Improving the Ethical Dimension in the Innovation Process:
Proposal for an Ethical Engineering Design Method

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ABSTRACT

Large companies' engineering design processes rarely consider the ethical and moral dimensions of innovation projects. This need for ethics is increasingly felt, particularly with the advent of digital technologies. The research mainly focuses on product designers in large companies during the innovation/creativity phase. The authors propose and evaluate the efficiency of a method allowing them to consider ethics from this first stage of product development. A specific database incorporating ethical categories and problems from the early stages of idea generation supports this study. This database is inspired by a research project funded by the European Commission called ETICA. The authors evaluate the proposal with a detailed case study in a large automotive company. This case study highlights the contribution of the extended ethical design method from an ethical point of view and a financial one for the company. They believe that the proposal will boost creativity by addressing innovative product designers' usual fixations.

1. INTRODUCTION

Information and communication technologies (ICT) have grown considerably in recent years. From the advent of computers to today's Internet of Things, the amount of data processed, the improvement of algorithms, and the progress of Artificial Intelligence (AI) raise new moral and ethical questions. These questions are in addition to the usual uncertainties associated with consequences not anticipated by product designers. Thus, designers today have greater ethical responsibilities, including dealing with the potential risks created by their products (Goebel et al., 2019). For instance, the arrival of autonomous vehicles has created new moral dilemmas that have not fully been resolved yet. Technological advances have led to a proliferation of personal data that have threatened users' privacy for several years now (Wright et al., 2013). Also, new military problems have arrived with recent technological advances that pose issues of just war (Killmister, 2008). Consequently, research on the ethical practice in R&D has grown exponentially since the 1990s (Figure 1).

Throughout this article, we sometimes use the word "design" to refer to "industrial design" as defined by the World Design Organization[1]: "Industrial Design is a strategic problem-solving process

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Figure 1. Number of sources on the ethical practice in R&D published every five years, between 1990 and 2015 (Reijers et al., 2018, p1444)
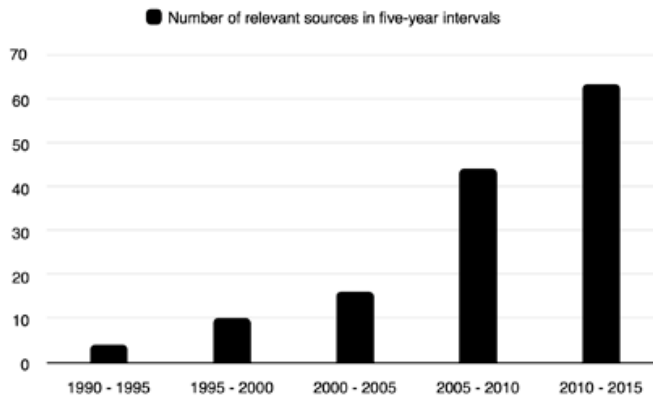
that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences." Besides, we use the term "innovation" exclusively in this context of industrial design.

Engineering ethics seeks to codify the moral obligations of engineers towards the profession, clients, and the larger society. It is about applying moral codes to the practice of design. Equivalent and recurrent terms often used in the literature are "responsible design" and "responsible innovation," which encompasses ethics, honesty, transparency, and environment. Since the 1990s, some scholarly work has been done on moral values and design. We can mention Friedman on value-sensitive design (Friedman and Hendry, 2019), Nissenbaum on values in design (Nissenbaum et al., 2013), Van den Hoven and Van den Poel on design for values (Van den Hoven and Vermaas, 2015), and Spiekermann (2016) on value-alignment.

Engineering codes have emerged to address these ethical issues, notably in the United States as early as 1912 with the American Institute of Electrical Engineers (AIEE) proposing the AIEE Code, followed by the American Society of Civil Engineers (ASCE) in 1914 with the ASCE Code, which were globally adopted. Engineering codes evolved rapidly. Among others, the codes of the Engineers Council for Professional Development (ECPD Code), of the National Society of Professional Engineers (NSPE Code), and the Institute of Electrical and Electronics Engineers (IEEE Code) have influenced the way ethics was applied in engineering in the United States. Furthermore, Europe has been a pioneer in taking ethics into account and defining a framework for ethical innovation. An example is the European Commission with its Responsible Research and Innovation (RRI) approach – not to be confused with Responsible Innovation (RI) approach, see Owen and Pansera (2019) – which aims to anticipate and assess the potential impact on society and the expectations for research and innovation. It seeks to foster the design of inclusive and sustainable research and innovation (European Commission, 2015). The same is true for some countries, such as the Netherlands, Germany, or the United Kingdom, which propose responsible research and innovation policies.

In a traditional engineering design process, the themes addressed in the early design phase do not present an in-depth reflection on the ethical and social impacts of different products and services. Existing methods consider cases such as ecology with eco-conception but never ethics in general (Livotov et al., 2019; Rossi et al., 2019). The methods used in companies are particularly deficient in this respect and often favor other tools, whose effectiveness has already been proven many times economically speaking, like design thinking (Bouwman et al., 2019). There are also other methods, such as decision-based design frameworks, which are normative approaches, i.e., they are concerned

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