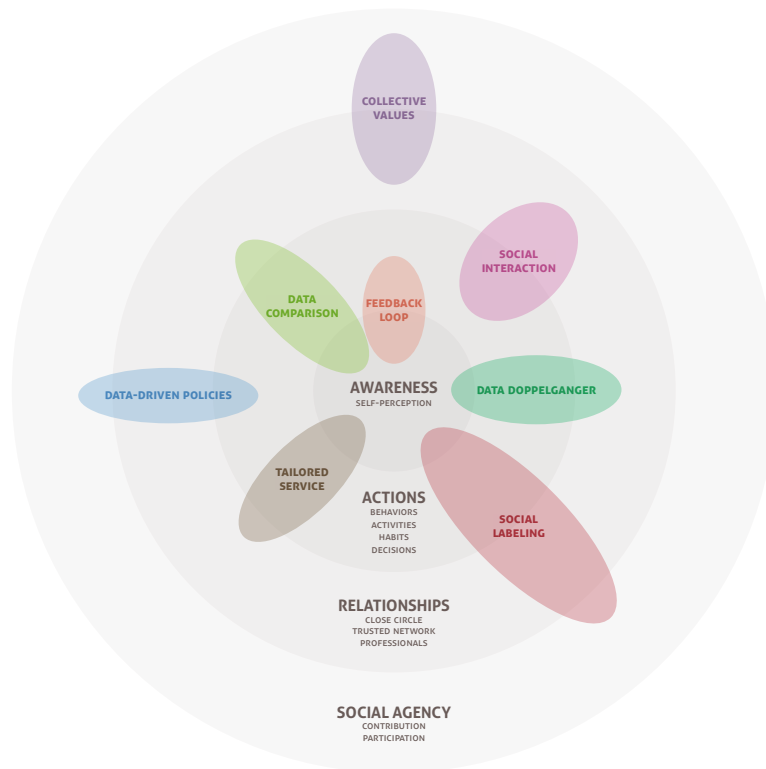


Fig. 2 – Impact layers.

Fig. 2 shows the four impact layers which emerged from the research, and on which the use of personal information has an impact. First, it impacts awareness and perception of the self. This impact layer belongs to the very personal sphere of interaction with the self. The return of information from a system to users in the form of visualization, feedback and insight, impacts on individual self-perception and self-reflection. The second impact layer concerns the dimension of actions and behaviours. The proactivity of services, their suggestions, alerts, and tailored experiences based on profiling, impact the action that the user performs in specific occasions and in daily life activities. The third impact layer relates to interpersonal relationships

and roles within them. Social interaction based on data, the comparison with data from other people and tailored experiences offered by services impact relationships and roles that users have within their personal and professional networks. The fourth impact layer refers to social agency in the political, cultural and public domains. Participation and contribution to society through sharing and providing data for research, data-driven policies, in collective values, and even contributing to social labelling mechanisms: user's information has an impact on how society shapes itself.

Personal information as a matter of design

While scientific literature mainly addresses the topic of the impacts of the use of personal information on privacy concerns and technical solutions to that (Joinson *et al.*, 2010), a significant contribution to the discussion that goes beyond the problem of privacy can be found throughout scientific communication for the masses. Focusing on the use of personal information in digital solutions, it is possible to report several cases of misuse (even while promoting bottom-up innovation) related not only to privacy violations, but also to issues related to surveillance, fraud, and persuasion through social engineering. Among several examples, such as the various allegations brought against Facebook for violations of the privacy of its users and the related permission of data usage for social engineering and persuasion for political purposes (Young-Joon, 2017; Hewes, 2018; Geib, 2018), we can also identify misuse (or unintended use) of data and information by users themselves. Currently, it is easy to have indirect access to private information through expert use of technologies that make it possible to gather, combine and relate information and extract useful knowledge in a completely legal way. One example is the case of Angelina Jolie's fans who were able to use Google Maps to identify and visualize the exact position of the geo-referenced information written in pictures of a tattoo posted on Instagram by the actress, which reports "the latitude/longitude of the places where she adopted her four kids" (Sui, 2008). It represents a use of the information contained in social media that was not intended by the actress when she posted the pictures of her new tattoo. Furthermore, the use of personal information can arouse concern about the reliability of data and of the interpreted information (Hughes, Joshi and Wareham, 2008), which can even cause severe problems, such as unreliable information in the field of Medicine 2.0. The research identifies several contemporary issues related to consequences of the use of personal information and clarifies the need for ethical criticism when designing solutions that

imply the use of personal data and information. During the design process, the creation of innovative connected services must consider the reliability and safety of the final solutions. New services and innovative solutions bring changes that can be perceived as utopian to some people, and completely dystopian to others. When creating such innovative services, designers are faced with a multiplicity of different perspectives about wellbeing, sustainability, and social justice. They should orient design choices to embrace the contradictions implied by the changes they can produce, and to deal with the complex issues that go beyond utility.

Facing the problem through design that considers impacts

While designing digital services, we deal with the inconsistency, variability and variety of the human perception. We should clarify and focus on the tangle of issues involved in the use of personal information, so as to better understand what is at stake in order to face the complexity of the issues involved in ubiquitous computing. Technologies should be developed to help people in their life, to improve and enhance life conditions, and to allow new activities. They should be meant as active contributions for creating a better future, but the directions of progress and the meanings of the future utopia is not such a contribution, nor is it common to everybody (Diener, 2009). We have started advocating the need to move toward the use of distributed cognition as a theoretical foundation for designing new communication and interaction technologies so as to maintain a human-centered focus. The design of human-computer interaction requires a comprehensive understanding of the cognitive processes and considering the relationships between all elements participating in the process (Hollan *et al.*, 2000). Some scholars developed approaches that aim to introduce social sustainability into the creation of technologically advanced artefacts (Khodzhaeva *et al.*, 2015; Friedman, 1996). Critical thinking has to be introduced in the design process, among designers and involved companies and stakeholders in order to: 1) improve services thanks to the possibilities personal information offers, and 2) to avoid negative consequences through the anticipation of possible issues related to the designed solution. Therefore, it is essential for designers to understand how technological solutions can imply the use of personal data to provide meaningful new services or improve existing ones. First of all, it is necessary to provide definitions of personal data and personal information, then we have to understand how the creation of value from personal data works in technological solutions.

The Impact Anticipation Method and Data Impact Toolkits

A possible approach to this challenge is the use of tools and knowledge within the design phases to raise awareness in designers and other professionals involved in the process. The Impact Anticipation Method has the purpose of helping designers who deal with innovative products and services to create robust, reliable solutions. It can improve the design process by foreseeing what the potential user will perceive about the solution with respect to several issues. It can also help in understanding if and how the solution will be socially and ethically accepted, and this can also influence its success on the market and its long-term adoption. The method is applied in different ways and using different tools according to the process phase and the design approach used. It is added to the already used UX tools, such as stakeholders' maps and user journeys, and it has the double purpose of: i) potentiating the values provided in the service; and ii) anticipating possible criticalities related to it. Furthermore, the dissemination of knowledge and tools can advocate and contribute to the discussion of the topic among the design community. By involving the identification of issues in their positive and negative aspects into the design process, the method aims to help designers in different phases anticipate points in question and carefully envision detailed innovative contexts. The Impact Anticipation method consists in the application of different tools specifically created in the form of toolkits that address different design phases and depths of analysis of the use of personal information. Regardless of whether the method is used for preliminary analysis of case studies and context, or to assess a designed solution in the creative or assessment phase, both the in-depth and the light versions of the Data Impact Toolkits contain tools that address two main objectives: raising awareness in designers about data and actors involved (understanding of data flows), and the identification of possible consequences related to the solution (exploration of impacts).

Understanding data flows

The part of the Data Impact Toolkit that addresses understanding and raises awareness of how and for what purpose personal data are used in a designed solution consists of two different templates. Both the templates include directions and explanations of how to use them in the bottom part. The first one (fig. 3) visually represents the flows of information from the data sources (sensors, devices, self-logging), which become information and then knowledge, to the specific features that add value within the service.

PERSONAL INFORMATION FLOWS

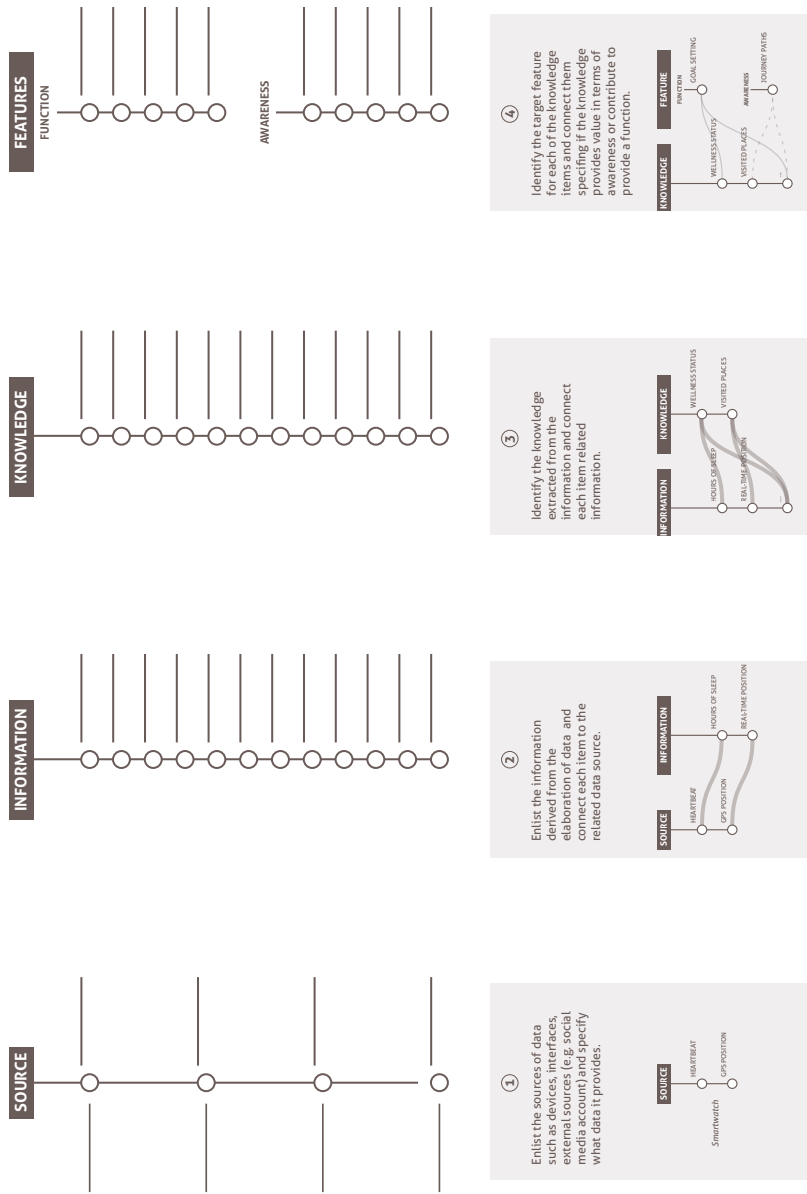


Fig. 3 – Personal Information Flows template.



Fig. 4 – Stakeholders and Value Map template.

The second template (fig. 4) shows which actors are directly involved in the service and invites readers to consider other possible actors and stakeholders that could gain some value from the knowledge acquired by the solution. The use of these templates by design students during courses at Politecnico di Milano demonstrated that the representing information flows and value provided by services through the use of personal information is a useful tool to raise awareness and bridge possible gaps that designers may have about which data and information are used in the analysed solution. Designers also learn specifically how data adds value to the service, and they can then envision possible improvement for the solution in terms of value provided for direct stakeholders and other actors.

Exploration of impacts

An analysis of two different sources brought to the identification of numerous issues referring to the use of personal information in digital and interactive solutions and services. The sources analysed are futuristic scenarios from sci-fi narratives and a selection of news articles from online magazines that refer to the use of personal information. The future scenarios described by science fiction authors are seen here as the representation of hopes and fears of our society with respect to the evolution of technologies (Shapiro, 2016). Furthermore, linking communication and the technological advancement of the masses actualizes those hopes and fears, and makes them useful for understanding current worries and wishes related to the future of technologies and technological services. The huge amount and variety of the emerging issues highlighted the need for a way to conveniently explore them. The Potential Issues Database is an interactive explorable collection of these issues. There are two explorable visualizations of the same database (the Light and the In-depth Potential Issues Databases) which refer to the depth needed for the analysis. The In-depth Potential Issues Database is divided into the eight Ethic-Oriented reference scenarios which emerged from the analysis of the sci-fi narratives (Varisco, Pillan and Bertolo, 2017), and then the information within each of the scenarios is organized into issues (belonging to a specific impact layer) that contain the single magazine's quotes. To use the database, designers follow three steps: first, they identify and then select the ERS that are relevant for the concept they're analysing; second, they navigate across the issues related to the selected ERS and identify the relevant ones; lastly, they cluster the issues in critical themes according to their sensitivity. The outcomes of the process are the resulting critical themes related

to the concept in analysis. This step of creating the critical themes is crucial, not only to inform the following assessment of a solution's features, but also to enter data into the Light Potential Issues Database. When time and effort available for the application is limited, the light version of the tool allows a quicker but meaningful analysis. The information in the Light Potential Issues database is clustered into the Critical Themes, so as to be used quickly through the possibility of selecting only the Critical Themes that resonate with the features of the solution under analysis. The Light version of the database is directly dependent on the In-depth one.

Critical Themes

The Critical Themes that emerge from the use of the In-depth Potential Issues Database can be considered as clusters of issues that refer to specific contemporary themes. The description (below) points out how the use of personal information in connected services creates a complex system of real and possible ethical and social consequences.

Consent or denial of service access: Personalization of services and tailoring of experiences are the results of the processing of user's data. The consequence of this personalization is the granting or denial of access to the user with regard to specific services or features. The right to access is decided based on information about the individual, and the result is a reduction of time and effort spent on professional tasks. The goal of automation to reduce time and effort does have some critical points: i) users have to provide data to allow services to check their right to access; if users refuse to provide data, the service access could be denied; ii) automatic data collection could result in totalitarian surveillance mechanisms. Data can also be used by third parties without giving the user the power to refuse; iii) the accuracy of the provided data and its interpretation are critical points. A misinterpretation of data can lead to serious errors in granting or denying access.

Awareness of data tracking, sharing and use: Services that detect and track people's data can return the information gained, and/or use this information for specific purposes, share it and even sell it according to the terms and condition that the user agreed to. Although most of the time the user is well aware of the tracked data, it is also true that some issues arise when the individual is not completely conscious of when tracking occurs, which data is collected, with whom it is shared or sold, who is using it and what kind of profit they make. It can happen that users not be totally aware of hidden tracking and, moreover, of what kind of information and knowl-

edge is extracted from their data. The user's unawareness of tracking, and the related impossibility of hiding from it, cause lack of individual power with regard to controlling the exposure of personal and intimate information to the external world. Service providers and third parties could gain profit from users' data without involving users in the trading process, and even without letting them be aware of the use of their information for a specific purpose, such as marketing and social labelling. Furthermore, the user could perceive hidden tracking even if it's not occurring, and so have the wrong sensation of being spied on.

Rights of data access management: The critical elements of data ownership and control of access are related to the user's right to decide who can see and/or use their information, which kind of information is used, the granularity of the information and the level of personalization. Access management affects the services received by the user and the individual impacts influencing the balance between individual freedom and privacy regarding policies, health and safety. While providing more and more personalized services, IoTs and ubiquitous sensors are collecting data on everyday actions and behaviours of people. The increasing tailoring and optimization of tasks and services requires much data, and its use by third parties and the related power of the user in denying said access is not always clear. Hidden tracking, as well as the pervasive availability of data thanks to its sharing on the web, make the control of the use of information difficult.

Automation of actions and services: The use of personal data makes it possible to create proactive services and automatic task management processes to save time and effort. This automation is modifying both how the service is provided and the user experience. Tailoring and proactivity are changing the paradigms of services as in the case of healthcare services that shift the focus from curing illness to self-care and prevention. The automation of analysis of personal data, however, brings up doubts on how technologies such as Artificial Intelligence can be used. Persuasion and decision-making based on personal data analysis is nothing new, and the perfection of gathering and collection as well as the automation of the analysis, thanks to technological advancement, raise issues especially when services imply Artificial Intelligence, such as Machine Learning algorithms, to automate procedures and manage complexity: i) algorithms have been labelled as biased against people of colour (Corbett-Davies *et al.*, 2016); ii) biases and prejudices in learning algorithms (Crawford, 2013) become particularly critical when Machine Learning is applied to the field of justice and law-making because of its socio-political implications; iii) even programmers do not always understand clearly how algorithms make decisions. The suggestions and filtering options

provided by services through the use of algorithms that analyse personal data can create selective exposure to content and information (Liao and Fu, 2013).

Alteration of cognitive load: the use of Artificial Intelligence allows human focus to shift from the tasks to the user experience. The cognitive load on decision-making and task completion can be lowered or raised due to automation: proactive services can lower cognitive load and allow the user to focus on less repetitive tasks and on the experience. However, the use of the technology itself can increase the cognitive load due to higher expectations from the user. Also, the return of information and knowledge in the form of visual feedback or insights and suggestions can raise the cognitive load related to burdens on new issues, such as the exposure of individuals to the external world. New problems can also be created by the invasiveness of the service or the return of too many details due to the granularity of gathered information, which in turn creates issues related to psychological effects (Mućko, Kokoszka and Skłodowska, 2005).

Alteration of risk of judgment: automatic detection and analysis are moving the burden of task completion from humans to machines, and analysis is performed mostly on automatically detected data instead of data that is actively provided the human. While automating processes through AI makes choices and task completion easier, it also removes the effort for judgment from humans, raising risks of inattentiveness in decision-making processes: i) the ‘automation paradox’ refers to systems making decisions while humans mentally ‘switch off’ (Greengard, 2015); ii) decision-making tasks based on personal information, as well as judgments made by machines through the use of algorithms, could open new perspectives of discrimination. In the USA, employers can require employees to submit to genetic testing (“H. Rep. No. 115-459,” 2017). This change in the law inevitably affects relationships between subjects. The employer is now entitled to gather employees’ information not related to current health issues, but related to future possible diseases. The discrimination can be based on something that could never happen; iii) The interaction with bots and AI changes the attitude of users during their experience. They can feel less judged than if interacting with another human being.

Self-mirroring in data: the use of personal data has many possibilities of creating knowledge for the individual. Users’ self-perception changes and relates to the self-knowledge they acquire while understanding their own data (Arda, 2014). When the user receives information back from the service, feedback can be returned in the form of information visualization or through the analysis of the information, in the form of insights, suggestions and tailored proactivity. This return of information about mechanisms such

as inner body functions and behavioural patterns renders visible something that is usually hidden to the individual. The knowledge acquired from data changes the perception users have about their own body, actions, behaviours and the returned information has to be relevant, accountable and understandable. It is possible that the received knowledge changes the way the user will act in the future (Ancker *et al.*, 2015). Self-tracking can be seen as a way to deeply connect the self to the body, but also as a distractor from life: i) people tend to pay more attention to tracking their lives than living them (Young, 2013); ii) when individuals analyse the received feedback, they experience disembodiment: knowing themselves through data creates disconnection between the knowledge and the physical (Young, 2013); iii) personal information can be used in digital life as a representation of the individual in virtual environments and users can reflect themselves in their data doppelganger, as well as being misrepresented by their digital identity.

Information overload: details and granularity of data gathered by advanced sensors increase the precision of the information and the knowledge extracted from it. However, it is important to consider the psychological impact the information has when is received by the user. Self-knowledge can be negatively influenced by overload of information (Swar, Hameed, and Reychav, 2017) that is irrelevant or has too many details: i) overexposure to information for users could be misleading, or even make them worry about irrelevant knowledge leading to further consequences such as control addiction (Mućko *et al.*, 2005); ii) increasing amount of available data is raising questions about its usefulness, possibilities of extracting valuable knowledge from it, and even concerns about privacy and surveillance.

Alteration of attitude and quality of life: digital services are providing value in services both for users and stakeholders. Although tailoring and automation make it possible to improve already existing services, as well as to create new ones for specific purposes, the use of personal information brings consequences in terms of alteration of users' attitude toward actions and behaviours and with regard to quality of life: i) the increasing availability and pervasive use of sensors to detect people's data alter their attitude toward everyday life behaviours due to the "observer effect" (McCarney *et al.*, 2007) that brings people to behave in a different way when they know (or think) they're being observed (services can also take advantage of the "observer effect" for the user's good, aiming to change a bad behaviour according to the user's goal settings); ii) the ubiquitous and pervasive connectivity that allows users to be "always present" in their digital representations raises the issue of the impossibility of hiding and disconnecting, which can change in approaches toward everyday activities.

Data use for public benefit: a utilitarian ethical approach applied to the use of personal information, as a benefit for large groups of people or even in the whole of society, can produce by-products in the form of problematic effects for individuals and for society itself: i) the gathered data can be used for public services and for increasing public knowledge to encourage better decision making, such as for creating policies or energy saving strategies (Marr, 2015); ii) massive amounts of data about people can make them become targets for massive surveillance and deny access to services according to their and other people's data.

Creation and management of communities of value: the interaction of people through their data often creates an actual community, thanks to the sharing of values connected to the purpose of data tracking common to community members. However, it is important to consider that: i) the exposure of data in the community has to be voluntary; ii) even if the amount of data is big enough to make a decision, only the collected data contributes to the decision-making process, while the "voice" of non-tracked people is cut out and not represented in the results.

Democratization of services: the use of personal data to enable remote interaction makes it possible to provide affordable or even free services and features for lower income people, as well as increasing the plateau of users. The democratization of services is granted for people who can provide their data (those who do not have access to an Internet connection or cannot afford the necessary devices are not considered). Users' intentions to share data can be obstructed by: i) not being part of a specific interest group or community; ii) unawareness about the availability of the service; iii) doubts about unknown uses of the data collected.

Changes in design choices

Among the possible applications of the method in the design processes for interactive innovative products, we can reflect on the use of critical themes and issues as assessment and discussion elements to: i) frame the state of the art in terms of current solutions in the preliminary context analysis and foster reasoning in the preliminary user analysis; ii) identify possible impacts of a solution concept so as to make more aware design choices during the creative phase; iii) assess proofs of concept and the related scenarios of use to verify the solution and support the definition of user tests. The use of these discussion elements in different design processes can help to identify user's rights, generate design guidelines, assess concept features, and

identify possible improvements. The application of the method performed in design activities helped not only designers to develop awareness on the consequences of their actions and outcomes, but also researchers to assess and improve the method itself and its findings. The results from the application of the Impact Anticipation Method in design processes shows that the method can support the design process thanks to different applications and tools for the analytic, definition and assessment phases (Varisco, Colombo and Casalegno, 2019; Varisco, Pavlovic and Pillan, 2019; Varisco, Pillan and Marti, 2019). It helped designers create robust, consistent and resilient solutions supporting the design through the introduction of critical thinking in the whole process – from preliminary phases to the assessment of the solution. The designers involved in the application of the method demonstrate increased personal awareness on the topic by changing and improving the outputs of the design processes through more thoughtful design choices with respect to: i) the use of personal data in terms of collection, storage and elaboration; ii) the derived information and knowledge; iii) the possibilities that this knowledge opens in adding value to the services; iv) and the possible impacts that the use of personal information could have on individuals and society. Furthermore, while exploring case studies, designers have the sensitivity to understand and identify valuable user's rights and design principles that go beyond the topic of privacy, using a critical thinking approach that embraces the complexity of the various impacts looking toward design choices as possible solutions.

The role of design in the discussion on the consequences of the use of personal information

As the research pointed out, the design of solutions that implies the use of personal information is a critical concern. The need of critical thinking for the design of such solutions emerged not only from the literature and the critical themes which were identified during the application of the Impact Anticipation Method. It was also underscored by the difficulty of designers and students in figuring out and becoming aware of both how and when personal information is implied in their designed solutions, and the potential impacts that the use of such information and the derived knowledge could have. The Critical Themes clarify the need for thoughtful design choices which take into account the user's rights regarding privacy and security, but also regarding less evident impacts such as: i) perturbations in self-perception and self-awareness due to self-mirroring into data and feedback received

from services; ii) the automation of the extraction of knowledge about individuals that changes people’s cognitive load, actions and behaviours; iii) the alteration of people’s quality of life, freedom and access to services thanks to increasing availability of services that imply personal data as a matter from which to extract knowledge; iv) the alteration of the individuals’ participation in society and the community, and the changes in their interpersonal relationships and roles. The outcomes of the design processes in which the method has been applied clarified that designers have the sensitivity and capability to identify and interpret user’s needs. They can mediate between companies and users and also help define best practices. Designers have an active role in designing innovative solutions and their aware design choices can produce an active contribution to the identification and interpretation of user’s needs and rights with regard to management of their data.

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