

Special Article

Rossum's Universal Robots: Not the Machines*

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ABSTRACT

Purpose: One assumes in the era of rapidly expanding technology that robot implies mechanical beings. This is not how the word was used initially and represents one of those metamorphoses to another conceptualization. This is an investigation into Capek's original play, *Rossum's Universal Robots*, for an understanding of his intended meaning.

Methods: Karel Capek was Czechoslovakian. His play was written in 1920, first performed in 1921, and presented in New York in 1922. It has come to symbolize Western society's feelings about robots. Capek's writing and the original play might clarify the definition of robot for the record, in light of some controversy as to whether the da Vinci Surgical System™ is a robot or not.

The Play: Rossum was a great physiologist who chemically synthesized living protoplasm and was capable of constructing artificial life forms: first, a dog; then, a man. His son was an engineer who quickly was able to manufacture large numbers of humanoids at lower costs “. . . producing a robot has been brought down within 15 years from \$10,000 to \$150.” This is the first foreshadowing of Moore's Law. But critically, these are not machines, even though his robots outperform humans. The story turns sinister as the robots eventually revolt and kill their creators.

Conclusions: Like many things in our vocabulary, the term robot was initially used for a biologic organism that was created for servitude. Defined by the Robotic Institute of America (1979), a robot is “. . . “a reprogrammable, multifunctional manipulator designed to move materials, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks.” This is far from the intended use envisioned by Capek, but applies to the da Vinci Surgical System.™ As Alquist in *R.U.R.* concludes: “. . . if there are no more human beings left, at least let there be Robots!”

INTRODUCTION

ONE CANNOT UNDERSTAND the technologic history behind the development of modern robotic systems without bringing up Karel Capek.¹ Capek, a Czechoslovakian, was profoundly influenced by the Bolshevik Revolution of 1917.² His play, written in 1920, first performed in 1921 (Fig. 1), and presented in New York in 1922, symbolizes much of Western society's feelings about robots. In addition, the current foundation of the modern use of the word robot is at odds with Capek's intention. How did the word become morphed philo-

logically? The emphasis here is to eliminate misconceptions regarding the definitions of “robots” and correctly present the true legacy of Karel Capek along with that of his brother, Joseph.³

Capek first used this word to represent a new biologically engineered worker, much like in ant colonies in his play, *R.U.R.* (*Rossum's Universal Robots*). This term, “**robota**,” and its origins are often misrepresented in modern medical literature, but the Czech meaning implies forced laborer or serf. Robots were originally meant to mean a species of biologic servants, more like Mary Shelley's *Frankenstein*. Yet, even Shelley's monster has lost its original connotation (in the original, the monster is

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ČESKÉ ZEMSKÉ DIVADLO V PRAZE
NÁRODNÍ DIVADLO

V úterý 23. ledna 1921. Mimo předplacení.

Poprvé.

R. U. R.

(Rossum's Universal Robots.)

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

Harry Domin, centrální ředitel	Něna, její chůva	Marie Hubošová
R. U. R.	Marius, Robot	Eugen Vavšer
Isk. Fakty, generální technický	Sally, Robotka	Anna Červená
Ředitel R. U. R.	Damon Roboti	Eduard Tesal
Dr. Gall, přednosta fyziologického a výzkumného oddělení R. U. R.	Čerchý Robot	Karel N'ár
Dr. Matějovský, předosta ústavu pro psychologii a výchovu Robotů	Tied	Emil Focht
Konrad Buman, generální manažer	Páry	Hynek Lalanský
Čin ředitel R. U. R.	Robot Primus	Václav Zetronda
Slavimí Alquist, šéf stavby R. U. R.	Robotka Helena	Eduard Kubica
Helena Gřibová	Robotský sluha	Eva Vrblička
		Václav Zintl

Děje se v budoucnu. První akt deset let po vstupní komedii.

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

Chcívati: Jaroslav Hott, Vojta Novák.

Ve středu 26. ledna 1921.

<p style="text-align: center;">Odpoledne o 2^h. hod.:</p> <p style="text-align: center; font-size: 1.5em;">Š Á R K A</p> <p style="font-size: x-small;">Čtvrtek 22. I. o 2. hod. R. U. R. Pátek 23. I. o 2. hod. Fakstall. (Zvolí ceny) Sobota 24. I. o 2^h. h. Lakomí. o 7. hod. R. U. R.</p>	<p style="text-align: center;">Večer o 7. hod. mimo předplacení. Pro Gulčel itale otičnicou.</p> <p style="text-align: center; font-size: 1.5em;">KOUZELNÁ FLÉTNÁ</p> <p style="font-size: x-small;">Neděle 30. I. o 2^h. h. Eugen Onšig. o 7. hod. Její pastorkyňa.</p>
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Předprodej vstupenek jest zařízen takto: V pondělí prodávají se vstupenky na všechna představení od čtvrtka do neděle a ve čtvrtek na představení pondělní až úřední příštího týdne.

Prodej vstupenek mimo divadlo: Párodní vstupenky M. Truhlářova, "Koruna" (vstřední 1402) a "Na kávu" (vlevo 402). Věčerní vstupenky M. Truhlářova, "Koruna" (vstřední 4002) na Novácké ul.

FIG. 1. The original "play bill" for R.U.R. in Prague, 1921.

very intelligent) of an enlightened dream gone awry. So it is fitting that the term robot is not what Capek had initially envisioned. This leads to the necessity to understand his original intent if we are to be accurate. Finally, perhaps the more "humanoid" we make our robots, the more correct our original use of this word will become.

THE PLAY

The play is *R.U.R. (Rossum's Universal Robots)*, and its tale is worth retelling.⁴ Helena is a young, beautiful girl who comes to visit an island factory of Rossum's Universal Robots. Domin, the manager of the factory, falls in love with her and tells her the true method by which the robots are manufactured. Rossum was a "great physiologist" who chemically synthesized living matter, called protoplasm. Rossum set out to imitate nature, and he first constructed an artificial dog and then a man. Domin chides the "old man's" dreams, calling his first tries "bungling attempts" that take him 10 years. His first "man" survived for 3 days.

Then, "up came young Rossum [his son], an engineer. When he saw what a mess the old man was making, he said, 'It's absurd to spend ten years making a man. If you can't make him quicker than nature, you might as well shut up shop.'" Young Rossum is an engineer, not a physiologist. He continues: "A man is something that feels happy, plays the piano, likes going for a walk . . . But a working machine must not play the piano, must not feel happy . . . to manufacture artificial workers is the same thing as to manufacture motors." Domin confides to Helena that "Mechanically they are more perfect than we are, they have an enormously developed intelligence, but they have no soul. In fact, we are told that the cost of producing a robot has been brought down within 15 years from \$10,000 to \$150."

But these are not machines; they are biochemically synthesized in vats and constructed. The robots live for about 20 years and work themselves until they are "used up."

Helena takes pity on the robots and convinces one of the factory's human workers, Dr. Gall, to begin making modifications in the robots. Adding a sense of pain will allow the workers to remove their hands from danger; emotions lead to irritability, and soon they begin to show defiance. Secondary to the modifications induced by Helena and Dr. Gall, the robots begin to grow more intolerant of their human "masters." In the end, the robot leader states, "You are not as strong as the Robots. You are not as skillful as the Robots. I want to be master. I want to be master over others." He commands his fellow robots to kill all of mankind.

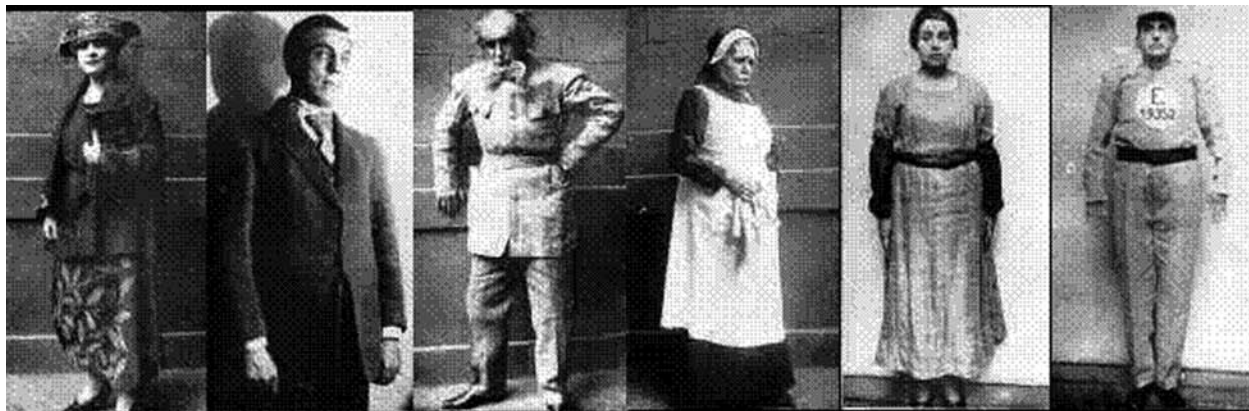


FIG. 2. The original robots (actors) from the Prague cast.



FIG. 3. Pen and ink drawing by Josefa Capka regarding his brother's robot. This is a caricature of the author.

The robots take over the island and kill all the human inhabitants except one, Alquist, who is the robot repairman. Unfortunately for the robots, during the rampage that kills all of humanity, they also have lost Rossum's secret for animation. They try with the aid of Alquist to rediscover the formula but cannot succeed. Alquist in desperation at the end of the play, prays, "Lord . . . if there are no more human beings left, at least let there be Robots! – At least the shadow of man!" But there is a hopeful ending; two of the robots have fallen in love with each other and are prepared to die for the sake of both species.³

Rossum's Universal Robots became extremely popular (Fig. 2) after it opened in Prague in 1921.⁵ The play was produced throughout Europe, in London and New York City. Throughout its early history, the biologic focus remained with a clear underlying theme, almost Faustian. Man's hubris in usurping God's role in nature, Rossum's son and engineer states: . . . "the product of an engineer is technically at a higher pitch of perfection than a product of Nature . . . God hasn't the slightest notion of modern engineering."³

Karel's brother Joseph catches the spirit of the biologic focus of "robots" in a pen and ink caricature that dates from the inception of the play (Fig. 3).⁴ The humanoid robots are clearly like us, flesh and blood. There are no metal men; there was no intention by Rossum to mechanize human function other than to ease the toil of mankind. Where did the morphing into our mechanical automata occur? The legacy of the mechanized android certainly existed for many decades before Capek's play. By the early 17th century, Diderot, of encyclopedia fame, alluded to de Vaucanson's flutist as an android.⁶ The term widely used by machines recapitulating human endeavor would most correctly be automata or automaton.

CONCLUSIONS

Karel Capek (pronounced CHOP-ek) was Czechoslovakia's leading novelist, playwright, and columnist.⁷ He died in 1938, and his obituary in *Newsweek* (January 2, 1939) said of *R.U.R.* . . . "although it was the least interesting of all his works, it brought him greatest fame." In addition, he later recounted how his brother Joseph gave him the inspiration for the name of his biologic creations. He thought to call them originally Labori, but his brother countered with the term Robots. The popularity of this singular play resulted in the common use of the term for mechanical beings. This transcendence occurred in Karel Capek's own lifetime, much to his dismay. "I recoil in horror from any idea that metal contraptions could ever replace human beings and awaken something like life, love, and rebellion. Such a grim outlook is nothing but an oversimplification of the power of machines and a grave insult to life," he stated in a 1935 interview.

Concluding by reiterating the fascination with current robotic surgical systems, are these complex, computer-controlled, master-slave surgical systems robots? Certainly not according to Capek. But as clearly presented, his intentions were superceded by the unexpected popularity of his play, and by rapid usurpation of his word by many, especially young science fiction authors. But his original intent may yet find application with the advent of biomimetic robots.⁸ These devices are actively being pursued at research institutions and combine more biologic-like actuators with the control systems of computers.⁹ Actual muscle-like power devices can result in movement of the robot.

So our da Vinci Surgical Systems™ (Intuitive Surgical, Sunnyvale, CA) are as much entitled to the term robot as is Robosapien™ (WowWee Ltd., Hong Kong). The more important lesson from the tale of Rossum's robots is that our technologic hubris should carefully be integrated with considerable foresight. The evolution of surgery will then not be subject to the same fate as our fictional colleagues of Capek's play.

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