Designing ethically in a complex world

MULTIPLE CHALLENGES WITHIN DESIGN
FOR PUBLIC AND SOCIAL SYSTEMS

Edited by
Elena Caratti and Laura Galluzzo

DESIGN FOR
SYSTEMIC CHANGE

FrancoAngeli
DESIGN INTERNATIONAL

Design International series

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12.1 The power of AI

When facing the latest advancements of digital technologies, we often feel divided between the excitement of exploring unprecedented innovations and the fear of being overtaken by the technologies themselves. As one of many, Artificial Intelligence (AI) today ignites alively debate between scholars and a diffused enthusiasm in the technological business world. After the inital theorization and field experiments with AI in the 1950s (McCarthy *et al*., 1955), for decades it was just considered a possibility of the future, alternating moments of euphoric optimism to others of disillusion and research stasis. Today, the high calculation capacity of computers has allowed governments and companies to extensively leverage on AI to develop systems, services and products.

AIs are defined as non-biological entities that are capable of learning independently, thinking in a simple way, and consequently acting without being supervised (Holmquist, 2017; Crawford, 2021; Kieslich *et al*., 2020). They can operate in a wide variety of urban spaces

and domains (Crawford, 2021), taking the most diverse forms and effects, and consequently leading to unprecedented opportunities and challenges (Verganti *et al*., 2020), but also to risks and unpredictable implications (Bertolaso and Marcos, 2023; Roco, 2016). This makes them perceived by most human beings still as opaque and out of control (Kieslich *et al*., 2020), and they generate a complex set of expectations, ideologies, desires, and fears (Crawford, 2021).

The way AIs work is, however, easily understandable: they collect data, then iteratively analyze and classify them through models and parameters given as initial input by humans. From the data they build algorithms used to process more data. The more data AIs take, the more performative the algorithm and the more precise the outcome.

Thus, data used to train AIs and perfect the algorithms became a primary resource of economy (Fuad-Luke, 2009; Zuboff, 2019) and are used by companies as a market lever to make money from bets on the behaviour of future users. What is demanded for people is where and how data are retrieved: the answer is they are usually stored in publicly accessible datasets, built with images collected in public spaces or uploaded by people on social media feeds (Crawford, 2021). When they get old, Crawford continues, these collections of data are seen merely as infrastructure, and no attention is paid to the fact they can contain personal or potentially damaging data.

Moreover, AI systems classify data with labels that are biased by the categories provided by humans. These flawed labels are used to recognize human identity, gender, and race, but they result in being racist and discriminatory, as they leave behind the complexity of subjectivity while they build biased hierarchies and boundaries for our society.

This would be enough to raise ethical concerns, but there is more: among the several applications of AI are facial recognition and the collection of biometric data. Biometric data are personal data resulting from specific technical processing relating to the physical, physiological, or behavioural characteristics of a person (e.g., facial images or fingerprint data), which allows or confirms the unique identification of that person (Privacy Plan, 2021). Cameras can capture the facial signature and collect data in public spaces or private spaces open to the public, without any form

of consent or dissent (Kohnstamm, 2012). With institutions not yet offering sufficient guidance and regulations in the field, most people don't know when and where data are collected: the result is a tendency not to protect our uniqueness and little awareness of the deployment of this technology (Ada Lovelace Institute, 2019; Pew Research Center, 2019), which becomes discriminatory and harmful for a number of human rights (Amnesty International, 2020).

Rooted in the first military applications of AI which had the logic to find and punish offenders, this raises strong legal and ethical concerns on the privacy and autonomy of people when this enters everyday life automatic identification, together with fear and urgent need for protection (Quintarelli, 2020).

However, this is not AI's responsibility. If it is true that in AI what is intelligent is not artificial and what is artificial is not intelligent (Bertolaso and Marcos, 2023, p. 10), machines do not act neutrally and autonomously without human directions, and human intention is at the center of the debate. To Crawford, AI systems are «embedded in social, political, cultural, and economic worlds, shaped by humans, institutions, and imperatives that determine what they do and how they do it» (Crawford, 2021, p. 211). For Quintarelli (2020), AI does not behave ethically or unethically as it has no idea what ethics is: humans must oversee whether its results are aligned or conflicting with ethical principles. This vision is strongly challenged by the fact that AI systems are designed to benefit the institutions and corporations they serve, and in this sense, they are «expressions of power that emerge from wider economic and political forces, created to increase profits and centralize control» (Crawford, 2021, p. 211).

If, as human beings, we see the concrete risk as lying in weakness, and we rely on legislation to protect ourselves or on philosophy to understand the ongoing changes, how do we position ourselves as designers? How could we contribute to the typical human-centric approach when technologies are so harmful for our human identity?

12.2 The role of design

Privacy is such an urgent issue that legislators and scholars have investigated it extensively, and the protection of personal data today is discussed in terms of human dignity and personal identity, with citizens described as interested parties (Floridi, 2022). The contribution of design in the context has, however, received much less attention (Wong and Mulligan, 2019). Privacy protection is a strongly technology-based field, in which dominant engineering approaches assume that privacy is predefined and does not need to be challenged at the design level. Only in recent times has design – especially critical design and partially service and UX design – started to explore the topic, more in a dimension of social-political activism and criticism against *surveillance capitalism* (Zuboff, 2019) than in the design of producible solutions.

Privacy by Design (PbD), theorized by Cavoukian (2009) in the 1990s as a set of principles to guide companies in adopting privacy protection in an integrative way, has recently been included in the General Data Protection Regulations (GDPR) (ART. 25). This introduces the human-centred design approach in the field of personal data protection and requires EU organizations and system developers to include all the principles of data protection in their design processes. To Felzmann *et al.* (2020), the legal legitimation of PbD opens space for inclusion of other design principles guided by values in the field of computer science and AI, as Friedman *et al.*'s (2008) Value-Sensitive Design (VSD) methodology, or the envisioned concept of Trasparency by Design (Felzmann *et al*., 2020).

Floridi (2022), a professor of philosophy and ethics of information, believes that our era is, more than any other, the age of design, since digital is providing immense freedom to restructure and organize the world in a multitude of new ways. This is a promising statement if we follow Simon's definition of design where to design is to «devise courses of action aimed at changing existing situations into preferred ones» (1982, p. 129). We, designers, could have a multitude of opportunities and tools to realize our purpose.

If we still seem to lack a collective human project for our digital age (Floridi, 2022), from the standpoint of designers we see design itself

as one of the critical drivers of innovation when navigating the ongoing transition (Bertola *et al*., 2021). This is due to its capacity to link technological systems with cultural and societal evolution and to its approaches based on users' and societal values. Indeed, design has always been a human-centric discipline, which is good guidance for a twin transition where digital goes together with sustainability that includes human beings and the rights of humans and non-humans.

Given these premises, in the next sections we question the possibility of designing in the anti-surveillance field, combining the critical part with the pragmatic-functional dimension.

To address the ethical concept of individual privacy, the presented research adopts a multi-layered systemic approach, framed at a crossroad between fashion and textile-knitwear design with engineering for AI, computer vision and machine learning. In such complexity, the human-centric approach is contaminated by the contribution of other disciplines in an advanced co-design process that uses digital technologies to generate a fashion product that protects the identity of the wearer from harmful digital surveillance.

The cultural assets of fashion, that shape individual and social identities through the material and immaterial values of its products (Crane & Bovone, 2006; Crane, 2012; Bertola, 2021), are combined with the high precision of machines and the acute complexity of technology in the textile-knitwear field, that open perspectives on innovative technical performances for the development of advanced products, also in fields other than fashion.

Through this combination of fashion and knitwear design, and a collaborative effort with engineering for AI, the research developed an adversarial textile made with computerized knitting machines and resulted in Cap_able, a collection of clothes that embed algorithm-generated adversarial images, able to deceive facial recognition systems. These are garments that protect people from AI while making them aware, and at the same time visible to other human beings (Didero and Conti, 2022).

By reading the methods, process and the results of the research, we reflect on how designers work in handling the expertise of engineering researchers, experts in ethics, policies, and knitting technologies, and in combining them with the contribution of ma-

chines not just in the development of a fashion product, but in the search of a multifaceted solution to such a complex global issue.

We observe and question how much space is left for design thinking if a part of the creation is left to algorithms? What is the object of design? And how does the process itself still lie in the hand of designers with so many external inputs to deal with?

The ultimate goal is to observe how the methodologies of design foreground the ethics of design practice, and how such research can potentially reveal hidden agendas and values, and explore alternative design values (Bardzell and Bardzell, 2013). We explore possible directions for designers to place themselves at the boundary between AI engineering, fashion design and textile-knitwear technical knowledge, without forgetting the ethical aspects, and to think of themselves as «an essential creative engine real-time informed about the impacts, actions and reactions of its surrounding cyber-physical ecosystem» (Bertola *et al*., 2020, p. 61).

12.3 Exploring the boundaries of fashion and AI collaboration

Fashion design and AI engineering are combined systematically to create an adversarial textile that can fool facial recognition systems. This intersection between fashion and engineering indissolubly weaves the indulgent domain of design and the logical savvy of Artificial Intelligence, orchestrating the genesis of an original breed of adversarial textile-sartorial engineering for cloaking individuals against their surveillance. As William Gibson aptly prophesied with *Zero History's* Ugly T-shirt, Cap_able seeks such an effect; that is, visibility-disruptive garments whose already problematic registry and retention by surveillance systems efface them (Gibson, 2010). Cap_able epitomizes this vision by seamlessly blending design, technology, and ethics.

Central to this fusion is the potential integration of Jacquard technology, a pivotal step that transcends adversarial digital images into tangible, physical solutions. This marks a significant shift, emphasizing the importance of the Cap_able design process – a journey orchestrat-

ed collaboratively by designers, engineers, and textile technologists.

The process unfolds in ten distinctive phases, each revealing the intricacies of how this collaborative effort navigates the realms of creativity, innovation, and functionality.

1. Image Creation: computer science engineers create generative adversarial networks (Didero and Conti, 2022) to obtain digital images. These images form the first phase in the adversarial textile that is being designed to fool facial recognition.
2. Testing Digital Images: digital images are rigorously tested by using masks to round out colour and photographic detail. Ultimately, the goal is to have a digitized textile that outsmarts facial recognition algorithms.
3. Boosting Adversarial Images: from the digital test results, the team identified areas that need improvement. The objective is to fine-tune algorithms such as YOLO, among other versions, to ensure the adversarial images are compelling (Didero and Conti, 2022).
4. Image Transfer on Fabric: once an optimal digital image is achieved, designers transfer it onto fabric. This phase is accomplished through different fabric types and scales of the digital image, which requires careful consideration to produce the desired effect (Figure 1).
5. Designers' Fabric Elaboration: in that case, designers adapt and transform the adversarial digital image to suit the fabric they selected for their garments. Their creative input ensures that the concept depicted digitally can be transformed into something wearable and tangible.
6. Involvement of Fabric Technicians: fabric technicians utilize Jacquard technology and computerized knitting machines, producing complex textiles that enhance the adversarial image's depth and texture (Figure 2).
7. Pattern Placement and Optimization: strategic placement of the modified textile on patterns or knitting machines allows for efficient use of materials, while optimization techniques help increase cost-effectiveness and reduce material wastage.
8. Garment Manufacturing: the changed cloth enters the garment- manufacturing stage. The clothing pro-

duction occurs along predetermined lines, seamlessly merging with the adversarial fabric (Figure 3).

9. Real-time Object Recognition Testing: complete testing is done under real-life scenarios using object recognition software (Figure 4).
10. Data Collection and Iterative Refinement: data are collected depending on test findings and how effective adversarial textile was in protecting the wearer from facial recognition attacks. This enables experts to refine and improve inputs made into models. This cycle is aimed at constantly improving robustness within a digital environment.

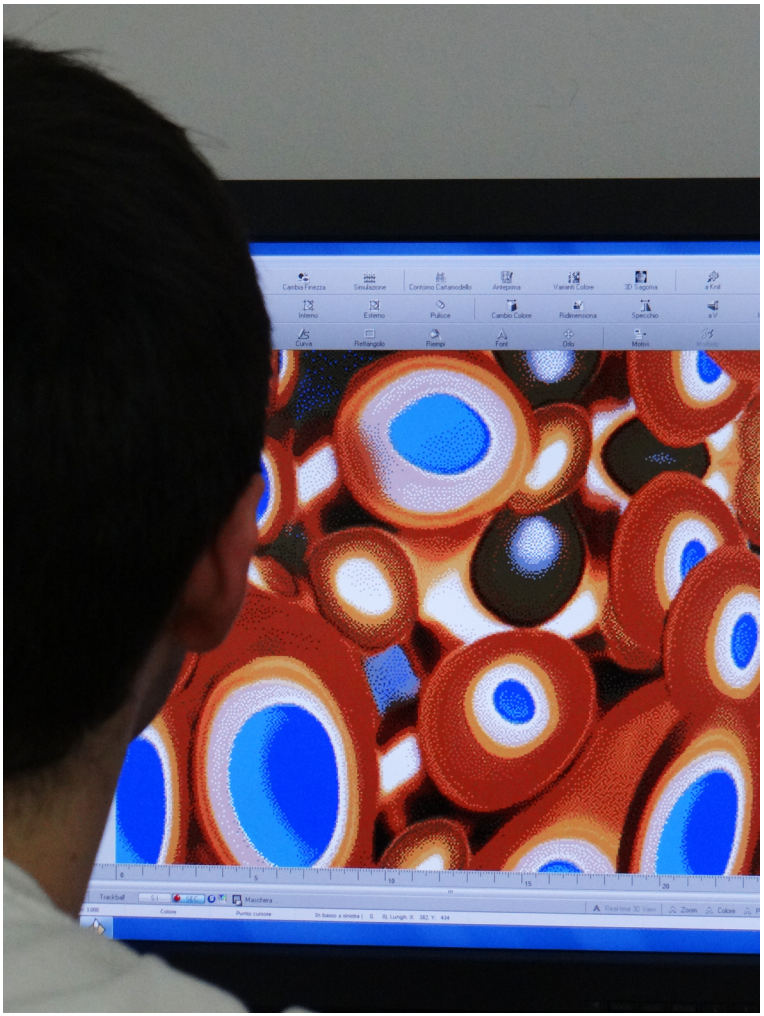

Figure 1.
Technician working on transferring the digital adversarial attack into a Jacquard fabric.

Figure 2. Shima Seiki computerized knitting machine, used for prototyping.

What we notice in this process is how, through creative and cooperative methods, Cap_able positions designers as essential contributors to the relationship between design, technology, and ethics. It signals a shift in the paradigm where designers go beyond their traditional roles and become sense-makers in a technology-saturated environment. This role extends beyond controlling the aesthetics of garments or their practical use as objects to cover our bodies. Designers now navigate through algorithmic iterative loops that orchestrate collaborative human and digital expertise networks. Cap_able debunks traditional design practices by introducing new modalities into established textile-knitwear design processes.

In this renewed scenario, designers maintain control of the cultural and communicative power of fashion: the bright colours and the shapes of the garments generated by AI serve a practical purpose in telling how the collection is a physical capsule of intangible technological achievements, and how it is meant to be significantly visible to human eyes but hidden to the eye of facial recognition cameras.

It is provocatively an *AI camouflage, generated by AI*, and this adds another layer of complexity: designers can play with such a metaphorical mirror, reflecting the potential pitfalls of technology left unchecked. It underscores the neutrality of technology itself

Figure 3.
Knitted panels and Cap_able garments.

Figure 4.
Technology Test with YOLO (You Only Look Once).

and emphasizes the critical role of human decision-making in anticipating and mitigating its impacts. The action of designers through a fashion-forward approach, makes the collection more than a product; it transforms it into a dynamic statement, urging thoughtful consideration of technology's role in our lives. In an era dominated by digital progress, this transparency captures and encompasses the current state of technological progress. It is a testament to the convergence of fashion and AI, and it shows the extent to which these fields have converged.

Moreover, the research puts designers at the forefront of ethical issues, as in this case, human-centredness in a world in which AI replaces the human essence. AI, just like any technological advancement, should be used consciously; never should it operate outside human agency (Buolamwini, 2023). This is precisely where Cap_able's project stands: using AI and technology as a tool to coordinate a product designed by people for people, it envisions a future where designers play a pivotal role in shaping ethical technology and asserts the importance of human control amid ongoing technological advancements.

12.4 From sense-makers to ethical guides: design practices redefined in the era of AI revolution

As we see, the research initiates reflection on multiple levels: touching the combination of disparate expertise; challenging the fashion and textile design process with the extensive use of technologies; questioning the balance between ideas generated by humans and solutions generated by AI; and, lastly, requiring ethical awareness.

The first question raised is the collaborative design process that combines the human-centric approach with other disciplines. In this case, designers are no longer the main actors in creating 'the new' but their intervention is combined with those of engineers, of knitting technologists, and of AI algorithms that produce adversarial images.

We can, though, say that designers assume a leading role in framing the problem; in connecting different expertise to address it; and in exploiting the folds of technologies to answer it.
This is where designers become sense-makers (Verganti *et al*., 2020) and, as coordinators, guide interdisciplinary teams through sophisticated co-design procedures, demonstrating the discipline's strategic development.

Second, to design in these unprecedented conditions, at the boundary of computer engineering, fashion design, ethics and knitting technologies, means to challenge the practices (object and process of design) and the principles (being human-centric, abductive and iterative) of design (Verganti *et al*., 2020) and to do it with the massive presence of AI.

While Verganti *et al*. (2020) confirm that the principles of design are reinforced by the presence of AI, when we regard the practice we see a first shift in the object of design: in Cap_able, the designer is not designing the garment, or the texture, or at least is not designing it alone. The details of the pattern are defined by AI, and so is the functional aspect of the pattern in being adversarial. Designers are apparently losing control of the final aesthetic of the garment; but, as sense-makers, they are in charge of the resulting colours

and shape of meaning, leveraging the cultural and communicative traits of fashion.

The second shift concerns the process, namely *how* design decisions are made in terms of phases, methods, tools, or collaborative practices (Verganti *et al*. 2020, p. 214). With Cap_able, the known phases and methods of knitting design are influenced by the presence of AI, and designers become the ones who control the iterative loops of the algorithms and the collaborative network of expertise, both human and digital. As said before, it is an evolution of the established textile and fashion design processes through the introduction of new modalities.

Third comes the ethical reflection. As evidenced above, acting in a human-centric way when dealing with AI systems undeniably requires an ethical approach. If the ethics of AI (Quintarelli, 2021) must align algorithms with relevant values; critically evaluate their moral impacts; raise awareness on a conscious take on the challenges posed; and make the potential of good use visible, Cap_able brings the role of designers to the center in answering these requirements, as it uses AI to generate a new solution that prevents the harmfulness of AI systems themselves. By keeping its people-centeredness it puts human beings and the rights of humans at the center of the problem to be solved.

Conscious of the potential dangers of AI, as designers we do not feel the rivalry of the algorithms in generating the new: strong in the ability to handle complex problems holistically with a systemic perspective, we are capable of acting responsibly in guiding the algorithms toward a meaningful, ethical direction.

If the future is a cultural fact (Appadurai, 2014), with countless revolutions underway, it is not the technology itself that writes the history of humanity, but it is the ability to direct it, and direct it ethically. The ultimate purpose should be the *technological humanism* theorized by Bertolaso and Marcos (2023), where humans do not crushed under the functionalities of machines they have been so smart in modelling, and technology serves individuals and the common good, reconciling the subjects and the collective.

In this scenario, the research is a concrete example of how designers are essential contributors in the relationship between

design, technology, and ethics, and of how creative, cooperative design methods may shape technology, guaranteeing a more moral and sustainable future.

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Silvia Pizzocaro: Full Professor of Industrial design at Politecnico di Milano. She holds a Master of Science in Architecture and a PhD in Industrial design. Her research activity is embedded in the Department of Design, section Design and cultures. Over the years she has worked at the intersection of product design theory, design research

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James Postell: Architect and Associate Professor of product design, School of Design, Politecnico di Milano and Professor Emeritus of the College of DAAP, University of Cincinnati. He has taught architecture, interior design and product design at: Texas Tech University, University of Cincinnati, DIS in Copenhagen, and Politecnico di Milano. His research focuses on the links between design, theory, and technology with emphasis placed on furniture, products, and interior design. He has designed many interior projects and furniture pieces and currently researches and writes on interiors, furniture, craftsmanship and materiality.

Virginia Tassinari: Her research focuses on how philosophy can contribute to the contemporary design research discourse. Previously a lecturer and researcher at Politecnico di Milano (IT) and LUCA School of Arts (BE), she is currently Assistant Professor at TU Delft (NL). She is a visiting scholar at Parsons, the New School of Design (USA), visiting lecturer at Université de Nîmes (FR) and design researcher at foresight and design studio Pantopicon (BE). Virginia is currently a member of the International Coordination Committee of DESIS Network, within which she is also co-initiator with Ezio Manzini of the DESIS Philosophy Talks, a series of discussions on design for social innovation & philosophy. She recently published *Designing in Dark Times. An Arendtian Lexicon* (Bloomsbury, 2020, with Eduardo Staszowski) (for which they won the Compasso d'Oro 2022 Design Prize) and *Re-framing the Politics of Design* (Public Space, 2022, with Liesbeth Huybrechts and Oswald Devisch).

Umberto Tolino: Associate professor and Designer, he conducts research and practice in the fields of Communication and Interaction Design. His works have been included in four ADI Compasso d'Oro Design Index and he was awarded a Compasso d'Oro honorable mention

(2018) and a Red Dot Design Award (2019). He has more than twenty years of teaching experience at the School of Design, Politecnico di Milano, holding lectures on digital communication and advanced visual design studios. Currently, he is Vice-Rector for Communication and Cultural events of Politecnico di Milano.

Francesco Vergani: PhD, Post-Doc Research Fellow at the Department of Design of the Politecnico di Milano. He is member of Polimi DESIS Lab where he collaborates in research activities focused on the reactivation of local communities in urban contexts such as *Vocabolario di Quartiere* (2019-ongoing), a situated vocabulary in the Nolo neighborhood (Milan), developed within the living lab *Off Campus Nolo*. He is currently Adjunct Professor at Politecnico di Milano.

Salvatore Zingale: Associate Professor at the Department of Design of Politecnico di Milano and teaches Design Semiotics at the School of Design. He is particularly interested in the cognitive and inventive processes of design activity and dialogicity in cultural interactions. On the relationship between design and alterity, he has edited *Design e alterità. Conoscere l'Altro, pensare il Possibile* (FrancoAngeli, 2022) and *Design meets Alterity. Case Studies, Project Experiences, Communication Criticism* (FrancoAngeli, 2024). He is author of the volume *Relazioni dialogiche. Un'indagine sulla comunicazione e la progettualità* (FrancoAngeli, 2023).

This volume focuses on the ethical challenges of design for public and social systems, attempting to clarify what it means to design *ethically* in a complex world and how it is possible to do so, within a multifaceted reality in which everything is interconnected and constantly changing. The first section of the book introduces some theoretical aspects, principles and values underlying ethical design. The second part is aimed at reflecting on the relationship between ethics and design from a phenomenological perspective. Ethics, in the philosophical sense of the term, pertains to the whole range of behaviors that individuals adopt to conduct their existence without causing damage to themselves or others, what challenges does design for public and social systems face in designing ethically? Can designers become real agents of social transformation? What kind of impact and effects do designers produce within the public and social system? How can we recognize those ethical design practices that bring about real structural change? What is the role of digital technologies? Our aim is to offer a series of critical reflections and concrete examples of the substantial effects of an ethical approach to design, with recognition of the value of otherness and the awareness of the interdependence between artifacts, individuals, societies, governments, institutions, and the planetary ecosystem.

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