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Chapter VI

Biometrics: Past, Present and Future

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ABSTRACT

This chapter discusses the current state of the art of biometric systems. The use of biometrics is an important new part of the design of secure computer systems. However, many users view such systems with deep suspicion and many designers do not carefully consider the characteristics of biometrics in their system designs. This chapter aims to review the current state of the art in biometrics, to conduct detailed study of the available technologies and systems and to examine end-user perceptions of such systems. A framework is discussed that aims to establish guidelines for the design of interactive systems that include biometrics.

INTRODUCTION

In the recent movie adaptation of Philip K. Dick's short story "Minority Report," a man walks through a crowded shopping mall. As he passes by, electronic billboards scan his irises. Their presentations instantly change, with electronic actors calling the man's name aloud to attract his attention, immediately tailoring their presentations to suit his pre-recorded profile of preferences.

As with any movie presentation, this vision of a dystopia of corporate advertising linked to biometrics outwith the control of the individual contains just enough grains of truth to make us wonder. We can trace through many of the technologies that would be necessary for this vision to become reality and ask, "Is this possible?" We can trace through many of the societal realities of today and ask, "Is this already happening?"

In fact, we can readily identify many complex issues relating to biometrics in our current societies and there is a need to consider their implications from social and ethical perspectives. The technical aspects of acquiring and comparing biometrics have matured in much the same way that multimedia technologies matured in the 1990s. That is, we know how to do things with these new technologies; we must now figure out how they should be applied and the potential effect they will have on our societies.

It is important to consider these issues at this juncture because if we do not define and choose which reality we prefer one will be imposed on us. Such an imposition would not necessarily be from government, but merely as a result of technical development, where one alternative finds widespread support and eventually squeezes out all others. Indeed, at this time, the rate of development of biometric devices and their uptake in public society far exceeds the rate of development of ethics or policy regarding their use.

This chapter will review some of the complex issues relating to the use of biometrics in our current societies. The nature of biometrics and some of the characteristics and limitations of contemporary devices will be discussed. A framework based on privacy, consent and awareness will be presented and it will be shown how cryptographic techniques can be employed to provide the important properties of privacy and non-repudiation in a biometric system.

Definitions of Biometrics

A biometric is some measurement of the biological characteristics of an (human) individual. There are many forms of biometric data for which capture and verification is possible via some device. Fingerprints, voice recognition, and retinal, face or hand scanning are all feasible with current technology. However, the nature of biometric data is such that there are significant risks associated with its capture and use in a secure environment (Schneier, 1999).

We can define two broad classifications for the method of acquiring biometric data: direct and indirect. A direct biometric is data that represent a measurement that is made of some physical characteristic of an individual, for example a fingerprint or a retinal scan. An indirect biometric is data that represent a measurement that is made of an individual's actions, such as the rhythm of typing on a keyboard.

Direct biometrics generally have a higher probability than indirect biometrics of establishing a 1:1 correspondence between the identity of an individual and the biometric. The method of acquisition is generally more invasive than indirect