Chapter 3
Grounding Machine Ethics within the Natural System

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ABSTRACT

This chapter explores machine ethics within the larger context of the natural system from which it springs. While computing power and computing machines have grown exponentially since the twentieth century, the foundation for this growth is the planet’s natural resources, which may not be able to sustain this type of continual exponential growth. This chapter explores some of the basic natural limiting factors that may prohibit computing power if solutions are not found. Specifically, the chapter explores limitations from: population growth, e-waste, rare earth minerals, water, oil, and energy production. Within this context, possible solutions for producing machines ethically are briefly explored.

INTRODUCTION

Humans are limited by their machines. In the modern world, these limitations are directly related to computing power, machine programming, progress in fields that are components of machines, and natural resources to physically produce them. Computing power has grown exponentially this past century. The abilities of intelligent machines have, in many ways, progressed faster than has our ability to assess their effects on social and natural systems, and safeguard their ethical uses and even independent actions.

Humanity has existed for hundreds of thousands of years in something like its current form; computing machines have existed for less than one hundred. But, look what has happened in that short time. It took less than seventy years between the first powered flight and the first mission to the moon. Meanwhile, that moon lander had less computing power than a modern programmable coffeemaker. Almost everyone alive was born within this exponential growth of computing machines, so their use, utility,
and “goodness” all seem like givens. But, can this growth continue unabated into the future, or even for another hundred years? This chapter takes a long-term ecological view in exploring this question and how to possibly sustain the use of these machines, rather than the shortsighted, profit-driven motives that dominate current geopolitical decisions.

BACKGROUND

As computing power advances, it also advances humanity’s ability to produce increasingly advanced machines, which have increasing amounts of autonomy and decision-making powers, creating an increased importance of machine ethics (Moor, 2006). Hence, the various submissions for this book and the interesting questions they discuss. However, in addition to the very important questions of how to make machines behave ethically, comes the often-overlooked question of whether to produce a machine at all, regardless of whether or not that machine will then behave ethically, based on the natural realities of this planet and the resources required to produce them. It is this necessary grounding of machine ethics within the natural system that seems to be frequently overlooked and will be the focus of this chapter. It seems that those whose job it is to build and discuss computing machines are more likely to talk about our mastery of nature rather than our place within it. This chapter takes a different approach and may come to outcomes that are unexpected.

The ubiquity of machines and robots in our everyday world continues to rapidly rise. According to the International Federation of Robotics (IFR) (2014), in 2012 alone, about three million service robots for personal and domestic use were sold, 20% more than in 2011 and the value of sales increased to US$1.2 billion. IFR projections for sales between 2013-2016 predict huge increases in the field and sales of about US$17.1 billion. It projects sales of all types of robots for domestic tasks could reach almost 15.5 million units in that period of time. The market for toy and hobby robots is forecast to be about 3.5 million units, and another three million robots to be produced for education and research. The IFR also predicts that robots for the handicapped and elderly will increase substantially in the next twenty years as well (International Federation of Robotics, 2013).

Robots are also a booming industry in military applications. When the U.S. started wars in Iraq and Afghanistan in 2003, there were no ground robots. In 2009, there were over 12,000 ground and 7,000 aerial robots in use (Lin, 2009). Scott Hartley, co-founder of 5D Robotics, one of several businesses creating military robots for the U.S. government, said, “Ten years from now [2023], there will probably be one soldier for every ten robots. Each soldier could have one or five robots flanking him, looking for enemies, scanning for land mines” (Diaz, 2013). While this may be a wishful projection from someone who stands to make a lot of money from its fulfillment, the trend is clear. The rise of military machines is already here, and the level of autonomy for these machines continues to rise as well, raising additional ethical concerns that need to be addressed by academics and the public (Lichocki, Kahn, & Billard, 2011).

While Intel co-founder Gordon Moore’s (1965) ‘law’ predicting that the number of transistors that would fit on a silicon chip would double every two years hasn’t been precisely correct, the general trend has been accurate. It graphically represents the rapid growth seen in the advancement of computing, and by extension AI machines and robots. The advancement of the microprocessor has been unprecedented. It is the only product in history that has been repeatedly made thousands of times faster, smaller, and more powerful than its predecessor for multiple generations.
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