

Robots – Some Cultural Roots

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Abstract: This contribution sketches some of the pre-history, the real story, and some circumstances of the birth of world-wide well-known and broadly used word *robot*.

1 Introduction

Once upon a time, very many years before engineers found a common ground for their considerations and experimentations with human-like machines, when Norbert Wiener (1948) gave to André-Marie Ampère's *cybernétique* a new meaning of a discipline focused to “control and communication in animal and machine”, and then when researches in the fields of Artificial Intelligence and robotics have started, many years before that all, the humankind has its secret dream about human-like machines.

Despite of the dreams expressed in such influential books like the Old Testament (cf. Genesis, 1.27 about the creation of Adam) or Homer's Iliad (XVIII, 415-420 about the Odysseus visit at Hephaestus workshop) or in legends like that about the Prague's Golem, at least from the beginning of the 18th century, we can find also real arte-facts which document the effort of mechanics to design and produce

human-like machines. The mechanical puppets by Jaquet-Droz in Neuchatel (Capuis, Droz, 1956) are good examples.

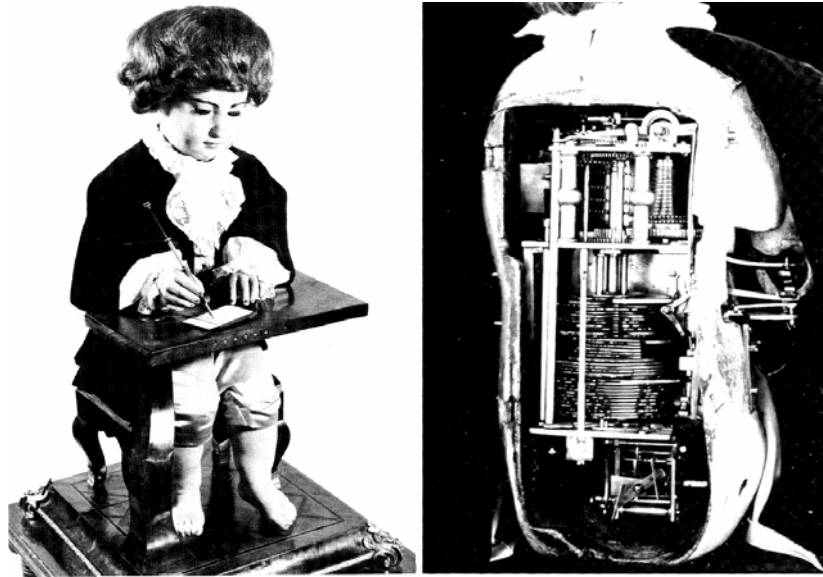


Fig. 1: Jaquet-Droz's Draughtsman completed in 1772-1774. The front-view, and the back-view with the mechanism (Capuis, Droz, 1956).

But a more interesting example is the Turk constructed by Wolfgang Kempelen in Bratislava, the present days capital of Slovakia (called Pressburg in German, and Pozsony in Hungarian). The Turk was (at least intended) as an *autonomous* mechanical chess player (which followed a clearly opposite goal like the human being playing with it). It was repeatedly very successfully demonstrated in many places in Europe (Standage, 2002).

The artificial humanoid being is a significant component also of the modernistic view of human. We can find it for instance in symbolistic theater convention where we often meet schematized characters in expressionism (two expressionistic plays by Georg Kaiser – *Grass I.* and *Grass II.* – are usually understood as influencing Karel Čapek work), the cubistic image of the man as an union of squares and triangles reminds deconstructed human-like machines (or machine-like humans?), and the futuristic yearning for mechanization of human and adulation of a “cold beauty” of the machines made by steel and tubes is depicted in their works.



Fig. 2: The Kempelen's Turk (with hypothesized construction trick) appearing first in spring 1770 in Vienna (Standage, 2002).

Likewise the famous Czech brothers Josef (1887-1945) and Karel (1890-1938) Čapeks had dealt with the idea of mechanical human-like creatures in couple of their individual or common works. We should mention some of them which appeared in the individual literary works by Josef Čapek. We should mention his short story *Opilec* (*The Drunkard*, 1914-5) where he is dealing with “mechanical alter ego” of the main character, and his essay *Homo Artefactus* (1924). Both works reflects the idea of human-like creatures with irony and sarcasm. To recapitulate: an image of the human *double* in the shape of mechanical human simulacra was just in the ear.... In *The Drunkard* (included into *Lelio* – Josef

Čapek’s collection of short stories published in 1917), as well as in the *Homo Artefactus* published in 1924, the artificial man-made man-like creatures are supposed as constructed in the base of mechanics. If we compare the inner view of Jaquet-Droz mechanical puppets with Josef Čapek’s drawings (appearing in *Homo Artefactus*), his understanding of the meaning of “mechanics” as well as a source of his (possible) inspiration seem to be clear enough.

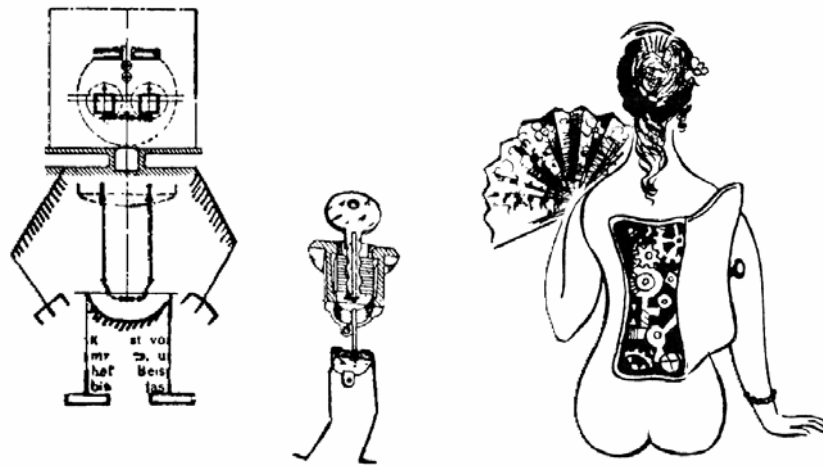


Fig. 3: Josef Čapek’s drawings from *Homo Artefactus* (1924).

2 The Conception

Today is relatively commonly known that the word *robot* appeared first in the play *R. U. R.* (Rossum’s Universal Robots)¹ by the Czech (from an other historical perspective perhaps Czechoslovak) writer and journalist Karel Čapek (1890-1938), who opened by his play perhaps two among the most appealing topics of the 20th century intellectual discourse – human-machine interaction and human-like machines. But do not forgive that the artificial humanoid being is one among the significant components of the modernistic view of human beings. We can find it in symbolistic theater convention. We often meet schematic characters in expressionism. The cubistic image of the man as a union of squares and triangles

¹ Nota bene: *rossum* is an English-like encryption of the Czech word *rozum* means approx. the same as the English *mind*.

reminds deconstructed robots. Remind also the futurists yearning for mechanization of human and their adulation of the “cold beauty” of machines made by steel and tubes often depicted in their artworks, and – last but not least – the political and social situation after the World War I.

Karel Čapek wrote the *R. U. R.* during his, his brother’s Josef (1887-1945), and their sister’s Helena (1886-1961) vacation in the house of their parents in the spa Trenčianske Teplice (now in Slovakia) during the summer 1920 reflecting in it all the above mentioned intellectual, political, social and artistic influences.



Fig. 4: A view of Trenčianske Teplice from the beginning of the 20th century.

As Karel has remembered in the Prague newspaper *Lidové noviny* (December 24, 1933), the first name for his “artificial workers” was *labors*, but he wasn’t satisfied with this word – it sounded too academically to him – and he asked his brother for a help. Josef “in passing” suggested the word *robot*, derived etymologically from the archaic Czech *robota* what means – alike in the Slovak language of these times – the *serfs obligatory work*.²

² The present days Czech equivalent of the English noun *worker* is (and in the time of Karel Čapek was) *dělník*, in Slovak was (and still is) *robotník*. The present Czech equivalent of the English verb *to work* is *dělat*, in Slovak *robiť*. The imperative mode *work!* is in Czech *dělej!*, in Slovak *rob!*

3 First Nights

The official first run of *R. U. R.* was in the Prague National Theatre in January 25, 1921 under the direction of Vojta Novák. The stage designer was a young architect Bedřich Feuerstein. Costumes have been designed by Josef Čapek, and the role of Primus – the leader of Robots revolt at the end of the play – was performed by Eduard Kohout. Meanwhile, the company of Municipal Klicpera's Theatre from Hradec Králové (a town about 100 km east from Prague) despite of the playwright and representatives of the National Theatre protests presented the play in January 2, 1921, so three weeks before its first night in Prague.

Městské Klicperovo divadlo v Hradci Králové

Jednota divadelních ochotníků
"Klicpera" v Hradci Králové.

PREMIERA! PREMIERA!

V neděli dne 2. a v pondělí dne 3. ledna 1921.

R. U. R.

Rossum's Universal Robots.

Kulturní drama o vstupní komedii a 3 aktech.
Napsal Karel Čapek. Režisr Bedřich Stein.

OSOBY:

Harry Dunin, vedoucí oddělení Rossumových Univerzálních Robotů	Ing. M. Hroch
Dr. Fabry, gen. technický ředitel R. U. R.	Jan Hlaváč
Dr. Calk, představa španělského a rytíře křesťanského R. U. R.	F. Pařík
Dr. H. H. H., představa dánské pro- střední a výchovné školy	M. Dufek
Univerzální robot, gen. konstruktér R. U. R.	J. J. J.
Helena Glyerová	Jan Hlaváč
Helena, její sestra	Jan Hlaváč
Čarila, robot	F. Kompiš
Čarila, robotka	J. Hlaváč
Damen, robot	A. Štrobil
Damen, robotka	V. Štrobil
Dr. H. H. H.	L. V. H.
Robot Primus	L. V. H.
Robotka Helena	L. V. H.
Robotský sluh	L. V. H.

Čet. 2. Hradec. — Děl se v Hradci na úterý od rána 1921. — Po předst. v
a státní sála přestává. — Míst předst. v 1. jedn. v 8. hod. 10. hod.

Začátek přesně o půl osmi hodině večerní.

ČESKÉ ZEMSKÉ DIVADLO V PRAZE

NÁRODNÍ DIVADLO

V úterý 25. ledna 1921. Mimo předplatění.

Poprvé.

R. U. R.

(Rossum's Universal Robots.)

Utopistická hra o vstupní komedii a třech aktech. Napsal Karel Čapek.
Režie: Vojta Novák. Výtvara: Bedřich Feuerstein. Kostumy: Josef Čapek.

Harry Dunin, vedoucí oddělení R. U. R.	Rudolf Deyl	Helena, její sestra	Marie Hlávková
Dr. Fabry, gen. technický	Miloslav Nový	Helena, robotka	Eugen Vlasov
Dr. Calk, představa španělského a výchovného oddělení R. U. R.	Alex. Tribenský	Damen, robot	Anna Červená
Dr. H. H. H., představa dánské pro psychologii a výchovu Ro- botů	Franz Malpavský	Dr. H. H. H.	Karel Štrobil
Konrad Rossum, generální konstr. R. U. R.	Franz Malpavský	Robot Primus	Jan Váňa
Univerzální robot, gen. konstr.	Franz Malpavský	Robotka Helena	Kašpár Zeman
Helena Glyerová	Franz Malpavský	Robotský sluh	Eva Vrcháčková
			Václav Zají

Děje se v budoucnu. První akt dění let po vzniku komedii.

Začátek o 7. hod. Po vstupní komedii a druhém akte přestávka. Konec o 10. hod.

Fig. 5: Theatre bills of the first nights of *R. U. R.* in Hradec Králové and in Prague.

The first night at the National Theatre was a great success. Many theatre critics observed a cosmopolitan character of it, the originality of the theme, and anticipated a world-wide success of the play.³ However, Karel Čapek was starting from rehearsals disappointed by the comprehension of the play as well as by the performance.

³ The play was soon performed in New York (1922), London (1923), Vienna (1923), Paris (1924) and Tokyo (1924) as well as in many other cities.

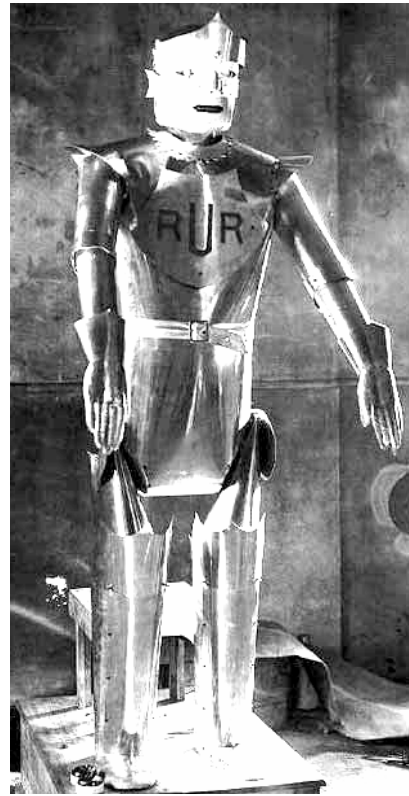
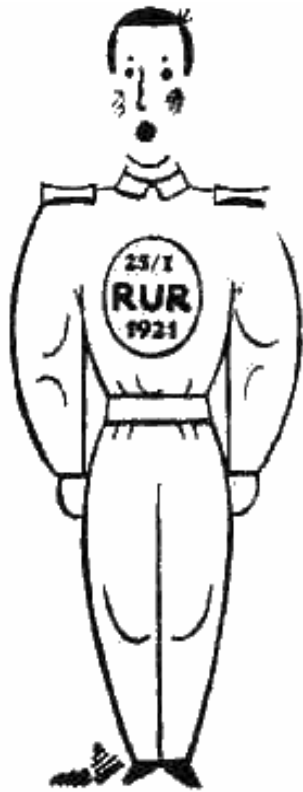


Fig. 6: Left: A caricature of Karel Čapek as a robot from the Prague first night of the *R. U. R.* (note the date on the robot's breast). The artist (and the costume designer for the first night) was Josef Čapek. Right: The costume of robots from the first American run of *R. U. R.* Note the important difference in comprehending robots!

Meanwhile the *R. U. R.*, with its futuristic and expressionistic features and cosmopolitan atmosphere became an appropriate part of an American culture. The first night of the play in the USA was in the Guild Theatre in New York City in the October 9, 1922 performed by the company specializing on a modern drama. The director of the performance was Nigel Palyfair. The first night was a success. *The New York Evening Sun* (October 10, 1922) wrote: „...like *H. G. Wells* of an earlier day, the dramatist frees his imagination and lets it soar away without restraint and his audience is only too delighted to go along on a trip that exceeds even *Jules Verne's* wildest dreams. The Guild has put theatregoers in its debt this season. *R. U. R.* is super-melodrama – the melodrama of action plus idea, a combination that is rarely seen on our stage.“

The play brought to its author a big fame in USA and soon the theme of the play, together with robots became part of an American pop-culture through science fiction published in pulp magazines in those days. In the context of the American culture Čapek's play lost its social satirical edge and the theme was transcribed in many sci-fi stories (esp. from the 20th to the 40th of the past century) in which predominated the atavistic folk fear about conflicts between human beings and machines (robots).

4 Karel Čapek's views

Despite of the fact that robots had been intended by their author as a metaphor of workers dehumanized by the hard stereotypical work, they had been soon misunderstood or misinterpreted as a metaphor of hi-tech that will destroy mankind because of human's inability to prohibit its misusage.

In the prologue of the play *R. U. R.*, Mr. Domin – the president of the R. U. R. robot factory – recalls the beginnings of the idea of robots for Helena Glory: *And then, Miss Glory, old Rossum wrote among his chemical formulae: "Nature has found only one process by which to organize living matter. There is, however, another process, simpler, more moldable and faster, which nature has not hit upon at all. It is this other process, by means of which the development of life could proceed, that I have discovered this very day." Imagine, Miss Glory, that he wrote these lofty words about some phlegm of a colloidal jelly that not even a dog would eat. Imagine him sitting over a test tube and thinking how the whole tree of life would grow out of it, starting with some species of worm and ending - ending with man himself. Man made from a different matter than we are. Miss Glory, that was a tremendous moment.*

So, Karel Čapek rejects the picture of his robots as a straightforward continuation of activities started sometime at the 18th century e.g. by Jacquet-Droz's puppets. He was disturbed by a social-political situation closely connected with industrial mass-production largely based on mechanical engineering inventions, on "tin and cogwheels", as he wrote. As he believed, the mechanical, stereotypical work is able to transform workers into parts of the process of mechanization.

But Karel Čapek was not a Luddite! He was not afraid that the new more productive machines will take worker jobs. He feared that human workers will work such a hard that they will lose their humanity and consecutively they will become certain kind of mechanisms. A metaphoric expression of this idea is the Čapek's robots, and there we can recognize one among the reasons why his robots are made up from organic substrate.

However, as much as Čapek disliked economical and political games on a one side, he admired science as a manifestation of human eternal desire to discover the

unknown, he admired science as the result of romantic effort of the mankind to know. So, it is completely understandable that he was inspired by state-of-the-art in science, mainly in the most rapidly developing branch of the science of his times – by chemistry. In *The Saturday Review* (July 23, 1923) Čapek express his opinion clearly explaining that “*The old Rossum’s* [the inventor of robots in the play *R. U. R.*] (...) *is no more and no less than the typical scientific materialist of the past century* [the 19th]. *His dream to create an artificial man – artificial in the chemical and biological sense, non in the mechanical one – is inspired by his obstinate desire to prove that the god is unnecessary and meaningless.*” Or in another place – in the newspaper *Lidové noviny* (June 9, 1935) – Čapek wrote: “*Robots are not mechanisms. They have not been made up from tin and cogwheels. They have been built up not for glory of the mechanical engineering. Having the author in his mind some admire of the human mind, it was not the admiration of technology, but that of the science. I am terrified by the responsibility for the idea that machines may replace humans in the future, and that in their cogwheels may emerge something like life, love or revolt.*”

5 Today’s views

“*What can we do when things are hard to describe? We start by sketching out the roughest shapes to serve as scaffolds for the rest; it does not matter very much if some of those forms turn out partially wrong. Next, draw details to give these skeletons more lifelike flesh. Last, in the final filling-in, discard whichever first ideas no longer fit*” describes Marvin Minsky (1986, p. 17) the path leading from ideas towards their realization.

For us working in the field of robotics, the word robot has a substantially different meaning that this one intended originally by Karel Čapek. Also the shape of today humanoid robots looks more like this one designed for the first night in New York as this designed by Josef Čapek for the first night in Prague.

In 1927, the first really useful robot developed by Westinghouse Company and called Televox was devised in Pittsburgh. It was able to supervise water containers in a high-rise building and start the pumps if necessary. In addition it was able to answer questions about the water level, to turn on a ventilator or a vacuum cleaner, to turn lights on and off or to open windows and close doors.

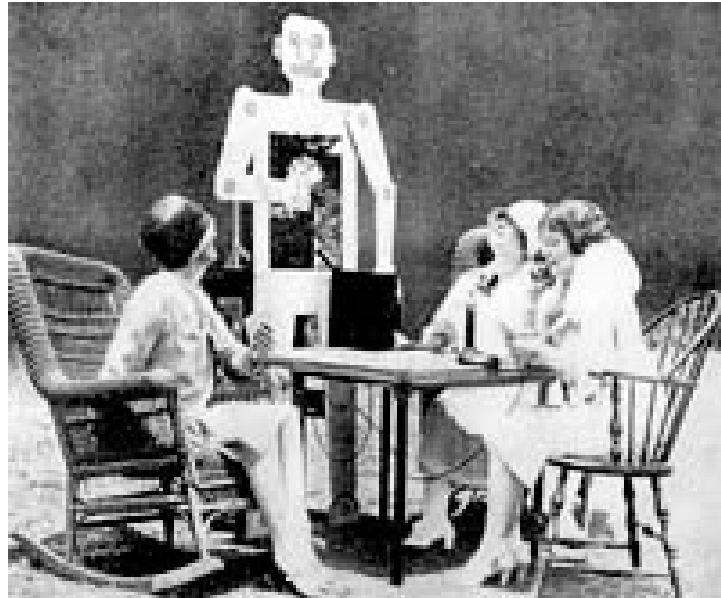


Fig. 7: Westinghouse Mr. Televox in action (1927).

Under the leadership of Rodney Brooks the famous Cog project of the MIT AI Laboratory resulted up to now in an upper-torso humanoid robot, which technically approximates human movements and sensing (Brooks et al., 1999). At the same laboratory Cynthia Breazeal – in order to allow social interactions between robots and humans – developed a platform with capabilities to simulate human emotive facial expressions, the emotional head Kismet (Breazeal, 2000).

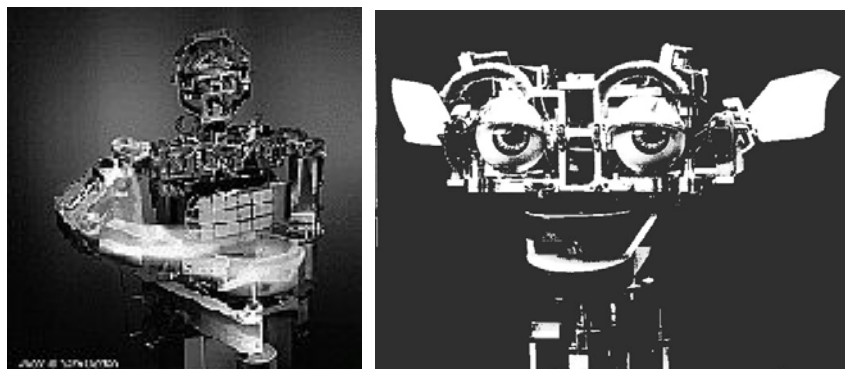


Fig. 8: Cog and Kismet, two famous today's robots from MIT AI Laboratory.

So, we have started to construct robots, and now they are gradually starting to behave autonomously in the environment shared with us. To document the progress made from the time of invention of the word in 1919 up to now, let us close our contribution by a first page information of the several times above mentioned Prague newspaper *Lidové noviny* (August 23, 2003): During his official visit of the Czech Republic the Prime Minister of Japan was accompanied also by the humanoid robot ASIMO (developed by Honda). During the visit, ASIMO laid a bunch of flowers to the bust of Karel Čapek.

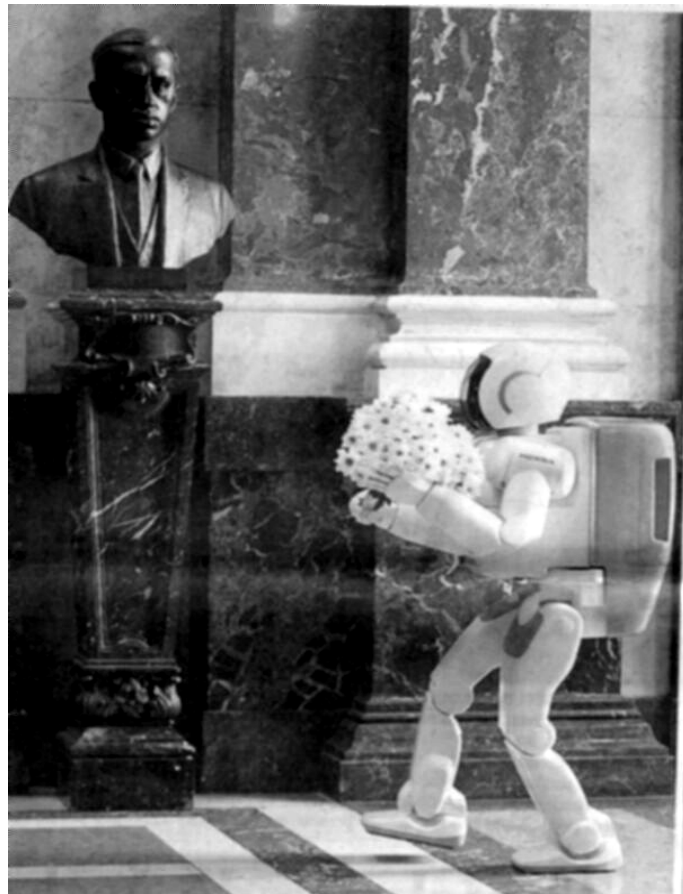


Fig. 9: ASIMO by Honda laying a bunch of flowers to Karel Čapek's bust in the Prague National Museum (August 22, 2003).

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