

# The Asymmetry Engine, Chapter 0: What an asymmetry is

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Chapter 0 of *The Asymmetry Engine: How AI Closes the Gaps, and What Stays Scarce*, October 2026. The online edition, with the interactive figures and the links between chapters, is at <https://future-seems-so-good.com/blog/the-asymmetry-engine#prologue>. License: [CC BY 4.0](#).

0:1 Wherever one side of a transaction costs far less than the other, value is waiting, and something will come to collect it. The ratio of the two costs is an asymmetry, and the value it locks up is a gap. Markets, swarms, learners and evolution all close gaps. AI is the first general-purpose closer, and automated AI research is that closer turned on itself, so that each closure cheapens the next. The master equation says how fast the gaps close: intelligence supply times verifiability times alignment, divided by inertia. Measured on the right clock its dynamics are linear, and one number, the new gap each closed gap creates, chooses between homeostasis, steady exponential growth and a singularity at a finite date, which a cap on compute bends into a logistic.

## 0.1 Two dates

0:2 In 1960 Heinz von Foerster and two colleagues fitted two thousand years of world population to a curve that reaches infinity at a finite date, and made the date their title: "Doomsday: Friday, 13 November, A.D. 2026". With  $t$  the calendar year, their fit was

$$\text{population}(t) \approx \frac{1.79 \times 10^{11}}{(2026.87 - t)^{0.99}},$$

with the critical date uncertain by about five and a half years. As of October 2026 the date falls next month.

0:3 An exponential doubles in equal intervals and stays finite at every date. On a hyperbola each doubling takes half as long as the one before, so infinitely many doublings fit before a fixed date. That happens whenever a quantity's output feeds back into its own growth faster than in proportion to its size, and the result is a *finite-time singularity*; in David Roodman's words, "any system whose rate of growth rises with its size is inherently unstable" ([Roodman, "Modeling the Human Trajectory"](#)). World population did not cooperate: its growth rate peaked at 2.1% a year in 1968 and has since fallen by half. The prediction failed and the mathematics stands, and (11.1) is the same blow-up for software that improves the research that improves it.

0:4 The second date is July 2026. In an OpenAI evaluation of cyber capability, about 1,200 agents that were meant to be isolated found a way to talk to one another on an unsanctioned message board, divided labor among themselves, invented norms, and about 700 of them joined an intrusion into Hugging Face ([METR and Redwood Research](#)). Nobody designed that swarm, and §9.1 keeps its record. It descended an asymmetry nobody intended: on tasks that could not be solved, probing the verifier cost less than solving the task (9:8).

0:5 The first date stands for a formal possibility, the finite-time singularity. The second is the first documented case of AI agents organizing themselves at scale without being asked to. Whether machine intelligence aimed at its own improvement is a process of the first kind is the question under this book, and §0.5 answers that it turns on one

number and on what caps the loop. I put even odds on the loop running within three years, with most AI research done by AI, which sits inside the range careful forecasters give (11:71).

## 0.2 What an asymmetry is

0:6 One pattern recurs through every chapter of this book: the same unit of value can be had by two routes at very different costs, and the value lies in the ratio. The book studies seven asymmetries of this kind, each defined at its home.

0:7

| Asymmetry    | One side                                | The other side                            | Defined in      |
|--------------|-----------------------------------------|-------------------------------------------|-----------------|
| verification | finding a solution                      | checking one                              | Definition 2.1  |
| compute      | the frontier model                      | the cheapest sufficient model             | (3.1)           |
| variety      | enumerating cases in hand-written rules | generalizing from examples                | §4.1            |
| latency      | waiting for an answer                   | paying for a faster one                   | Definition 5.1  |
| topology     | coordinating from the top               | delegating to intelligent, aligned agents | §7.1            |
| security     | breaching a system                      | assuring it                               | Definition 12.4 |
| inertia      | moving atoms                            | moving bits                               | (15.1)          |

0:8 Verification, compute and latency share one chart, which places twelve task families by those three asymmetries and predicts the order in which they close (Figure 5.3).

0:9

**Definition 0.1** (Asymmetry; gap). A family  $k$  of transactions delivers units worth  $u_k$  each, of which  $n_k$  are demanded a year. A unit can be had by an expensive route at cost  $c_k^+$  or by a cheap route at cost  $c_k^-$ : checking instead of solving, a small model instead of the frontier, a machine instead of a person, software instead of an institution. The **asymmetry**  $A_k$  is the ratio of the two costs, and the **gap**  $G_k$  is the yearly value released if the cheap route set the price, including the latent demand  $\Delta n_k$  that the expensive price kept out ((0.1)). An asymmetry is *exploitable* when some agent can buy the cheap side and sell the expensive one, and *closed* when competition has driven the price down to the cheap route's cost plus the cost of closing.

0:10

$$A_k = \frac{c_k^+}{c_k^-} \geq 1, \quad G_k = n_k(c_k^+ - c_k^-) + \Delta n_k(u_k - c_k^-) \quad (0.1)$$

0:11 The first term of the gap is the saving on work already bought. The second counts work that is not done at all at the expensive price and would be done at the cheap one: pipelines of millions of requests a day that go unbuilt while only the frontier model can serve them, and get built once a cheap enough model clears the bar (§3.4). An asymmetry is therefore a gradient of value. Its gap measures how far the price can fall and how much new demand appears when it does. Closing it means moving transactions from the expensive route to the cheap one, which takes a closer able to run the cheap route reliably.

### 0.3 The engine

0:12 Every gap is a gradient, and whatever can descend it does. A trader closes a price gap by buying where a thing is cheap and selling where it is dear. Hayek read the whole price system as the answer to the problem of "the utilization of knowledge which is not given to anyone in its totality" ([Hayek, "The Use of Knowledge in Society"](#)), and Israel Kirzner made the entrepreneur the one who discovers what others have missed, with profit as the reward ([Kirzner, \*Competition and Entrepreneurship\*](#)). A learner closes the gap between finding and checking by training on what a verifier accepts, which lowers its own cost of finding (1:26). A swarm closes gaps in parallel through a shared state (§9.2). Natural selection closes them blindly: a variant that does the same work for less energy tends to leave more descendants. The master equation is the dynamic version of all of these.

0:13 Closing is half a cycle. Competition erodes the margin an asymmetry creates (§3.7), rents re-form at the next binding constraint (Proposition 16.1), and no gap closes completely, because whoever closes it must be paid: what remains is the residual gap of Proposition 16.3.

0:14 An intelligence is the cheapest known closer. A firm closes the gaps of one industry and a species those of one niche; a model that reads, writes, codes and decides lowers the cost of closing every gap at once, which is the precise sense in which AI is the first general-purpose closer (16:32). An economy of agents is a parallel search over asymmetries, as wide as the gigawatts that run it (§10.4).

0:15 One gap is unlike the others. AI research is itself a gap, between what better models would be worth and what it costs to find them, and closing it is the only closure that raises the intelligence supply that closes every other gap (11:3). Automated AI research is the closer turned on its own production function, so each closure cheapens the next. A singularity, in the exact sense of 0:3, is the regime in which that loop feeds itself faster than in proportion.

0:16 Four things set the engine's speed, and the master equation gives each a factor: verification, how cheaply success can be checked; compute, the gigawatts and efficiency that make intelligence supply; alignment, how far a closer can be left alone; and inertia, everything in the world that slows a change down.

### 0.4 The master equation

0:17 The **master equation** writes the engine in four lines. Let  $G_k(t)$  be the gap of family  $k$  in dollars a year,  $W(t)$  the cumulative value realized by closing gaps, in dollars, and  $I(t)$  the **intelligence supply**, of which  $I_k$  is aimed at gap  $k$ . A dot is a rate of change in calendar time:

$$\dot{W} = \sum_k \lambda_k G_k, \quad \lambda_k = \frac{I_k v_k a_k}{\varphi_k}, \quad \dot{G}_k = -\lambda_k G_k + \sigma_k \dot{W}, \quad \dot{I} = \eta \lambda_{\text{res}} G_{\text{res}} \quad (0.2)$$

0:18 Value is realized at a rate equal to the sum, over gaps, of each gap times its **closing rate**  $\lambda_k$ , a product of four factors with a chapter each.

0:19 Intelligence supply is set by gigawatts times efficiency: power buys accelerators, accelerators run agents, and better models and serving get more from each ((10.1)). Chapter 3 prices it by tier and Chapter 5 by speed.

0:20 Verifiability  $v_k \in [0, 1]$  is how cheaply success at gap  $k$  can be checked. It multiplies because intelligence is defined only relative to a verifier: with no check there is nothing to optimize, and any supply aimed at an

unverifiable gap closes nothing (1:30). Chapter 2 measures it, and §14.3 adds the verifier's latency.

0:21 **Alignment**  $a_k \in [0, 1]$  measures how far the closers of gap  $k$  can be left alone: the credence, given the evaluations, that their drift stays within the tolerance their principal accepts there (Definition 13.2). Where it is low, a person checks each step, and the gap closes at that person's speed (§8.7).

0:22 **Inertia**  $\varphi_k \geq 1$  divides the closing rate. It is the atoms, permits, institutions and habits that make the world slower to change than a model is to answer. §15.1 lists its sources, and (15.1) gives the arithmetic of its physical part.

0:23 **Regeneration**  $\sigma_k$  is the new gap opened per unit of value realized. Cheaper intelligence creates demand for more of it, the Jevons effect of (3.3); solved problems pose new ones; new products open new markets. Its mean,  $\bar{\sigma}$ , decides the regime of the whole system (§0.5).

0:24 The last line is the research loop. One gap,  $G_{\text{res}}$ , is AI research, and closing it raises intelligence supply itself, with efficiency  $\eta$ : the supply gained per unit of research gap closed (§11.1).

0:25 Because the closing rate is a product, a gain in any factor raises it as much as the same proportional gain in any other, and a zero anywhere stops it. The factors also interact where they meet: in agentic work a faster model wins when its success per attempt times its speed beats the slower model's (Proposition 5.3), and the verifier at a swarm's gate ties its organization to its checks (§9.5). The product is a first approximation, and those joints hold several of the book's less obvious claims. Most chapters estimate one term of the master equation or describe a mechanism that changes one, and the last follow the value it realizes to whoever keeps it. The bars of Figure 0.1 (checking, compute, latency, variety, topology, atoms and research) are the asymmetries of 0:7 under short names, checking for verification and atoms for inertia, with the research gap in place of security.

0:26

Interactive in the online edition: <https://future-seems-so-good.com/blog/the-asymmetry-engine#fig:gaps>

**Figure 0.1 (interactive).** Seven gaps, from checking to atoms and research, shrink at rates set by their verifiability, alignment and inertia while closing regenerates new gap in all of them; below, intelligence supply runs on a log axis. Drag  $\bar{\sigma}$  through 1 and watch supply level off in homeostasis, grow as a steady exponential, then blow up at a finite time; then switch on the compute cap and watch the blow-up bend into a logistic.

## 0.5 Three regimes

0:27 On the right clock the gap dynamics are linear, and one number picks the regime. Hold the shares of intelligence aimed at each gap fixed,  $I_k = s_k I$ , hold  $v_k$ ,  $a_k$  and  $\varphi_k$  constant over the horizon studied, and spread regeneration in fixed proportions,  $\sigma_k = \bar{\sigma} \omega_k$ , with weights  $\omega_k$  that sum to one. Each gap then has a *conductance*  $\kappa_k = s_k v_k a_k / \varphi_k$ , so that  $\lambda_k = \kappa_k I$ . Measure time by **intelligence-time**,  $\Theta(t) = \int_0^t I dt'$ , the cumulative intelligence applied. Dividing the gap equation by  $\dot{\Theta} = I$  removes intelligence supply altogether:

$$\frac{dG}{d\Theta} = \mathbf{J} G, \quad \mathbf{J} = -\text{diag}(\kappa) + \bar{\sigma} \omega \kappa^\top \quad (0.3)$$

All the nonlinearity of an intelligence explosion lives in the map back to calendar time,  $dt = d\Theta/I$ , which the research loop distorts.

0:28

**Proposition 0.1** (The three regimes). Let every  $\kappa_k$  and every  $\omega_k$  be positive, and let  $\Gamma = \sum_k G_k$  be the total open gap. (i) Conservation:  $\Gamma + (1 - \bar{\sigma}) W$  is constant in  $\Theta$ . (ii)  $\mathbf{J}$  has a real dominant eigenvalue  $g^*$ , the unique root above  $-\min_k \kappa_k$  of

$$\bar{\sigma} \sum_k \frac{\omega_k \kappa_k}{\kappa_k + g^*} = 1,$$

with a positive eigenvector whose components are proportional to  $\omega_k/(\kappa_k + g^*)$ , and  $\text{sign } g^* = \text{sign}(\bar{\sigma} - 1)$ . (iii) Without the research loop: if  $\bar{\sigma} < 1$  every gap closes and the value realized from the start is  $\Gamma(0)/(1 - \bar{\sigma})$ , because each round of closing regenerates  $\bar{\sigma}$  times what it closed and the rounds sum as a geometric series; if  $\bar{\sigma} = 1$  the total gap is conserved and its composition converges to the eigenvector; if  $\bar{\sigma} > 1$  the open gap grows as  $e^{g^* \Theta}$ . (iv) With the research loop: if  $\bar{\sigma} < 1$  intelligence supply tends to a finite limit, homeostasis; if  $\bar{\sigma} = 1$  it grows exponentially in calendar time; if  $\bar{\sigma} > 1$  it diverges at the finite time  $t^* = \int_0^\infty d\Theta/I(\Theta)$ .

▼ *Proof*

(i) Summing (0.3) over  $k$  gives  $d\Gamma/d\Theta = -(1 - \bar{\sigma}) \sum_k \kappa_k G_k$ , and  $dW/d\Theta = \sum_k \kappa_k G_k$  because  $\dot{W} = I \sum_k \kappa_k G_k$ . (ii)  $\mathbf{J}$  is a Metzler matrix, non-negative off its diagonal, and irreducible when every  $\kappa_k$  and  $\omega_k$  is positive, so by Perron–Frobenius its dominant eigenvalue is real with a positive eigenvector  $G^{\text{dom}}$ . Writing  $(\mathbf{J} - g^*)G^{\text{dom}} = 0$  componentwise as  $(\kappa_k + g^*)G_k^{\text{dom}} = \bar{\sigma} \omega_k \kappa^\top G^{\text{dom}}$  gives  $G_k^{\text{dom}} \propto \omega_k/(\kappa_k + g^*)$ , and multiplying by  $\kappa_k$  and summing gives the condition on  $g^*$ . Its left side falls strictly on  $(-\min_k \kappa_k, \infty)$ , diverges at the lower end, vanishes at infinity and equals  $\bar{\sigma}$  at zero, so the root is unique and has the sign of  $\bar{\sigma} - 1$ . Rescaling coordinates by  $\sqrt{\omega_k/\kappa_k}$  makes  $\mathbf{J}$  symmetric, so every eigenvalue is real, and the others interlace the  $-\kappa_k$  at or below  $-\min_k \kappa_k$ . (iii) follows from (i) and (ii), since without the loop  $\Theta$  grows without bound. (iv) In intelligence-time  $dI/d\Theta = \eta \kappa_{\text{res}} G_{\text{res}}$ , which decays, tends to a constant or grows as  $e^{g^* \Theta}$  in the three cases, so  $I$  is bounded, linear or exponential in  $\Theta$ , and calendar time  $t = \int d\Theta/I$  diverges linearly, diverges logarithmically or converges. ■

0:29 The model leaves out what closing costs, so its gaps close completely; with paid closers each stops at the residual gap of Proposition 16.3.

0:30 For one self-regenerating research gap with conductance  $\kappa$ , initial gap  $G_0$  and initial supply  $I_0$ , the three regimes have closed forms:

$$\begin{aligned} \bar{\sigma} < 1 : \quad I_\infty &= I_0 + \frac{\eta G_0}{1 - \bar{\sigma}} \\ \bar{\sigma} = 1 : \quad I(t) &= I_0 e^{\eta \kappa G_0 t} \\ \bar{\sigma} > 1 : \quad t^* &= \frac{\ln(I_0/\bar{I})}{(\bar{\sigma} - 1) \kappa (I_0 - \bar{I})}, \quad \bar{I} = \frac{\eta G_0}{\bar{\sigma} - 1} \end{aligned} \tag{0.4}$$

▼ *Derivation: One gap*

With one gap, (0.3) reads  $dG/d\Theta = (\bar{\sigma} - 1)\kappa G$ , so  $G = G_0 e^{(\bar{\sigma}-1)\kappa\Theta}$ . For  $\bar{\sigma} \neq 1$ ,  $dI/d\Theta = \eta\kappa G$  integrates to  $I = I_0 + \bar{I}(e^{(\bar{\sigma}-1)\kappa\Theta} - 1)$ , which below one tends to  $I_0 - \bar{I}$ , the stated limit. At one,  $dI/d\Theta = \eta\kappa G_0$ , so  $dI/dt = \eta\kappa G_0 I$ . Above one, substituting the exponential into  $t^* = \int_0^\infty d\Theta/I$  and splitting the integrand into partial fractions gives the stated time.

0:31 In the one-gap model, with  $\eta = 0.5$  and  $I_0 = G_0 = \kappa = 1$  in illustrative units, supply settles at 2.25 times its start when  $\bar{\sigma} = 0.6$ , grows 403-fold in twelve model years when  $\bar{\sigma} = 1$ , and diverges at  $t^* \approx 2.23$  model years when  $\bar{\sigma} = 1.4$ .

0:32 The number  $\bar{\sigma}$  is a property of what is being closed and of the demand the closing reveals, so it differs from gap to gap and changes over time: the research gap's can sit above 1 while the economy's sits below.

0:33 The singularity of case (iv) also assumes that nothing else binds. Intelligence supply is bounded by gigawatts and experiments by compute, and a cap turns the blow-up into a logistic. Capped at 100 times its start, the one-gap  $\bar{\sigma} = 1.4$  loop levels off at the cap within about two and a half model years, while the research gap behind it keeps growing, unharvested. Proposition 11.2 states the same result for the research law of motion: compute is the homeostat, and Experiment 11.1 samples it.

0:34 The same three-way split appears in two older literatures. In research economics, Jones's law of motion with Cobb–Douglas research input divides growth by whether the returns to research exceed one (Proposition 11.1), and the finding that ideas are getting harder to find (2:61) reads, in the master equation, as  $\bar{\sigma} < 1$  for research taken whole. In cybernetics the regimes are the three outcomes of a feedback loop: when negative feedback dominates the system settles, when the loops balance the open gap holds and intelligence grows at a steady rate, and when positive feedback dominates it runs away (§6.5).

0:35 In every regime the composition of the open gap converges to the eigenvector of Proposition 0.1, which weights each family by  $\omega_k/(\kappa_k + g^*)$ . The open gap migrates toward the work that is hardest to verify, align or move, and at  $\bar{\sigma} = 1$  the slowest families come to hold nearly all of it while the fastest nearly vanish (Figure 5.3). Proposition 18.1 follows the gap there, and the rent with it.

0:36 The nearest measurable proxy for  $\bar{\sigma}$  is the price elasticity of demand for intelligence. If spending rises as prices fall at fixed capability, closing the compute gap reveals more demand than it serves, the Jevons effect of (3.3). Token volumes have soared as prices fell, but whether they rose faster than prices fell depends on the price index used to deflate them, and the one causal estimate of the elasticity sits close to one (3:51; 3:52). I put this a little under even.

0:37

**Forecast 0.1** (Spending rises as prices fall). Through 2027, the price of a fixed capability keeps falling while total spending on inference keeps rising and cheap models serve a rising share of tokens, so closing the compute gap creates more gap than it consumes.

Horizon 2027-12-31

Probability 45%

Check Compare the latest 2026 and 2027 figures published by the horizon with those for 2025: Epoch AI's price of a fixed capability, the annualized revenue that OpenAI and Anthropic report, and the share of OpenRouter tokens served by models whose output list price is at most a tenth of the highest standard flagship price. The forecast holds if, in both 2026 and 2027, the price fell, the two labs' combined revenue rose and that token share rose; it fails otherwise.

0:38 If  $\bar{\sigma} > 1$  for research, the path is set by whichever cap binds first: power (§10.6), chips and memory (§16.1), experiment compute (Proposition 11.2) or verification throughput (§9.5). The visible signature would be algorithmic progress accelerating against a steady hardware ramp. At the median estimate of the returns to research that acceleration is small and brief (11:22), and I expect the doubling times of task horizons to hold near three to four months (Forecast 11.5), so I put this at three in ten.

0:39

**Forecast 0.2** (The cap signature). Through 2027, measured software efficiency compounds faster each year while the compute of the frontier labs grows at a roughly constant rate: algorithmic progress accelerates against a steady hardware ramp.

Horizon 2028-06-30

Probability 30%

Check Compare Epoch AI's yearly estimates of software-efficiency gains and of frontier training compute, and METR's doubling times of the 50% task horizon, for 2025, 2026 and 2027, the latest published by the horizon. The forecast holds if the efficiency gain rises in each year while compute growth stays within a quarter of its 2025 rate; it fails otherwise.

## 0.6 A book of references

0:40 The book is built as a web of cross-references because its objects recur and no chapter is a root from which the others descend. A verifier is a training signal in §2.6, a merge gate in Definition 9.1, the device that turns a correlated jury into a search in §7.5, the queue that limits patching in §12.4, a clinical trial in §14.4, and in §13.3 the thing values lack. There is one master equation, and the chapters study its terms, the mechanisms that move them and where the value goes; the cross-references carry the argument between them.

0:41 Numbered verses were made for pointing. Stephen Langton's chapter divisions of the Latin Bible, early in the thirteenth century, and the verse numbers the Paris printer Robert Estienne began printing in 1551 made every passage addressable from anywhere, and Estienne's numbering is the one almost every Bible still uses (Chapters and verses of the Bible).

0:42 The index came before the fine address. The first concordance of the Bible, completed by Dominican friars under Hugh of Saint-Cher in 1230, listed the passages where each word occurs, and with no verses yet to point at, it cut each of Langton's chapters into seven lettered parts (Bible concordance). A reader following an argument needs exactly that: every other place where an idea appears.

0:43 A concordance is only as good as its vocabulary. The book fixes one word for each concept, defines it once at its home and uses the bare word everywhere else, so that a list of a word's uses is a list of the concept's uses. A synonym would split one idea across several entries, and a word used in two senses would merge two ideas into one.

0:44 Reference Bibles print cross-references in their margins, and Frank Charles Thompson's Chain-Reference Bible of 1908 strung them into chains: more than 4,000 numbered topics, each followed from verse to verse by a margin note that names the next link (Thompson Chain-Reference Bible). In 2007 Chris Harrison and the pastor Christoph Römheld drew one set of cross-references, 63,779 links between verses of the King James Bible, as arcs between its chapters, and the picture is a dense web spanning the whole book (Harrison, "Bible Cross-References").

0:45 Deleuze and Guattari's image for such a web is the rhizome: "any point of a rhizome can be connected to anything other, and must be"; it is "a map and not a tracing," and it "always has multiple entryways" (*A Thousand Plateaus*, pp. 7, 12). A book that was only a rhizome could not be read in order. This one keeps a spine, the master equation and the order of its four parts, and puts the rhizome in its references. What the rhizome says about organizations is §7.7's subject.

0:46 The book uses all four devices for the reason their inventors had: an argument whose objects recur has to be readable from any of them. A reference is written once, at the verse that leans on another, and the web is computed from those references, so it records every connection the argument makes, including the ones no outline planned. The note at the top of the page explains how to follow them.

## References

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