

(with the aid of a viewing program) but also be used extensively by other programs that manipulate information, summarize it, reason with it, and correlate it with information from other sources on behalf of human users. In order to be able to access and operate on such information reliably it needs to be rigorously structured; the human eye and the human mind are far more capable of compensating for variations, applying common sense, and inferring than most software. There are a growing array of tools available for defining data structures that can be moved across the network, such as Abstract Syntax Notation One (ASN.1); however, there will be a growing need to standardize semantics for data elements that may appear in records retrieved from information servers on the network. Indeed, the success of such standardization efforts will be central to the success of large scale, distributed scientific programs in areas as diverse as systemic biology and botany, molecular biology, global climate change, and the initiative to map the brain. While some communities, such as the library community and more recently the various groups interested in electronic data interchange (EDI) have substantial experience in this area and have made some progress within limited domains, this is a new concept for many scientific communities and one that these communities are having considerable difficulty making rapid progress in realizing. Further, while many of these scientific and research communities clearly recognize the need to develop such standards for data elements and a clear focus exists within the research community to address the issue, it is far less clear who will do the work to develop and maintain similar standards for the more mundane or commercially-oriented standards .73

Sadly, until such time as these structured information interchange standards become defined and widely implemented, we will be unable to realize one of the major potential payoffs of creating libraries of electronic information—the ability to view these as knowledge bases that can provide a foundation for the development of more capable software agents that can act on our behalves, but that can function relatively independently, without the need for a human being's eyes, mind and judgment to preprocess large amounts of information.

## 11. Digital Images and the Integrity of the Visual Record

In a very important recent book titled *The Reconfigured Eye: Visual Truth in the Post-Photographic Era* [Mitchell, 1992], William Mitchell traces the historical role of the visual image as a record of events. Prior to the development of photographic technology, painting served the cultural role of recording things, events and people. In the 19th century photographic methods were developed which were far more accurate than painting in reproducing and recording; indeed, the author argues that the development of these technologies freed painting to explore new and less literal reproductions of visual reality. While “trick photography” and various photographic effects were developed very early in the evolution of photography, there seemed to be a fairly well understood implicit consensus that these uses of photography to capture unreal images

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<sup>73</sup> Indeed, for the commercial standards, in the worst case we are likely to see a number of different commercial information suppliers attempting to establish incompatible de facto standards in order to capture markets and ward off competition. The notion that open standards actually establish and foster the growth of markets in information is not yet generally accepted by most of the commercial information suppliers.