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One Design Rule to Rule Them All: Towards a Universal Golden Rule for Designers of Human-Technology Interaction

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Abstract. The aim of this article is to raise awareness and discussion of the ethical aspects of the human-technology design of socio-technical systems in general, as well as the Human-Computer Interaction (HCI) designer responsibility towards users, stakeholders, and society. The dark side of HCI design is rising and the HCI community must respond to it in order to maintain its credibility and legitimacy. This article identifies and discusses four dimensions in human-technology interaction design ethics. To sum up these ethical dimensions of design and the responsibilities of a designer, this position article concludes with a proposed universal golden rule for designing human-technology interactions: *Design as easy to use, honest, sustainable, and safe human-technology interactions as you would want others to design for you*.
Keywords: Design Ethics, Human-Technology Interaction, Human-Computer Interaction, Socio-Technical Systems, Universal Golden Rule.

1 Introduction

To better understand the importance of human-technology interaction design for individuals, organizations, and society in general, we can first think about what the following examples have in common: a) doctor struggles with difficult to use information system which wastes valuable time that the doctor could otherwise spend with the patients, b) person books a flight but does not realize that selecting a country of living will automatically add unneeded and unwanted travel insurance to the booking, c) a person visits a website and begrudgingly has to accept all website cookies because it is too difficult to try to select which cookies to accept, and d) a jumbo jet crashes down with fatalities when pilots mistakenly select an incorrect autopilot setting and do not notice it until it is too late. All these real life examples have their root causes in the design of these systems, and the user interfaces and human-technology interaction design of these systems. More specifically, in these cases, the designers of these user interfaces and interactions have not fulfilled their ethical responsibility towards their users, stakeholders, and society in general. As design can be defined as an act of choosing among options (possibilities) of future ways of being or

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interacting, it puts the responsibility of the result of this design act and its outcome firmly on the designer [1].

The aim of this article is to raise awareness and discussion of the ethical aspects of the human-technology design of socio-technical systems in general, as well as the Human-Computer Interaction (HCI) designer responsibility towards users, stakeholders, and society. Furthermore, this article warns about the rise of the dark side of design and calls for the HCI community to respond to it in order to maintain its credibility and legitimacy. This article identifies four dimensions in human-technology interaction design ethics and proposes a universal golden rule for human-technology interaction design and extends the previous version of the article [2].

The socio-technical systems approach consists of complex and interrelated interactions between technical systems and social systems, where all these different systems are working together and aiming towards reaching a common goal [3]. These complex interactions between individuals and technology must therefore be designed well enough for these common goals to be reached [4]. The socio-technical HCI design focuses today on innovative and balanced relations between technology, organization, tasks, and users [5]. In addition, socio-technical HCI has less participatory focus, aiming at designing for organizational capacity enhancement and the interests of both users and organizational management [5], [6].

Mumford [7] stated that complex projects have often similar characteristics, as they affect large numbers of people, who can face very serious problems if the system does not deliver the level of service that these people need, and on time. Understanding and solving these complex problems is the only way we can design and develop systems that are efficient, effective, and innovative [7]. Designers have the responsibility of connecting and coordinating between human and society needs, and the new opportunities raising from science, technology, and business [8]. New technology introduces new tasks, new interaction methods and new process, and learning these new ways of working as well as unlearning the old ways of working is challenging for humans [9]. Therefore, design process involves making choices and taking risks, as the designers cannot know everything [7]. Therefore, a critical question in the design field is, how we can make good design decisions for complex situations and once we have made those design decisions and they have been implemented, how we are able to live with the results [7]. Not all design errors have grave consequences, but even minor problems in human-technology design can create a lot of trouble and time wasted for the users, organizations, and society in general [10].

Given the complexity of the systems designed and the large number of users they are affecting, the designer cannot generalize designs or design activities and try to follow a blueprint of design with predefined rules and characteristics, because contexts of use change, users change and the whole system and its socio-technical context changes [11]. Therefore, ethical design should be seen as an evolutionary process, and the designer should try to direct this evolution and its steps in an ethical and sustainable way [11].

There have been researchers warning about the risks of design activity and the ethical implications of design (see e.g. [11], [12], [13], [14]). Furthermore, there have been calls for designers having a social and moral responsibility for the consequences of their actions [11], [12], [15]. Therefore, designers should be made aware of the ethical implications of the design and the responsibility of the designer towards users, stakeholders, and society through the education of future designers. Raising future ethics-aware designers as well as educating the current designers is very important, as the technological advances such as the internet of things, artificial intelligence, autonomous driving, 6G, and like will certainly introduce new ethical challenges that the designers have to tackle. Furthermore, there have been calls for new, contemporary and open perspectives for design of socio-technical systems to ensure that the new systems would be meaningful to all engaged actors [16]. In this human-centered socio-technical approach, users and other individuals in organizations and society in general should act as active stakeholders in improving and contributing to their environment [17]. Furthermore, the ideation, design, and development of new technologies imply that a human influences these technological advances in

order that the technology fits the needs and capabilities of the human and social components [17], [18].

Ethical questions related to design of complex socio-technical systems are not easy. For instance, would a designer as an expert in human-technology interaction design a user interface for launching nuclear weapons? If a particular designer would refuse such design task due to personal views of morality of such task, they then might have to worry that some less capable designer might do the design of this interaction and thus create possibilities of mistakes and bad design. Therefore, designers as individuals and as communities need universal rules to act as moral compasses, so that the designers would know how to make ethically sound decisions in increasingly complex design contexts. Furthermore, in addition to personal ethics, also social ethics, which focuses on the social arrangements for decision-making in an iterative design process and how people make decisions collectively, should be taken into account when formulating universal rules for ethical design.

In general, there are four requirements in any professional field that define and quality a person as a professional in that field [19]: 1) There are requirements for extensive intellectual training that involves mastering a complex body of knowledge, 2) There is an expectation of contribution to society through professional service, 3) There is an assumption of autonomous judgment in work carried out as a professional and 4) Following a regulated set of professional behavioral standards which are embodied in a code of ethics in that particular field. One example of such a field is medicine, where the Hippocratic Oath has been guiding the work of doctors explicitly and implicitly for many millennia. The purpose of these four requirements for professional fields is to establish the status of the profession, to regulate the membership of the profession and to convince society that the profession is capable of self-regulating and does not need to be regulated by the society. Individuals make ethical decisions on individual designs, but designers make decisions collectively on what is considered acceptable, moral, and ethical design in their field of profession, as well as making a policy that designers who conduct unethical design are not considered recognized members of this field of professionals.

The professional ICT work in socio-technical context, which includes information systems analysis and design, software development, and HCI design and evaluation among many other things, should also involve understanding and observance of the code of ethics. It can be argued that HCI professionals should adopt and enforce professional codes of ethics in their professional work, as their work influences users, stakeholders, and society in the socio-technical context (see e.g. [20]). The Association for Computing Machinery (ACM) has formulated a professional code of ethics for ICT work, as they argue that the very future of computing depends not only on technical excellence but also on ethical excellence [21].

In order to understand the ethical dimensions of human-technology interaction design, we need to first take a look into how this interaction is designed and how complex it is, as well as the ethical implications of design.

2 Ethics of Design

The development of information systems in socio-technical context is never merely a technical issue, as it also encompasses and affects the organization, users, and the process of change [22]. In order to find out the best way to develop such a complex system for a specific purpose in a specific context of use, it has to be first carefully designed. Design is a creative activity where different design possibilities and futures are evaluated and one of these design possibilities is chosen based on a set of criteria based on a careful evaluation [14]. Therefore, design is never a straightforward or apparent activity, because if there are no design choices to be made, then there is no design at all [14]. Because of this degree of freedom to choose between different possibilities, the designers have to adopt some criteria for this choice and what from their perspective is best to do [14]. From socio-technical systems perspective, design of socio-technical systems provides a new perspective and an unparalleled opportunity to improve the quality of working life and

humanism at work, having the possibility to replace tight controls, bureaucracy, and stress with technology that enhances human freedom, democracy, and creativity [23].

Design may be the best place to study ethics in technology, because design affects us all. However, not all of us are involved in design, and this asymmetry has great importance for the social ethics of technology [24]. Therefore, as ethics of design is defined as dealing with what is good and bad, what is wrong or right, the designers have to constantly make ethical choices, consciously or not [14].

The famous German industrial designer Dieter Rams [25] codified the principles of good design, where three design principles directly apply also for ICT and HCI designs in socio-technical context: 1) Good design is honest, meaning that the design is not done with an intent to mislead the user to do something or prevent from doing something, 2) Good design makes the system, product or service useful for its users, meaning that the users will benefit from the design, and 3) Good design is understandable, meaning that the user does not need manuals or training to understand the design and its possibilities.

Therefore, the design of socio-technical systems has an ethical perspective, which can be approached from general ethical principles, such as Kant's moral theory and categorical imperative: "*Act only according to that maxim whereby you can, at the same time, will that it should become a universal law*" [26], as well as the general universal golden rule found around the world in most cultures and religions: "*Do to others what you want them to do to you*". However, these general rules are not very actionable for designers in general and human-technology interaction designers in HCI field in particular, as there are many perspectives for design ethics. However, these general rules can be built on and adapted into universal golden rule specifically tailored for educating past, present, and future designers of socio-technical systems.

While there are many perspectives to address ethical issues in general, there are three major traditional approaches for the theoretical dimension of ethics [11]: 1) ethics based on obligation and duty, doing what is right and proper (deontology), 2) ethics based on maximizing the utility based on principles and goals (teleology), and 3) ethics based on the role of individual virtues (virtue ethics). However, no matter which approach is taken to the theoretical dimension of ethics, design ethics should as far as it is possible be able to foresee and prevent future problems while being able to address current problems effectively [11].

Design ethics should be able to foresee future problems as far as possible, while effectively addressing current problems [11]. Although designers may not be able to foresee all consequences of their designs, they should always try to anticipate different ethical scenarios and possible ethical issues, carefully consider the consequences of their innovations and make efforts to uncover the values, potentials, motivations, and commitments that different stakeholders bring into the design process [11], [15], [27]. The designers should keep the past, present, and future users in the design loop in order to understand how things work and to better understand the cause–effect of different actions [11]. Designers of socio-technical systems should reconcile the social component with the technological one [3], [11]. Designers of socio-technical systems need to pay attention to several implications, many of which are unexpected, to ensure that the users and other stakeholders are not exposed to risks [11], [27]. However, the behavior of the users is generally unpredictable and most likely cannot be fully controlled [28]. Therefore, all design activities such as task formulation introduce a moral and ethical aspect because the design outcomes, such as user tasks, have a direct impact on the safety of the users and their perception of the system [29].

In order to formulate a universal golden rule that would address the complexity of ethical design, we need to identify different perspectives of ethical design. First, we take a look at the ease of use.

2.1 Designing for Ease of Use

After technology advanced and computers became more common in the 1980s, the need to minimize the resources a user needed to expend to achieve their tasks was identified as an important concern in the HCI community. Therefore, the concept of usability was expanded to

include also ease of use with the intention of saving human time and labor, which had become more expensive than the computing time [17]. The seminal studies such as Suchman's study of the copy machines and Gasser's study on computer use highlighted the gap between the intentions of the designers and the reality when the system was actually in use by real users [9]. Designers might very well have had a very clear plan on how the users should use the copy machine, but that plan of using the system was completely different from the situated understanding of copying by the real users, therefore leading to lots of problems using the copying machines [30]. As the number and complexity of the information systems increased, the HCI community identified a need for a standardized process to design for better usability and ease of use, and the process of user-centered design was introduced. The user-centered design advocated for several small usability design and evaluation activities spanning the entire development process instead of few larger usability evaluations at the end of the process when the design was already finalized and the changes would be expensive (see, e.g., [17], [31]). Despite the popular opinion amongst developers and managers, the outcome of this design of human-technology interaction in usability and user interface levels is not a matter of taste or a subjective opinion, but it can and should be objectively evaluated, while the concept of user experience should cover the subjective aspects of human-technology interaction [32]. The problems in the design of technological artefacts may originate from bad design, poor understanding of the use context and use situation, or from issues arising from factors outside the control of the designers and users [9]. This leads to users and organizations having to use technologies and systems that do not meet their needs, therefore wasting time and increasing the amount of errors and level of inefficiency [33], [10].

The costs of bad design causing problems for users in their everyday work are not easy to calculate and there are few concrete examples [10], [34], [35]. The users try to carry out their work even with computer systems that fit very poorly for their everyday work, and eventually users start to try finding out ways to work around the limitations of poor computer systems and ill-fitting technological artefacts, further complicating their work and introducing extra risks [36]. It has been shown that seemingly minor usability problems can add up to having grave economic and social consequences [37]. A real-life example of what kind of impact seemingly insignificant design choices that affect the ease of use in everyday work of users may have in larger perspective, an information system was introduced in early 2000s for hospitals in Finland for recording dictations by medical doctors as part of their routine practice after their appointment with a patient [35]. However, the human-technology interaction of this system was not designed with ease of use in mind and for, instance, saving a dictation after each patient required sixty (60) mouse clicks [38]. Therefore, assuming that each selection took at least one second, just saving one dictation will take one full minute of extra time from the medical doctors that could be better used for extra patient appointments. While exact effects of this problem are difficult to calculate, the worst-case scenario can be estimated by multiplying this time wasted with numerous clicks with the total amount of medical doctors in Finland, adding up to 4200 hours or 525 full working days potentially lost every day because of just this one design problem related to ease of use in just one task performed using just one medical information system in one country [35]. As the time of medical doctors could be much better spent interacting with their patients rather than interacting with computer systems, this case highlights the importance of designing for ease of use in the larger socio-technical context. Similar observations have been made by studies that have identified that critical care clinicians have to respond to a false alarm every 92 seconds and often these least important and erroneous alarms take the most attention from these clinicians, pulling them from attending other critical patients, squandering time and compromising patient safety and the productivity of critical healthcare personnel [33]. It has been argued that a transdisciplinary approach is required for designing healthcare systems [33] and that a transdisciplinary approach is needed for the design of human-technology interaction in general [39]. Another well-known example of the impact of small design problems to ease of use was the "300 million dollar button", where making small changes to human-technology interaction as a result of consulting the users increased website annual revenues by 300 million dollars [40]. Furthermore, even if an individual

system is designed well and it works well also for real users, it might not work so well when used together with other systems that these users are using as part of their work [9].

Therefore, good usability and particularly the ease of use has a profound effect on the level of interaction the user has with the system, their experience with the system, as well as the overall quality of the system and its functions [41]. Usability in general and ease of use in particular are important quality characteristics of software, systems, and services, and they are vital in facilitating the rich interaction between users and technology, the social systems, and technical systems in the socio-technical context [17], [18]. The concept of usability has been constantly evolving to adapt to the advances in technology and other emerging needs in the socio-technical landscape and as a result, the focus of usability research and practice have been constantly expanding (see, e.g., [17], [18]). These different usability standards (e.g., [42]) act as time capsules, having different approaches, viewpoints, and conceptualizations to usability, thus representing the views and best practices of their time, how the HCI field as professional community has seen them (see e.g., [43]).

This brings up the fundamental question if HCI in general and usability and UX design in particular are all about removing obstacles and problems to streamline user activities and the interaction between user and technology, or is it also about pursuing some greater good. Some indication can be found from the core tenets in HCI field which argue that users are unique and valuable as individuals, as groups, and as a society in general and that it is therefore worth designing user interfaces and tasks for systems that improve the work and life of these users. The bottom line is that the good design of these socio-technical systems is the responsibility of the HCI designer, as the users, stakeholders or the society can do very little to impact the quality of the designed human-technology interaction. The HCI community has been fighting for easy to use designs and against bad designs and bad usability since the concept of usability was created in the 1980s. The goal has been to educate designers and other stakeholders and advocating for good design practices and processes. However, as Le Guin [44] stated: “To light a candle is to cast a shadow”, and therefore it has not been a surprise that these HCI practices and processes, that have been created for noble purposes of making the life of users easier, have also started to be used for unethical and deceiving purposes. Therefore, next we need to look at the importance of honest design and the rise of the dark side of design.

2.2 Honest Design

One of the principles of good design by Dieter Rams is: Good design is honest [25]. Honest design means that the design is not done with an intent to mislead the user to do something or prevent the user from doing something, or otherwise manipulate the user. However, recently the very processes and principles of HCI that have been created to help to design good human-technology interaction have been used to create misleading and deceptive designs. This kind of dark design or deceptive design is not bad design. A bad design is an honest mistake, where the designer should have known better but ended up doing bad design out of ignorance or honest oversight. However, dark design or dark pattern is done with a deliberate and malicious intent to mislead or deceit the user [45]. The dark side of design uses the same HCI methods and processes developed to create good interfaces for the users to design the human-technology interaction with malicious intent, either causing the users to do something they did not intend to do or preventing the users from doing something they intended to do. Dark design misuses good and trusted design principles with malicious intent. There are curated lists of objectionable user interface designs, or dark patterns, where the designer has shown such malicious intent, and the extent and categorization of such designs is still being studied [45], [46]. In such cases, the designer uses certain tricks or types of deceiving design to make the user to do things they did not intend to do or preventing the user from doing something they intended to do, and to subvert user wishes and preferences [46]. This connects to the concept of manipulation, which is to subvert the persons decision-making and denying them true authorship over their own decisions [46]. For instance, the sharing economy marketplaces can manipulate both the sellers, such as accommodation sellers, and buyers, such as

the travelers [46]. Nevertheless, a designer of either bad design or dark design violates the ethical code and the human-centered values of HCI design community and violates the designer responsibility towards users, stakeholders and the society.

There is an interesting conundrum on when exactly persuasive design of systems and human-technology interaction becomes misleading. Persuasive design can be used to nudge the user into a particular direction which might be beneficial for the users, such as encouraging user to exercise more, eat healthier, consume less energy, or not to access suspicious websites. Such "nudges" are defined as initiatives aimed at steering people in some direction but ultimately allowing them to decide their own way [46]. However, there is a point where persuasion turns into misleading and deceit. In such cases the design can be asymmetrical, where the design can impose unequal burden on the choices that are made available to the users, or design can hide vital information from the users, or where the design gives unequal treatment to users making different choices [46]. Such dark designs have also been emerging in the specific context of design, such as game design, where unethical game design patterns result wasted time, wasted money, or negative experience for the players [47]. It can be argued that dark design or deceptive design is done in favor of the shareholders to the detriment of the users [48]. Ryanair has been infamous for how users are misled for choosing travel insurance when selecting "Please select a country of residence", where in an alphabetical list of countries the option "No travel insurance required" was the only way to avoid mistakenly buying an unnecessary travel insurance [49]. Furthermore, research has shown that many websites use a variety of dark designs or dark patterns to circumvent the intent of GDPR in their cookie consent dialogues [50]. This practice has been identified as unethical and exploitative, as it misleads the users into making decisions that put their privacy at risk [51]. Such designs induce excessive or unjustified ways to trick, mislead, or force the user to act in a desired way, ultimately depriving the users of access to important goods, opportunities, services, and their own free choice [46]. There has been calls for considering consent management platforms to be GDPR compliant only if the consent from the user is explicit, it is easy to accept or deny, and contains no preselected checkboxes and do not put one selection in more favorable position [52]. There have been calls for conceptual foundations of defining what makes a user interface a dark design, dishonest design or dark pattern, and why such designs are problematic for users and society [46].

There are also better and more ethical ways of persuading and enticing users to buy something additional, for example by showing what other customers have also been buying when they bought what this user is interested in. Such ethical design benefits both users, stakeholders, and society. However, designers of the human-technology interaction in general and the HCI professionals in particular must address the rise of the dark side of design and find ways to educate both the general public as well as fellow designers how to identify and avoid deceptive designs. The very reputation and legitimacy of all designers might be irrefutably tarnished by few bad apples who fall into the dark side. Legislators and regulators have already been taking notice of the rise of dark design and have started enacting legislations and regulations defining, restricting, and prohibiting deceptive design [46]. There have been actions to develop legislations that will define, restrict, and ultimately prohibit the use of dark patterns in human-technology interaction design, with enforcement of violations [46]. Therefore, designers of human-technology interaction should act fast and show the legislators and society that the human-technology design fields can self-regulate and fight against dark design, before design work starts to be more and more regulated and restricted by the legislators and the society. However, not only humans and society are affected by design choices, but also the environment and our planet in general. Therefore, next we need to look at the ethical perspective of sustainable design.

2.3 Sustainable Design

Ethical design can have an environmental impact through minimizing the amount of materials required for software or service, printing or manufacturing of products, as well as minimizing the amount of waste, hazardous emissions, and use of energy and materials [20]. There have been

grave concerns about the sustainability of design [11] and calls for harnessing the power of design as a deliberate means to change the behavior of users and society [53]. Design work in general has been characterized as the second most harmful profession that can be practiced, responsible for many difficult, harmful, troubling, and dangerous situations in our world (see, e.g. [11], [12], [13], [14], [15]). The assumption behind most persuasive technologies is that users do not have the necessary awareness or understanding to adjust their behavior and providing the information to create this awareness and understanding will make them change their behavior towards more sustainable target behavior that the designers intended [54]. However, it has been argued that behavior is not only the result of attitudes or intentions and that the focus should be moved from studying the cognitive aspects of behaviors to studying specific objects and actions as the source of sustainable or unsustainable behavior [54], [55]. The concept of defuturing has been introduced to define the unintended effects of the design, which can alter our collective futures in undesirable ways, even when the design is well-intentioned [1]. A design that is useful to its users, business or society has longer life-cycle, which has a positive impact on the sustainability through minimizing use of resources and waste [20]. It has been argued, that the designers, who bridge humans and society with new science and technology, have both the opportunity and obligation to shape a green and sustainable future and economy and to be on the front lines of that effort [8]. Therefore, sustainability should be understood as being much more than just material recycling and more as a cultural paradigm for shifting away from the novelty of new technology and its consumption, and shifting towards an aesthetic of well-designed and well-cared-for systems [1]. Furthermore, interaction designers should step away from models of individual behavior and studies of artifacts, and instead see sustainable behavior and designing systems towards sustainability as part of multidimensional and interrelated practices and practice elements [54]. Therefore, design for sustainability should consider the whole socio-technical landscape and its practices, rather than concentrating only on the design of a particular individual human-technology interaction.

Manzini [14] identified three principles for designing sustainable solutions: 1) Promote sustainable wellbeing, 2) Enable people to live as they like, and in a sustainable way, and 3) Enhance social innovation, and steer it towards more sustainable ways of living. However, there is a tension between the historical focus on technological novelty and human-technology interaction innovations in HCI research and practice, and the aims for sustainability and sustainable design [56]. Conversely, it has been argued that the existing HCI design principles could contribute to other fields of research and practice, and this kind of multidisciplinary approach could then lead towards achieving the goal of sustainability, depending on the context and purpose [57]. However, the roles of human-technology interaction design and HCI design principles in sustainable design should be studied further.

But all these other perspectives of ethical design mentioned above do not matter much if the design can cause danger and threat to the wellbeing of users and other stakeholders. Therefore, next we take a look at the safety perspective of human-technology interaction design.

2.4 Safe Design

The safety implications of designing human-technology interactions have been highlighted by many well-known accidents in different fields. The smooth and error-free interaction between humans and the technology is critical to the safety of the design [58] and it has been argued that the designers have a responsibility of ensuring that their design has a lasting influence on safety [59]. As the interaction between humans and technology is complex, it is not possible to design safe systems based only on their technical features, as the latent failures and miscommunications between humans and technology are not just technical by nature, but also involve individual humans and their contexts of use [58] Humans are naturally prone to making errors and the designers have to take into account in their design these kinds of user errors and unexpected behavior that are not as predictable than a faulty technology might be [37]. The first such example of designer responsibility was Air Inter Flight 148 preparing for landing [60]. The captain

configured the autopilot for a slight descent angle, so that the crew could make their landing preparations and checklists. Moments later the plane crashed into a mountain and the crew did not have enough time to react and save the plane and its occupants. The investigation found that the autopilot of the plane had a confusing user interface and it was easy to mix two autopilot modes: flight path angle (FPA) or vertical speed (V/S). The captain thought that he had selected the FPA mode, but in reality, the autopilot was switched to V/S mode, and the only visual difference between these modes were small letters and a dot between numbers in FPA mode [60]. The flight crew thought that the plane was descending at a normal -3.3 degree flight path angle, but in reality, it was descending 3300 feet per minute, which was much faster than intended. Therefore, the crash was inevitable and there was nothing that the flight crew could do to save the situation when they became aware of the danger. Later, when these conditions were tested in a flight simulator, most of the crews missed the wrong autopilot setting and therefore inevitably crashed the plane, no matter how experienced the crew was [60].

The second example of a seemingly innocent design choice for human-technology interaction resulting in almost a disaster was again the autopilot user interface for Loganair Flight 6780 [61]. The pilots were struggling to gain control after the plane was struck by lightning and the plane entered into a steep dive. The pilots were able to recover the plane only seven seconds before hitting the ocean. One of the identified root causes for this serious incident was the design of the user interface for autopilot status as well as the design of the human-technology interaction of the autopilot itself [61]. The pilots thought that the autopilot was off after the lighting strike, but, unknown to them, the Saab 2000 plane was one of the extremely few planes where pilot inputs to flight controls do not turn off the autopilot. Furthermore, the autopilot status was only indicated by a small “AP” text in the flight display. The text was green when the autopilot was on, but the text remained visible as white text when the autopilot was off. Therefore, it was extremely difficult for the pilots to establish the true status of the autopilot during an emergency, the pilots were not aware that the autopilot would not disengage when pilots inputted flight commands, and thus the pilots were trying to fight against the autopilot which was programmed for approach into landing. A total disaster was only avoided because rapid descent introduced invalid data into the flight computer, which finally turned off the autopilot in the nick of time [61].

The third such case was Therac-25, a radiotherapy system, where the designers did not get to know the real users, their tasks, and working conditions, and they did not test their design with real users and real tasks [62]. Furthermore, the designers did not take into account that users can do mistakes in human-technology interaction. Unfortunately, as a result of this problematic design, at least six people died because of massive radiation overdoses [63]. As a result, the design and development of such medical devices was strictly regulated by society, which could no longer trust the professionals to do self-regulating. However, it has been argued that while healthcare organizations have invested heavily in the newest technology and the development of medical technologies are strictly regulated, this investment has not really improved patient safety, because healthcare is still leaning on the heroism of individual healthcare professionals rather than on safely designed healthcare information technology [33]. Furthermore, these technologies do not communicate with other technologies used in the critical healthcare context, therefore increasing rather than decreasing the risk for errors [33].

Furthermore, increased levels of automation in systems, as well as advances in artificial intelligence and autonomous systems have been raising safety concerns [11]. It has been argued that by proactively conforming to the regulations, as well as to the ethical and inclusive principles, and by showing a safety mindset, the designers of autonomous driving could show that automated driving do not have to be heavily regulated by the legislators [64]. However, every design process includes uncertainties for which the designers do not have good probability estimates, and sometimes users respond to improved technical safety by more risk-taking behavior [59].

As we have now identified the perspectives of ethical design, we can now move to conclusions, where a universal golden rule for human-technology interaction design is proposed, and its implications to research and practice are discussed.

3 Conclusions

As design can be defined as an act of choosing among choices of future ways of interacting, it can be argued that the designers of human-technology interaction in socio-technical context are professionally and ethically responsible towards 1) users and other stakeholders, 2) companies and other organizations, 3) society in general, and 4) environment and sustainability. In addition to their overall societal responsibilities, the designers are also responsible towards themselves and towards the professional body of designers so that their design achieves the desired high ethical standards. Furthermore, the designer should be educated and have the moral inclination to follow good design practices and not do any harm to users, stakeholders, society or the environment. Designing human-technology interaction for complex systems in a complex socio-technical context always carries a risk of failure (see e.g. [7]), as the quality of the design can ultimately be measured only by real users in real context of use. The designers as individuals and as a professional field need universal rules to act as moral compasses to guide them to do their best, to help the designers make the right design choices and to act as moral backbones to resist having to make unethical design choices as part of their work as professionals.

It is important that the HCI professionals, researchers, and practitioners continue their fight against bad design and educating the users, stakeholders and the general public that problems in the human-technology are not the fault of users and that good design is professional responsibility of human-technology interaction designers. HCI as a field should continue this good work through education, training, and going back to the basics of ensuring good human-computer interaction [32]. Additionally, HCI professionals and other design professionals should also actively start fighting against the rise of dark design and advocating honest design practices. Users, designers, and society in general should be made aware of the existence of dark design and dark patterns in design. Furthermore, designers should recognize their ethical responsibility towards users, stakeholders, society, and the environment. Starting this discourse and acting on the rise of dark design is very important for the HCI as a field in the future, if HCI as a design field wants to avoid lawmakers and society starting to regulate its design activities as has happened in the design of medical systems. Curriculums should include courses on design ethics, designer responsibility, and the rise of the dark side of design. This theme of design ethics should also be reflected on other substance courses so that future design professionals in HCI and in other fields would understand the value of users and ethical design, and the dangers of bad design and dark design, as well as being able to recognize good design, bad designs, and dark designs.

To sum up these different aspects of ethical design and the responsibilities of a designer discussed above, this position article concludes with a proposed universal golden rule for designing human-technology interactions: *Design as easy to use, honest, sustainable, and safe human-technology interactions as you would want others to design for you*. This universal golden rule could be discussed, further refined, and brought into HCI education and practice. Furthermore, this universal golden rule could be brought into further discussion on ethical aspects in designing socio-technical systems. This rule could highlight the importance of ethical discourse among HCI educators, practitioners, researchers, as well as users, stakeholders, and society in general. This kind of golden rule could act both as a moral compass guiding the designers as well as a moral backbone that the designers could rely on when unethical design is requested by their fellow peers, employers, or customers. Designers who would follow this universal golden rule for human-technology design could be confident that they have done their best and can live with the consequences of their design, knowing that their design has made the world a better place.

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