The Past and Present Future of Biometrics

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San Jose State University

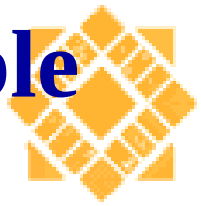
Presentation to the Biometrics Institute

Sydney, Australia

1 August 2003

The Future in the Past

"Personal identity verification with the following desirable features:



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- Speed – operation in seconds
- Decentralization…relatively inexpensive and requires no trained or skilled operating personnel.
- Ultravalidity …not susceptible to forgery or theft
- Convenience ..no need to carry identity cards or similar items"

--Hughes Research Laboratory Report #190, March 1961 (Rev. 1963)

“A large, diverse market

- The four features above promise products having a large, diverse market in nonmilitary, as well as some military applications..
  - In credit systems…retail stores, airline counters, etc….
  - With industrial and military security systems…restricted access areas in industrial plants, offices…
  - Personal lock…it could replace key and combination locks”

A Remarkable Forecast and Overview

D.E. Raphael and J.R. Young,
"Automated Personal Identification",
SRI, International, 1974

"Technology is Available Today

- to provide semiautomated and fully automated personal identification systems for use in business transaction and access control.
- How fast the transition will occur from manual to semiautomated systems in the latter 1970s to fully automated products in the 1980s will depend largely upon developments in the product features, multiple measurement systems, and technical and economic feasibility"

“Several product features that will be increasingly important for API systems:

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1. One or more personal characteristics will be used as the identifier.”

"Several product features that will be increasingly important for API systems:

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2. All personal ID systems will have some negative impact on the user, but those using passive measurements are more likely to gain user acceptance
   - In one study in a retail outlet, some established customers resented the need to 'prove' their identity by submitting to a thumbprint process each time a purchase was made. (In order to improve user acceptance, one marketeer has begun promoting thumbprints as 'thumb signatures')
   - In industrial applications, employees …are considered to be more willing subjects when they understand and acknowledge the need for security"

"Several product features that will be increasingly important for API systems:

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3. Most (API) procedures now under consideration depend upon the cooperation of the individual identified; there is likely to be growing use of procedures that can be used without an individual's cooperation, or perhaps, knowledge. Cooperation of the individual is usually enhanced if the identification procedure is convenient or 'invisible' "

"Several product features that will be increasingly important for API systems:

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4 The plastic card will continue to be an important vehicle for carrying personal identification information, but alternatives to its use will emerge as API systems become widespread

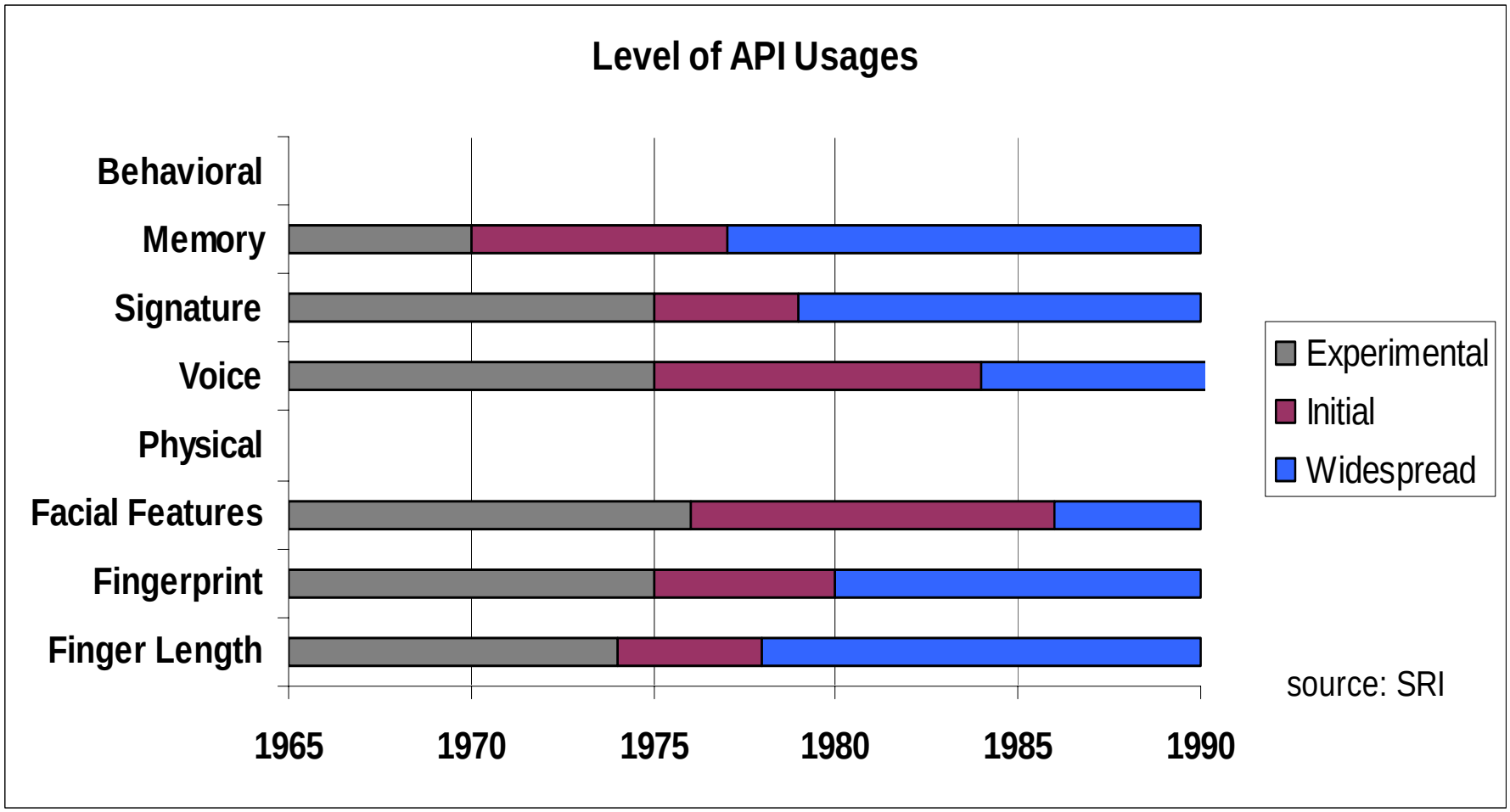
- A standards agreement would have to be a precursor to acceptance by merchants since few could afford to install the multiplicity of API products corresponding to the multiplicity of charge cards they accept"

SRI: The Future in 1974

Degree of Acceptance by Users (source: SRI)

	1975	1980	1985	1990
Behavioral				
Memory	↑ ↑ ↑	↑ ↑ ↑	↑ ↑ ↑	
Signature	↑ ↑ ↑	↑ ↑ ↑	↑ ↑ ↑	
Voice	↑ ↑	↑ ↑ ↑	↑ ↑ ↑	
Physical				
Facial Features	↑	↑ ↑	↑ ↑ ↑	
Fingerprint	↓	--	↑	
Finger Length	↑ ↑ ↑	↑ ↑ ↑	↑ ↑ ↑	

SRI: The Future in 1974



Privacy Concerns

"A recent study indicates that one-third of the American public is already uneasy about the proliferation of databanks and computer accessible files that contain more or less personal information. ..Many of these people will voice a fear that API systems will contribute to the mammoth cross-indexing capability – the capability of gathering more and more facts from previously prepared, but separate files"

Privacy Concerns

"The feared result is the ability of computer systems to compile complete dossiers on people, including their movements from place to place, purchases, financial transactions, and other activities heretofore considered personal and private. There is a strong possibility, however, that pending legislation relating to the transfer of data files from one owner to another will alleviate some concern about invasion of privacy, thus reducing an important deterrent to the use of API"

Fear of Rejection

"Insofar as persons subject to the identification process suspect that they will be falsely rejected, the fear of capricious failure will also constitute a negative impact for manufacturers of API systems"

Explosion of Interest (1975 - 1985)

- National Bureau of Standards, "Guidelines on the evaluation of techniques for automated personal identification", Federal Information Processing Standard Publication 48, 1977
- Mitre Test Program (hand, fingerprint, voice, fusion) (1976-1978)
- George Warfel, "Identification Technologies (Charles C. Thomas, Springfield, IL, 1979)

Sandia Test Program (1983 – present)

"Tighter security requirements to combat the threat of terrorism, and today's capabilities of transferring large amounts of information and funds at electronic speeds further increases the need for personal identity verification."
-- Russell L Maxwell, "The Status Of Personnel Identity Verifiers", 1985

Biometrics and Banking 1984

"Biometrics promise is long term. Biometric systems that would be cost effective in high-volume transaction environments are still in the early stages of R&D. Entrepreneurs active in such fields as hand geometry and voice print recognition can go only so far with the venture capital resources that are available. Some technology savvy bankers are therefore resigned to continuing relying on the less dependable, memorized personal identification numbers PINs are inherently vulnerable to theft or unauthorized use, especially when cardholders write their PINs directly on their transaction cards" –

J. Kutler, "Biometric Conversion", Transitions: The Journal of Financial Service Strategy, Vol. IV, No. 9, Nov. 1984

PIN Subscriber Surveys

- Which biometric is most likely to become commonplace in the following applications and indicate the year it will be fairly common to see biometrics in that situation?
- ATMs — Year common
  - (1987) fingerprint 48% — 1991.9
    signature 26%
  - (1988) signature 38% — 1995.8
    fingerprint 34%
  - (1989) fingerprint 49% — 1996.4
    signature 25%

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PIN Subscriber Surveys

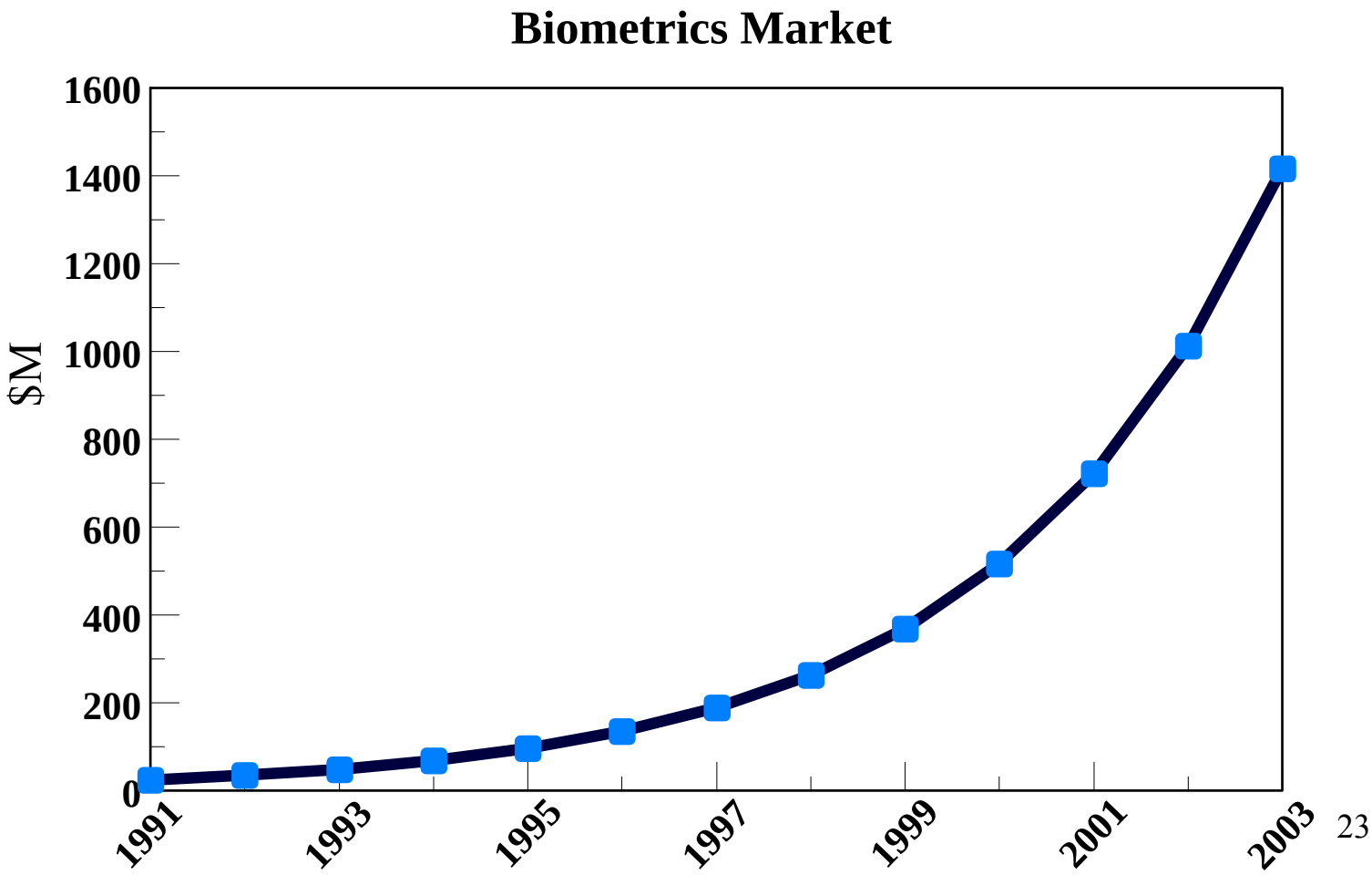
- Point of Sale — Year common
  - (1987) fingerprint 82% — 1994.7
    hand 12%
  - (1988) signature 71% — 1995.6
    fingerprint 21%
  - (1989) signature 75% — 1996.5
    fingerprint 21%

2000 Survey of BC Listserve

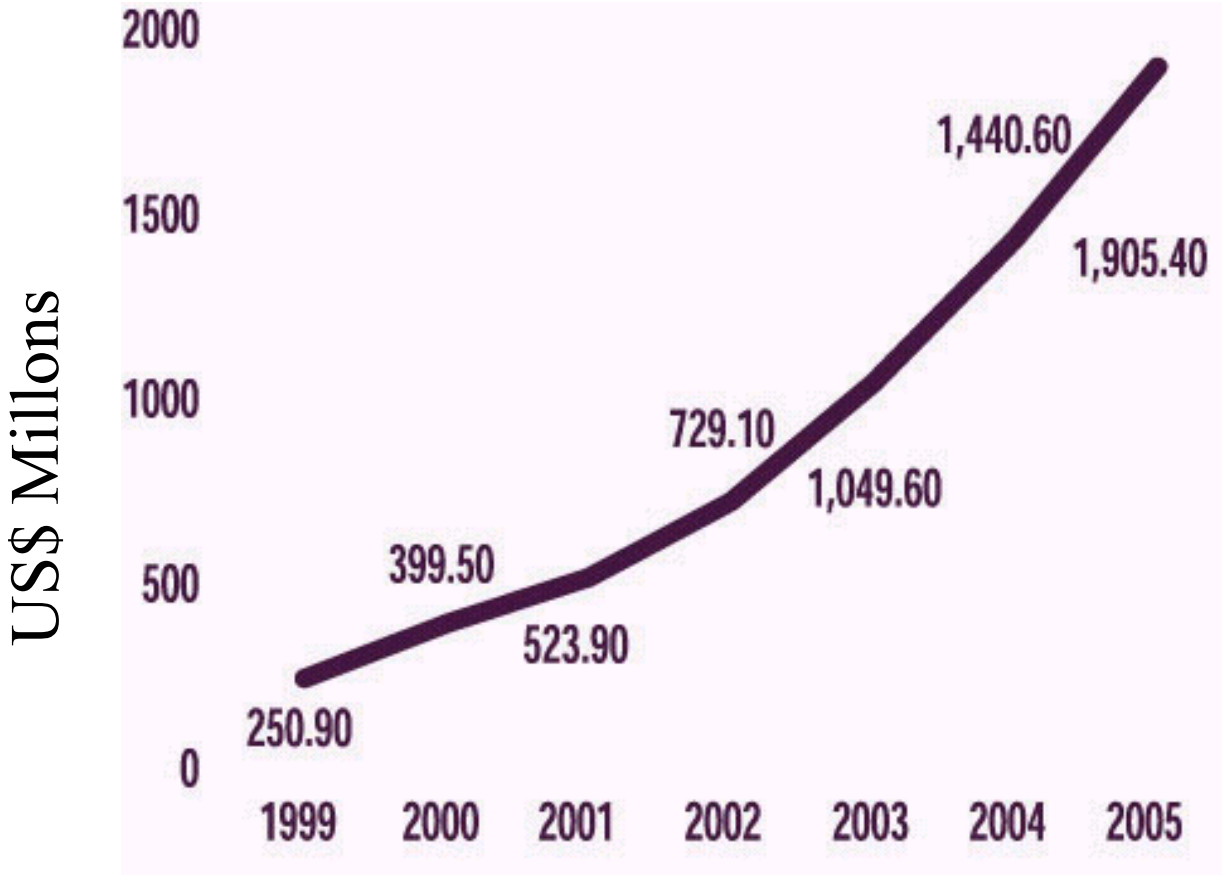
In which year will be biometric technology become extensively used for each application?

	ATM	C.C.	PC	CELL.	GOV.	T&A
Ave	2003.9	2004.7	2002.6	2004.4	2003.1	2003.7

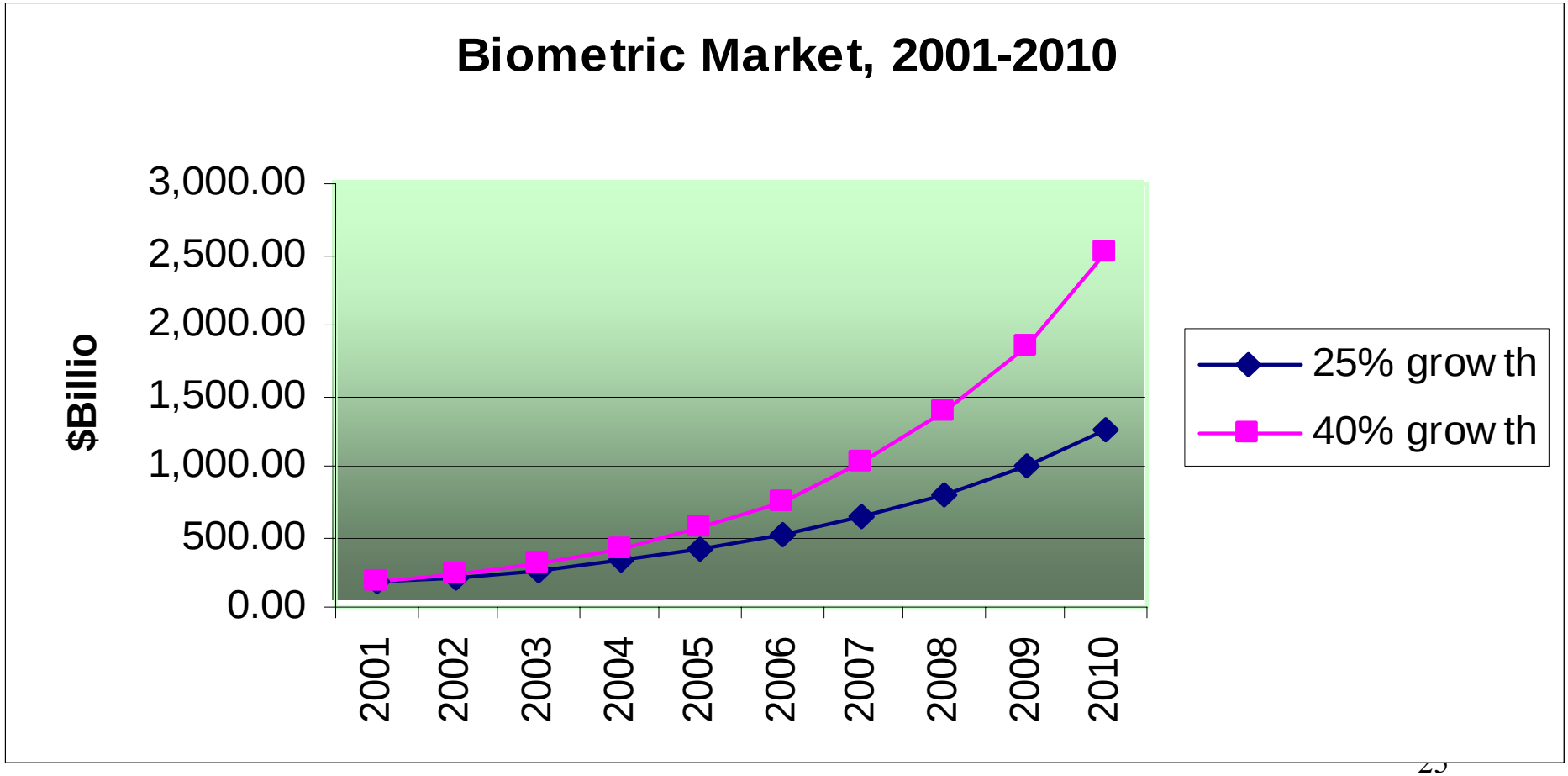
Frost and Sullivan (1990)



IBG Forecast (2000)



IBIA Forecast (2000)



The Future in the Present

The Register 22/07/2003

"While widespread use of biometrics technology is expected by 2008, a lot of work still needs to be done to iron out its shortcomings, according to experts".

http://www.theregister.co.uk/content/55/31865.html

Report to the French National Assembly 10 June 2003

Les méthodes scientifiques d'identification des personnes à partir de données biométriques et les techniques de mise en oeuvre

The scientific methods for human identification from biometric data and the techniques to use them

(Translation by Dr. Didier Mewley)

Author – aim of the report

- Christian Cabal, French MP
- www.assemblee-nat.fr/12/tribun/fiches_id/698.asp
- Advise the French Parliament on biometrics technology

Part 1: Hope and fear regarding biometrics

- The author of this study concludes that the biometric technology is not a viable solution in a short term, but reinforces the traditional security systems without replacing them.
- Maturity of biometric technology for surveillance of intermediate level places (airports, factories, offices) will happen in a short or medium term (2-6 years).
- Surveillance using biometrics to track criminals is not a solution in this short or medium term (2-6 years).

Part 2: Economic stakes

- Biometric technologies market: divergences in forecasts

	2001	2004
Institution 1	66 M US$	520 M US$
Institution 2	230 M US$	900 M US$

Bundesministerium
für Wirtschaft
und Technologie

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- Finanzgruppe

BioTrusT

Interdisciplinary Project for the
Promotion of
Biometric Identification Methods

Final Report Sept. 2002

German View

- “According to the vzbv (Federation of German Consumer Organizations), consumers who buy products and services of any kind will in the future most likely encounter biometric applications in situations involving authorization”

Biometrics and ATMs

- "…it has been found that the robustness and the level of security of biometric systems will have to be significantly improved before they can be used for automated teller machines. It is also necessary to bear in mind that it is impossible to demonstrate the level of security of biometric systems"
- "…the use of biometrics for ATMs cannot be expected to materialize in the next 5 to 7 years"

The Future in the Future

The Future of Biometrics (2020)

- "Widespread adoption is 5 years away"
- "The biometrics industry is on the verge of profitability"
- "Biometrics will bring a new era of security, convenience and user friendliness"
- "Biometric systems will become faster, cheaper and more accurate as the technology evolves"
- "Biometrics will end privacy as we know it"
- "Biometrics will not fulfill their promise for years to come"

Escaping "Groundhog Day"

Using the past future in the present to change the future in the future

An Alternative Future

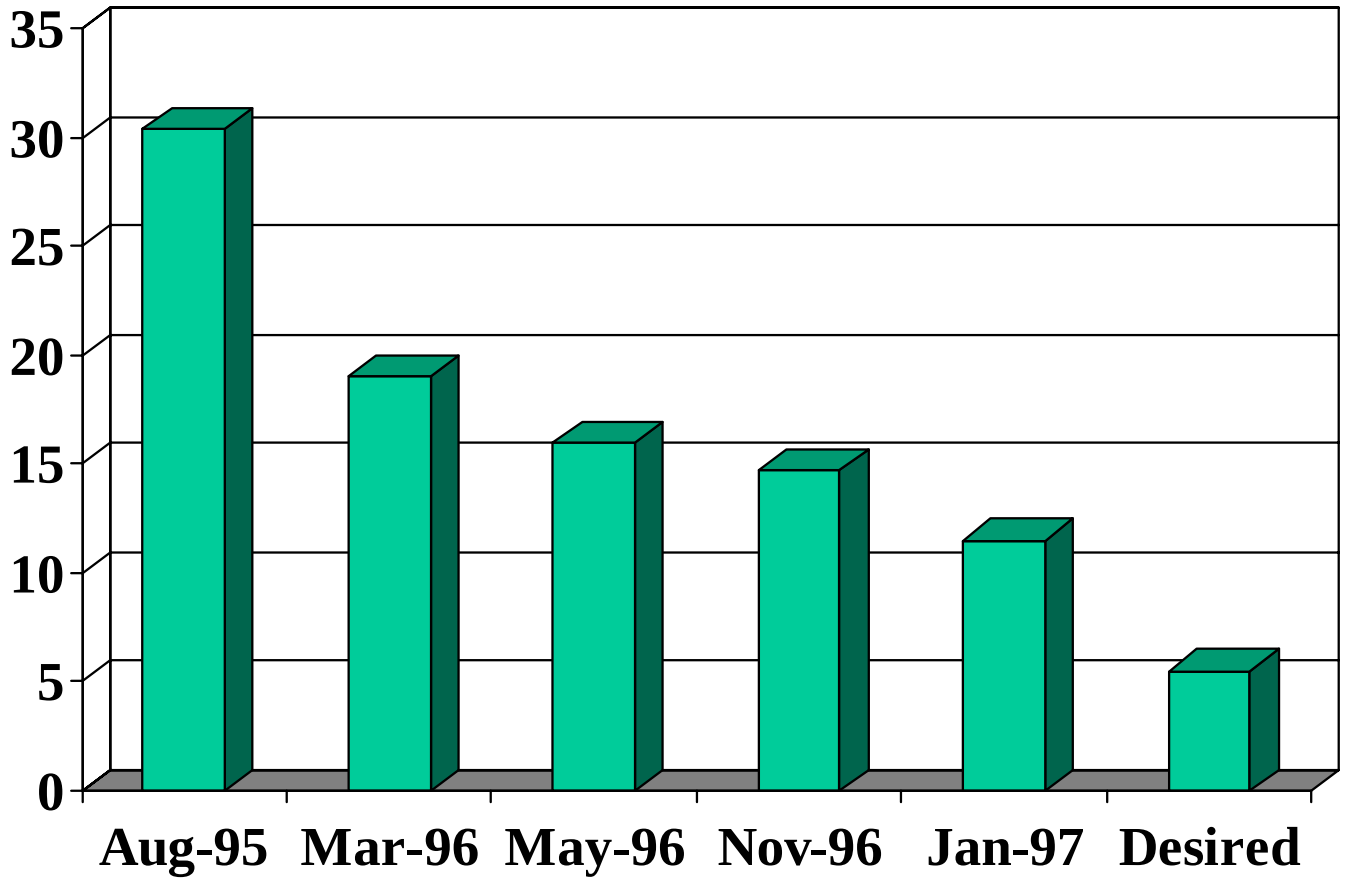
- Biometrics as a behavioral science
  - Human performance depends upon:
    - Habituation
    - Supervision
    - Age and physical health
    - Technical background

DISNEY

An Alternative Future

- Limitations on improvement in:
  - Throughput
  - Failure-to-acquire rates
  - False non-match rates

DISNEY ACCESS TIME IMPROVEMENT



An Alternative Future

- Realistic expectations of computer/human performance based upon:
  - Understanding of limitations of human/human performance
- An additional tool in the toolbox
  - Locks and keys
  - Encryption
  - Cards and tokens
  - PINs and passwords

An Alternative Future

- Improved cost/benefit analysis based upon:
  - Understanding of costs of current systems
  - Understanding security limitations of current systems
  - Experience with biometric system procurement and operation
  - Understanding of the process re-engineering and infra-structure costs

Technology Change

Technology	$100,000
Process re-engineering	$1M
Infrastructure Construction	$1B

-- Mike Thomas

VP Consumer Satisfaction,

United Airlines

CTST'02

An Alternative Future

- Changing commercial environment:
  - Decreased government reliance on the COTS marketplace for solutions to specialized, governmental problems
  - Increased cost of market entry for start-ups
  - Technology acquisition by large scale integrators

Role of Venture Capital

- Venture capital …"is not a substitute for government support of long-term scientific and technical research. Indeed, the venture capital industry is not designed to support early-phase research and rarely does so."

--**"Capitalizing on New Needs and New Opportunities: Government - Industry Partnerships in Biotechnology and Information Technologies"** (2001)
Board on Science, Technology, and Economic Policy,
National Academies of Science

Conclusions

- Historically, the future of biometrics has been:
  - over-hyped
  - over-feared
  - over-simplified
- History teaches us to question future:
  - biometric evangelists
  - hallucinating visionaries
  - modern-day Luddites

The Future of Biometrics

She'll be right. No worries!