No Limit to Lifespan if We're Machines Biologists apply engineering theory to aging and conclude that there's no cap to longevity

By Liz Brown Betterhumans Staff 8/26/2004 4:09 PM

There is no limit to how long humans can live—if we're anything like machines.

At least, that's what two biologists from the <u>University of Chicago</u> in Illinois theorize. <u>Leonid Gavrilov</u> and <u>Natalia Gavrilova</u> are known for applying <u>reliability theory</u> to aging, which they first proposed in two scientific articles in 1978.

Writing in an engineering publication, the researchers note how a consequence of their theory is that there's no fixed upper limit to human longevity

System failure

Reliability theory was developed in the late 1950s to describe the failure and aging of complex electronic equipment. It allows researchers to predict how a system will fail over time given a specified architecture and the level of reliability of its parts.

Credit: David Dolak
Number's up: Originally developed
in the 1950s for electronic
equipment, reliability theory makes
interesting predictions when applied
to human aging

The theory defines aging simply as increased risk of failure: Something ages only when it's more likely to fall apart tomorrow rather than today. If the risk of failure doesn't increase as time passes, then there is no aging.

Gavrilov and Gavrilova believe that the theory can also be applied to aging in humans because the way we age and die is quite similar to machines, an observation they expounded on in a 1991 book called <u>The</u> <u>Biology of Life Span: A Quantitative Approach</u>.

"The difference is minimized if we think of ourselves in this unflattering way: we are like machines made up of redundant components, many of which are defective right from the start," the biologists write.

Striking similarities

By looking at human aging data, the researchers find striking similarities between humans and machines. In both cases, the failure rate follows a curve shaped like a bathtub. The curve consists of three stages: Infant mortality, normal working and aging.

Mortality rates plateau during the normal-working period, which is from age five to between ages 15 and 20. Gavrilov and Gavrilova speculate that if we could maintain our bodies in the same form that they are during this time we could live an average of 5,000 years.

Even at very old ages, machines and humans share aging characteristics. For example, the risk of death for humans stops increasing exponentially for those who reach age 100. "If you live to be 110, your chances of seeing your next birthday are not very good, but, paradoxically, they are not much worse than they were when you were 102," the researchers write.

Because of this, the researchers conclude there is no fixed upper limit to human longevity—a conclusion that shatters the notion that there is a fixed maximum human lifespan.

To get their theory to work, the researchers assume that humans are born with a bunch of defective parts and do not start life in pristine condition.

"If we accept the idea that we are born with a large amount of damage, it follows that even small improvements to the processes of early human development—ones that increase the numbers of initially functional elements—could result in a remarkable fall in mortality and a significant extension of human life," write Gavrilov and Gavrilova.

The researchers' latest article is published in <u>IEEE Spectrum</u>, a publication of the <u>Institute of Electrical and Electronics Engineers</u>.

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