Computer Ethics and Intelligent Technologies

Yefim Kats
Southwestern Oklahoma State University, USA

INTRODUCTION

This article is a survey of moral and social challenges related to the development of intelligent technologies and the emerging phenomenon of the Semantic Web. We explicate the ethical issues arising from the growing popularity of intelligent software agents and Web-based knowledge representation systems. In this context, we consider the growing technical capabilities of intelligent software tools vs. corresponding social and moral responsibilities. Moreover, the rapidly changing software engineering environment is reshaping the role of an educator in the design and development of computerized systems in general and intelligent tools in particular. From this perspective, the integrated approach to software engineering education is discussed and analyzed.

BACKGROUND: COMPUTER ETHICS AND SOFTWARE ENGINEERING

Computer ethics—rooted as a discipline in the established ethical frameworks of deontology, consequentialism, and virtue ethics—refers to the manner in which these standard ways of moral discourse are applied to design and use of information technology (Johnson, 2001; Ermann, Williams, & Shauf, 2002). At first sight such a discipline seems to be as viable and explicitly defined as any other traditional branch of applied ethics. However, due to the recent explosive growth of software products and the rapid changes in the corresponding design procedures, computer ethics may need further refinement in the definition of its problem area, especially in a view of the popular conjecture that in the near future computer ethics may disappear as a separate discipline.

The claim of computer ethics' disappearance is clearly articulated by Johnson: "As we come to presume computer technology as part of the world we live in, computer ethics as such is likely to disappear" (as cited by Maturano, 2002, p. 71). The idea behind this line of argument is that with time, the use and design of information technology would become as routine as the use and design of, say, television sets. In this respect, we would like to make a distinction between the moral issues related to *design and development* of information technology vs. those related primarily to *use* of information technology. Consequently, it may be helpful to distinguish between *design ethics* and *use ethics*.

The argument for computer ethics disappearance seems more applicable to the *users* of information technology rather than *designers*. Unlike TV sets, computers consist of the clearly distinguishable *hardware* and *software* components. From the *software* development perspective, computer ethics is becoming increasingly important. Hence, it is imperative to define the set of mature and socially sensitive design methods for software developers, enabling them to follow the procedures to be reflected in the appropriate professional standards such as the Institute of Electrical and Electronics Engineers (IEEE) standards and recommendations. Once ethical guidelines are embedded into such standards, many moral and legal challenges faced by software engineers would be gradually reduced to sheer professionalism.

From this perspective, it is difficult to overestimate the *software engineering* skills for information technology professionals. Johnson (2001) correctly emphasizes the importance of the Texas initiative to establish licenses for software engineers in the state of Texas (USA). Such a license should assume a high level of proficiency in the *socially responsible* software design methods, provided that the appropriate code of ethics is integrated into the standard design procedures. As a result, it would also help "the public to understand how to think about the products and services being provided by software engineers," and consequently to make right choices about such products (Johnson, 2001, pp. 66-67).

The key issue is whether all moral and social concerns related to information technology design and use could eventually be addressed in a framework of the

appropriate standards and regulations, so that computer ethics (as Johnson suggested) would "disappear." The affirmative answer, which is essentially a form of *moral reductionism,* seems untenable, especially in view of the potentially unlimited variety of emerging software tools and the corresponding design procedures. First of all, we should take into consideration that software tools are increasingly created not only by the likes of Microsoft, but also by thousands and thousands of free-source software proponents. The popularity of the free-source phenomenon makes moral guidance in this area ever more important. Second of all, the importance of computer ethics is only emphasized by the explosive growth of intelligent technologies, such as intelligent agents and distributed knowledge representation systems. In the following sections we examine moral challenges related to the growing technical capabilities of increasingly popular forms of intelligent technologies.

INTELLIGENT TECHNOLOGIES AND MORAL RESPONSIBILITIES

In the current economic environment, the success of a business model is highly dependent on the information technology tools employed, especially for the emerging *e-commerce* businesses. At the same time, moral aspects of software design and use, such as data security and privacy, are directly related to the ability of businesses to attract and retain customers.

The problems related to business software have been aggravated due to the popularity of *intelligent agents* in e-commerce applications. Intelligent agents are often classified depending on the type of customer behavior they are supposed to support. The typical buying behavior pattern proceeds through the stages of need identification, product brokering, merchant brokering, negotiation, purchase, product service, and the follow-up evaluation of customer satisfaction. To give a few examples of the artificial agents assisting customers to carry out the aforementioned tasks, the monitors and notification agents are useful for need identification; intelligent agents like PersonaLogic and Tête-à-Tête are able to assist in product brokering; BargainFinder as well as Jango are used for the merchant brokering phase; agent systems such as AuctionBot and Kasbah provide help in the negotiation stage of a transaction (Maes, Guttman, & Moukas, 1999).

The mode of customer behavior determines the possible damage a particular agent technology can cause and the corresponding moral constraints to be imposed on such an agent. In this context, the benefits and the side effects of agent technologies are closely interrelated. The need identification procedures can be excessively intrusive, an issue especially important when dealing with underage potential customers. The current business practice in the 'consumer society' is often aimed at engineering the artificial needs and consequently creating the products to 'satisfy' them. Too often, humans and human rights are redefined by the corporations and politicians as consumers and consumer rights. We believe that this point carries on to intelligent technologies enabled and often intended to amplify the potentially abusive impact of intrusive business practices. The developers of such technologies should be taught to distinguish between support tool design vs. 'social engineering' tool design.

These considerations are especially relevant to the so-called mobile intelligent agents representing a form of distributed computing. Such agents are mostly involved in product brokering, merchant brokering, and negotiation. Although able to provide special technical benefits, in particular parallel processing and the efficient use of system resources, mobile agents pose new moral and legal challenges (Lange & Oshima, 1999; Mandry, Pernul, & Rohm, 2000; Turban & Wagner, 2002). In a most trivial sense, mobile agents act in a way similar to certain viruses such as Trojan Horses and may cause similar problems. The fact that they execute on the server side involves special security risks, including a potential unauthorized data access, data destruction, or abuse of host machine resources.

However, intelligent mobile agents are smarter than typical viruses and able to exhibit many more subtle patterns of malicious behavior. For example, negotiating agents may renege on their obligation to complete a transaction once they encounter a more promising opportunity. In general, taking into account that an agent may be required to make a decision dynamically, we have to consider the correlation between the ability to make a decision and the measure of moral responsibility for the decision taken—an issue especially important for mission-critical applications. A special concern is related to the emergence of the new cutting-edge technology, the *Semantic Web,* where agent-to-agent and agent-to-human interactions are closely linked to

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