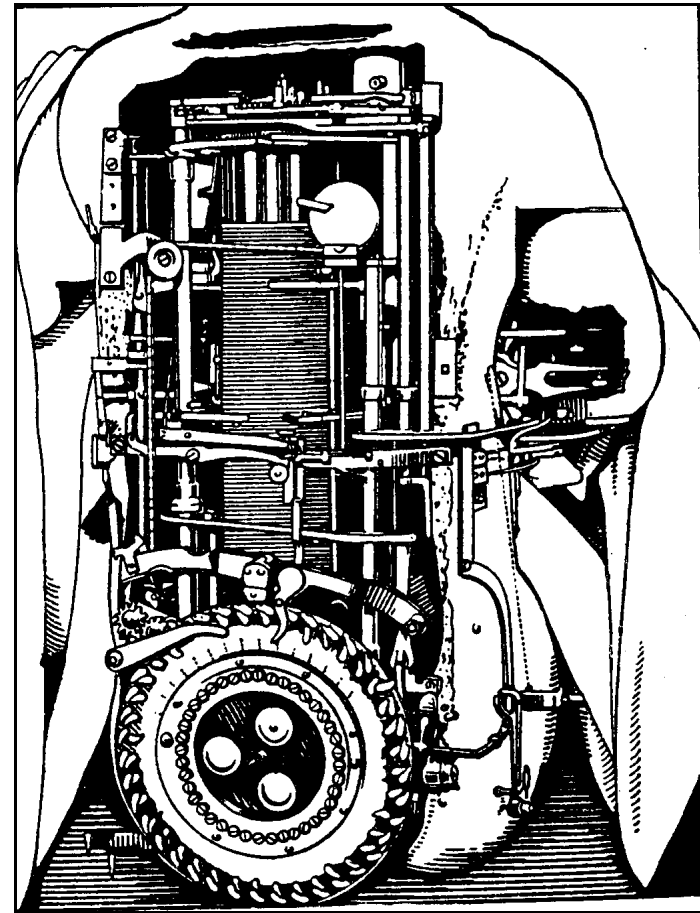


Early robots can be considered the many automatic toys

that were developed for the pleasure/astonishment of aristocratic people since the Renaissance. They reached high levels of automation and autonomous operation so that they were considered as automata during the XVIIIth century.



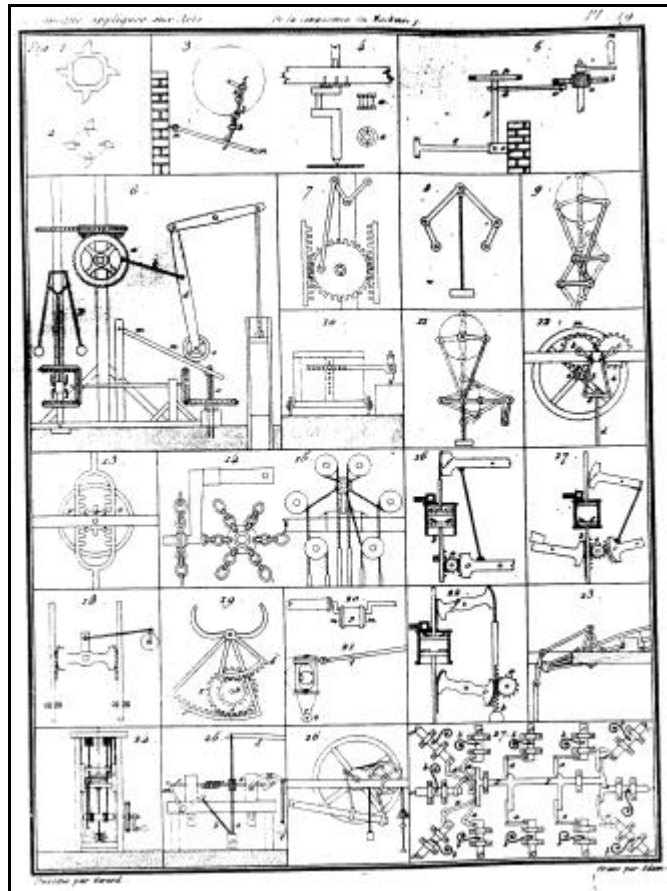
a)



b)

Fig. 6: The writer automata by Jaquet-Droz in 1760: a) the robot shape; b) the mechanisms.

Thus, at the beginning of XIXth century automatic devices were regularly designed and used.



The advent of Electronics

gave a further stimulus and jump in Technology, mainly because it allows to regulate and control several motors contemporaneously.

- to develop modern robots as today we mean for multi-degrees of freedom systems.

MODERN AND INDUSTRIAL ROBOTS

The following dates are fundamental and well known in the recent History of modern Robotics:

- 1947: Raymond Goertz built and used a servoed electric-powered teleoperator;
- 1954: George C. Devol obtained the first patent for a manipulator with memory;
- 1956: Joseph Engelberg and George C. Devol started the first robot builder company Unimation;
- 1968: Victor D. Scheinman designed the Stanford Arm;
- 1971: Japan Industrial Robot Association JIRA is founded;
- 1975: the U.S. Robot Industries Association RIA is founded;
- 1975: robots are implemented in a large scale production at Ford plant in Detroit
- 1981: robots are implemented in a large scale production at FIAT plant in Cassino;
- 1984 IEEE Journal of Robotics and Automation was established.

- Many other events and people have produced acceptance and success of robots

One can say that modern Robotics started by copying and mimicking the human arm, but soon attention was addressed to other solutions that got inspiration from the living world in nature and/or were conceived with artificial architectures to obtain the nature solutions.

Finally, at the end of 90s

people began learning not only how to design robots by their own , but mainly how to make them perform efficiently

In 1993

Engelberg reported still enthusiastically about R&D in Robotics in USA

He also pointed out that a general report on recent status on Robotics in the world is almost impossible, although some overnational projects help to have information, since the fragmentation of application fields is considerable and the secrecy of new or successful solutions is still a persistent behavior in the commercial world.

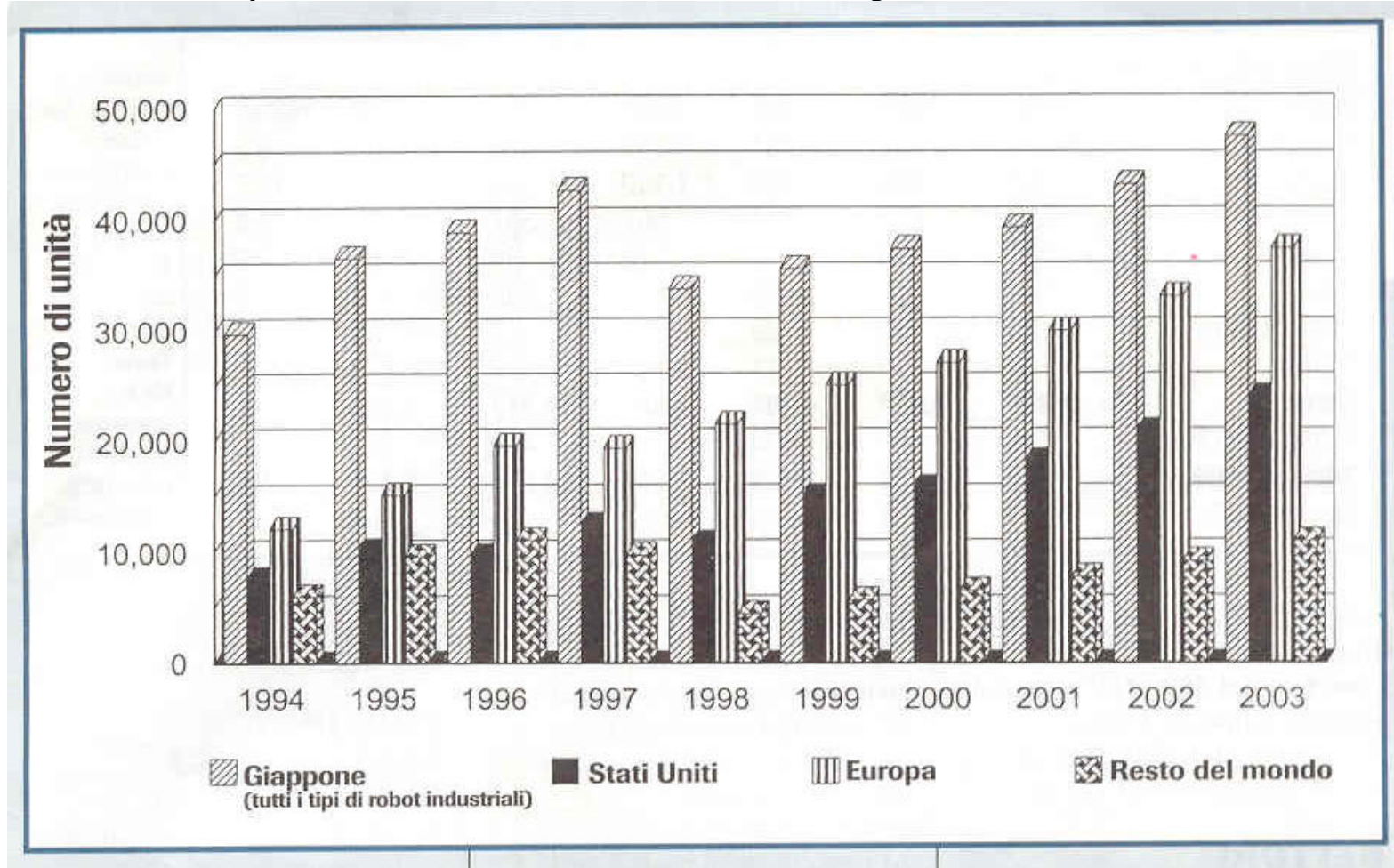
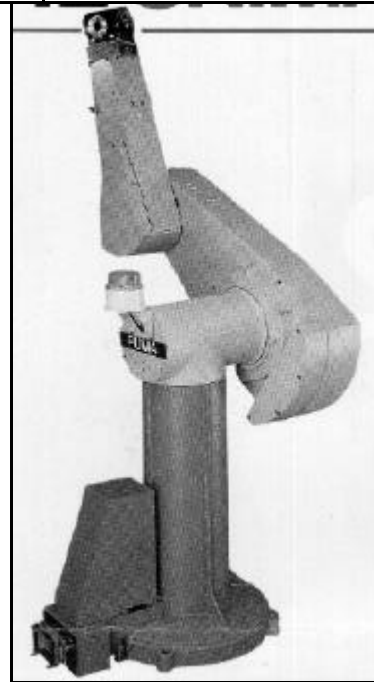


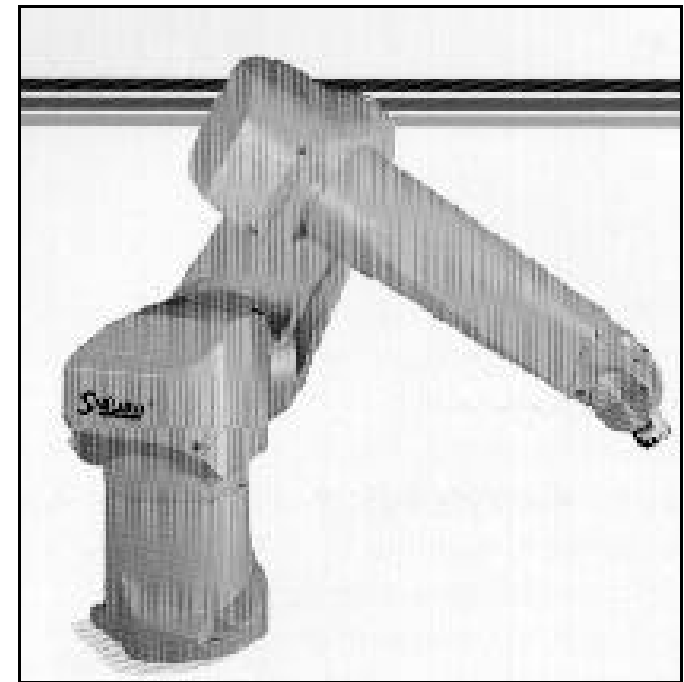
Figure 7 together with Table 1 shows an illustrative example of how industrial robots evolved in 10 years:.

Table 1: Performance characteristics of PUMA-type robots.

	PUMA562 (Fig.7a)	RX90L (Fig.7b)
d.o.f.s	6	6
Payload (N)	40	120
Maximum reach (mm)	878	985
Repeatability (mm)	± 0.1	± 0.02



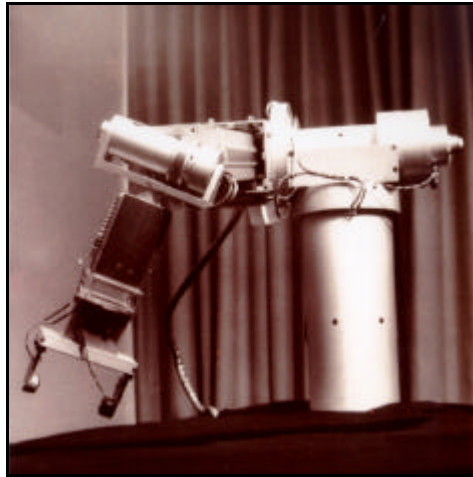
a)



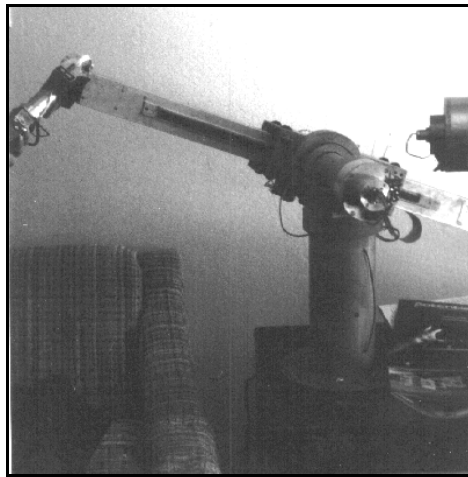
b)

Fig. 7: The design of PUMA-type robot: a) the PUMA562 at the beginning of 80s; b) the RX90L at the end of 90s.

Figure 8 is an emblematic example of how innovative solutions were and still are overpassed very quickly with the risk to be forgotten and not fully implemented.



a)



b)

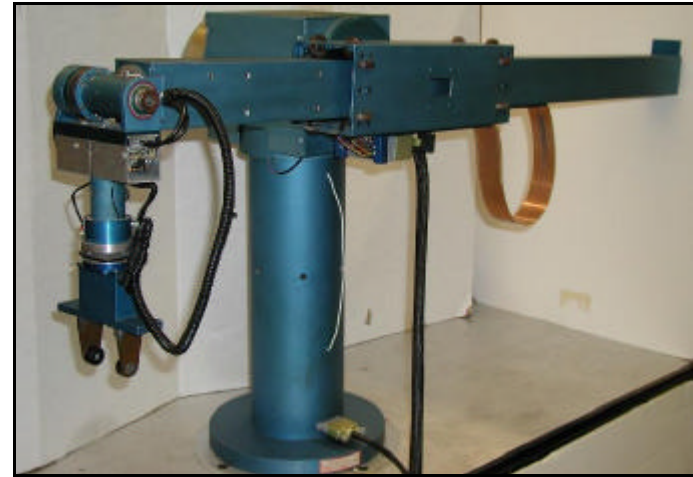


Fig. 8: The Stanford Arm: a) just built in 1969; b) in 1987 when old.

(Photos have been provided by prof. Oussama Khatib of Stanford University, who is gratefully acknowledged)

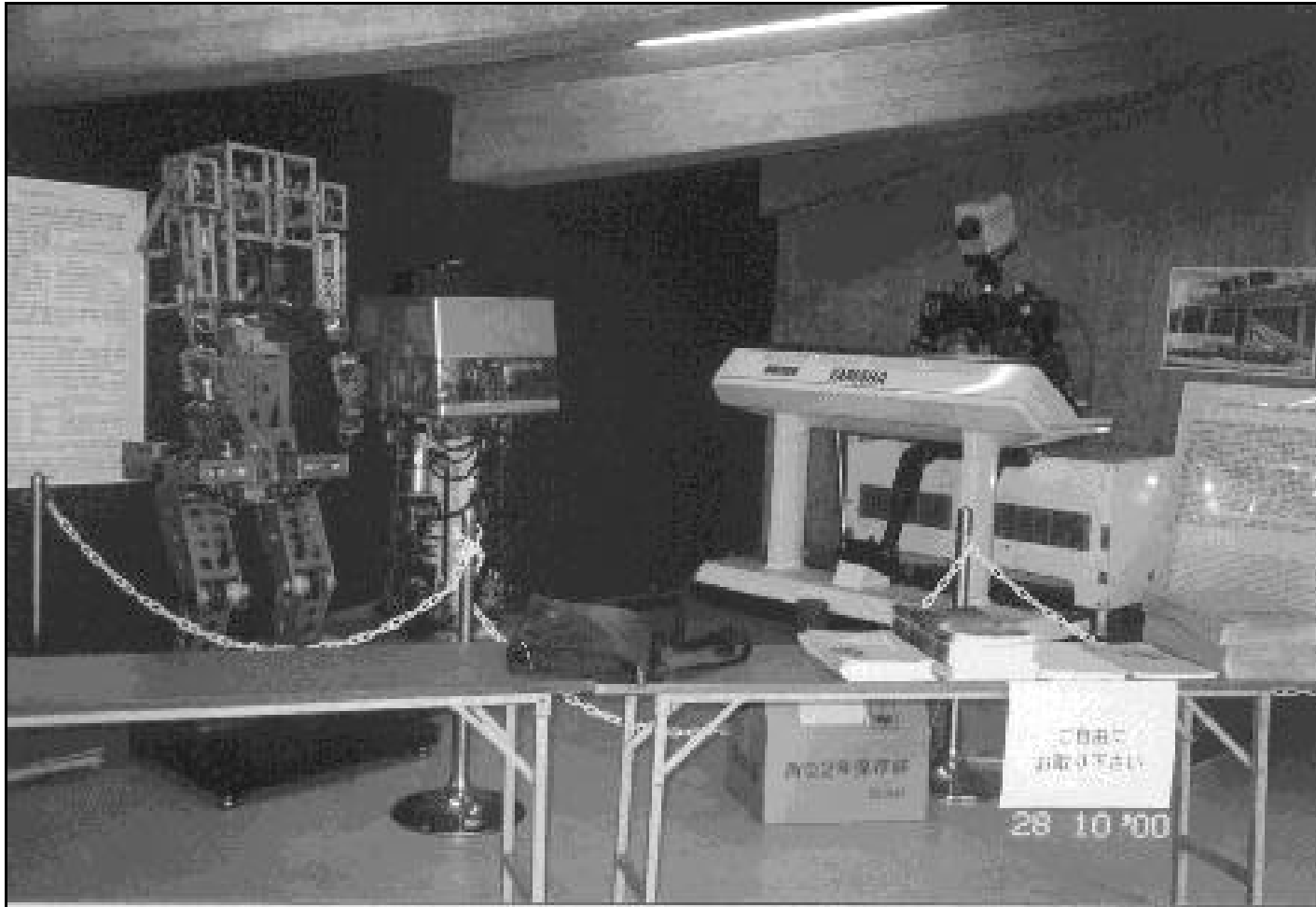


Fig. 14: An exhibition corner of past robots at Waseda University in Tokyo in 2000 (Courtesy of Waseda University).

Modern Robotics evolved tremendously very fast
so that it did not often give the time to look back to what has been done, but it was and still outstretched to find and conceive novelties.

Emerging new solutions for robots can be identified in:

- redundant manipulators
- parallel and hybrid architectures
- mobile robots, and particularly walking machines.

Redundant manipulators

are studied to solve problems regarding the avoidance of obstacles or path planning in complex environments.

Basically they consist of mechanical designs of different kinematic chains, even mimicking animal structures, but with a number of degree of freedoms greater than the minimum required for a general task.