

# On the Evolution of Complexity

[Author & abstract](#)[Download](#)[Related works & more](#)[Corrections](#)

## Author

Listed:

- W. Brian Arthur

[Registered:](#)

## Abstract

It is often taken for granted that as systems evolve over time they tend to become more complex. But little is understood about the mechanisms that might cause evolution to favor increases in complexity over time. This paper proposes three means by which complexity tends to grow as systems evolve. In co-evolutionary systems it may grow by increases in "species" diversity: under certain circumstances new species may provide further niches that call forth further new species in a steady upward spiral. In single systems it may grow by increases in structural sophistication: the system steadily cumulates increasing numbers of subsystems or sub-functions or sub-parts to break through performance limitations, or enhance its range of operation, or handle exceptional circumstances. Or, it may suddenly increase by "capturing software": the system captures simpler elements and learns to "program" these as "software" to be used to its own ends. Growth in complexity in all three mechanisms is intermittent and epochal. And in the first two is reversible, so that collapses in complexity may occur randomly from time to time. Illustrative examples are drawn from biology, but from economics, adaptive computation, artificial life, and evolutionary game theory.

# Suggested Citation

W. Brian Arthur, 1993. "[On the Evolution of Complexity](#)," [Working Papers](#) 93-11-070, Santa Fe Institute.

Handle: *RePEc:wop:safiwp:93-11-070*

Download reference

as



## More services and features

---

### [MyIDEAS](#)

[Follow serials, authors, keywords & more](#)

### [New papers by email](#)

[Subscribe to new additions to RePEc](#)

### [Author registration](#)

[Public profiles for Economics researchers](#)

### [Rankings](#)

[Various rankings of research in Economics & related fields](#)

### [RePEc Genealogy](#)

[Who was a student of whom, using RePEc](#)

### [MPRA](#)

[Upload your paper to be listed on RePEc and IDEAS](#)

### [EconAcademics](#)

[Blog aggregator for economics research](#)

### [Plagiarism](#)

[Cases of plagiarism in Economics](#)

### [Job market papers](#)

[RePEc working paper series dedicated to the job market](#)

### [Fantasy league](#)

[Pretend you are at the helm of an economics department](#)

## RePEc Biblio

Curated articles & papers on  
various economics topics

## Services from the StL Fed

Data, research, apps & more  
from the St. Louis Fed

IDEAS is a [RePEc](#) service hosted by the [Research Division](#) of the [Federal Reserve Bank of St. Louis](#). RePEc uses bibliographic data supplied by the respective publishers.