AUSTRIAN INSTITUTE OF TECHNOLOGY

From Hype to Hermeneutics

An introduction to Future Studies and Foresight

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Institute of Philosophy, CAS 2026



Wenzel Mehnert

- Background:
  - Cultural & Media Studies, STS, Philosophy of Technology
- Dual affiliation:
  - Austrian Institue of Technology (AIT)
    - Coordinating Research Field „Societal Futures
  - Technical University in Berlin (TU Berlin)
    - Co-Funded „Berlin Ethics Lab“
  - Alumni University of the Arts, Berlin (UdK Berlin)
- Imaginary Research
  - Particularly imaginaries of future technologies (e.g. Neurotech)

Agenda

- **Futures and Technofutures**
  - A conceptual introduction
- **How to study Futures?**
  - Forecast – Calculating Futures
  - Foresight – Widening Futures
  - Hermeneutics – Reflecting Futures
- **Conclusion & Take Aways**

Prologue

„Memory is our imagination of the past…

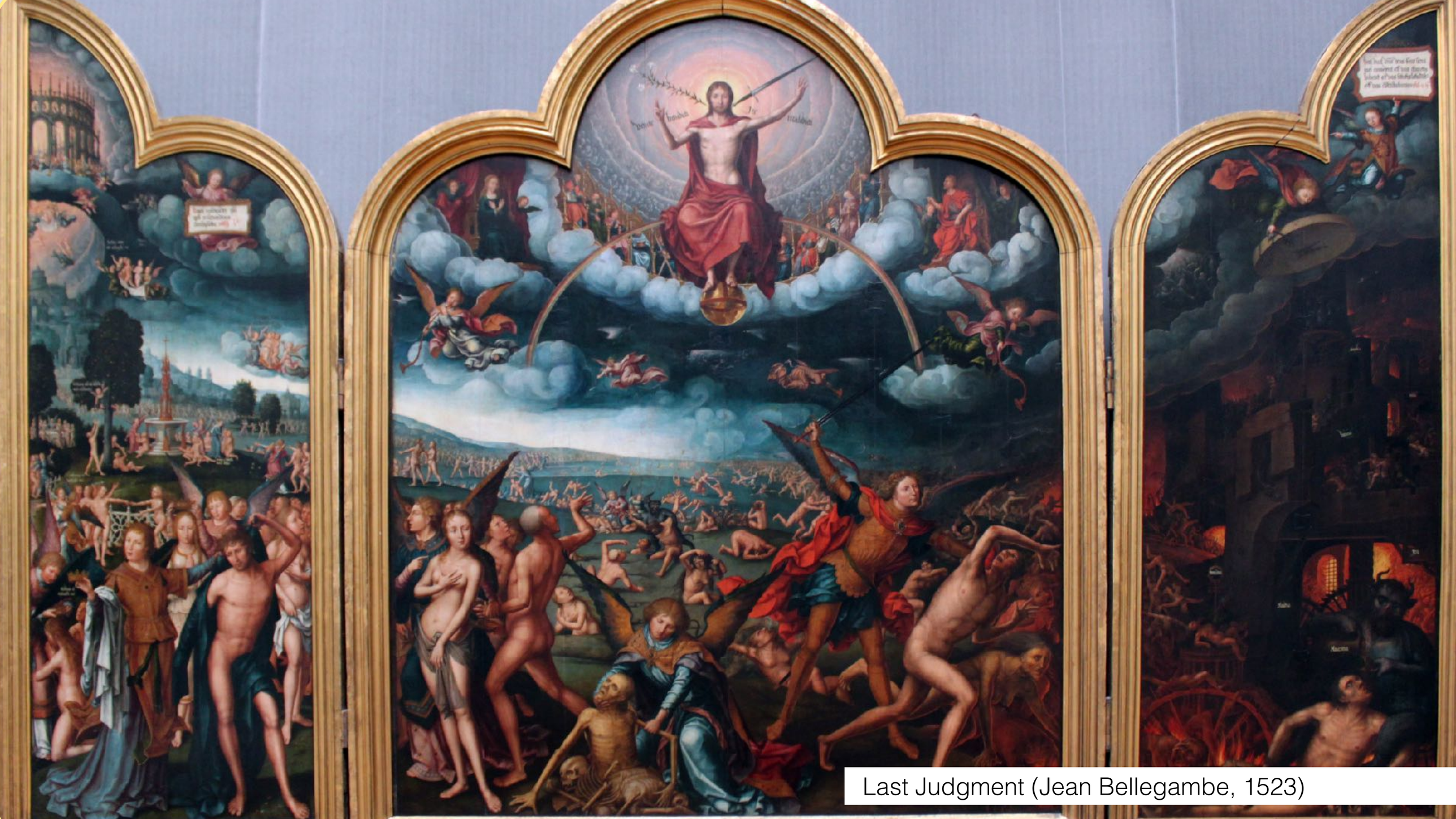
…and imagination is our memory of the future“

“记忆是我们对过去的想象……

……而想象是我们对未来的记忆”

Futures Studies as Imaginary Studies

Futures
and
Technofutures



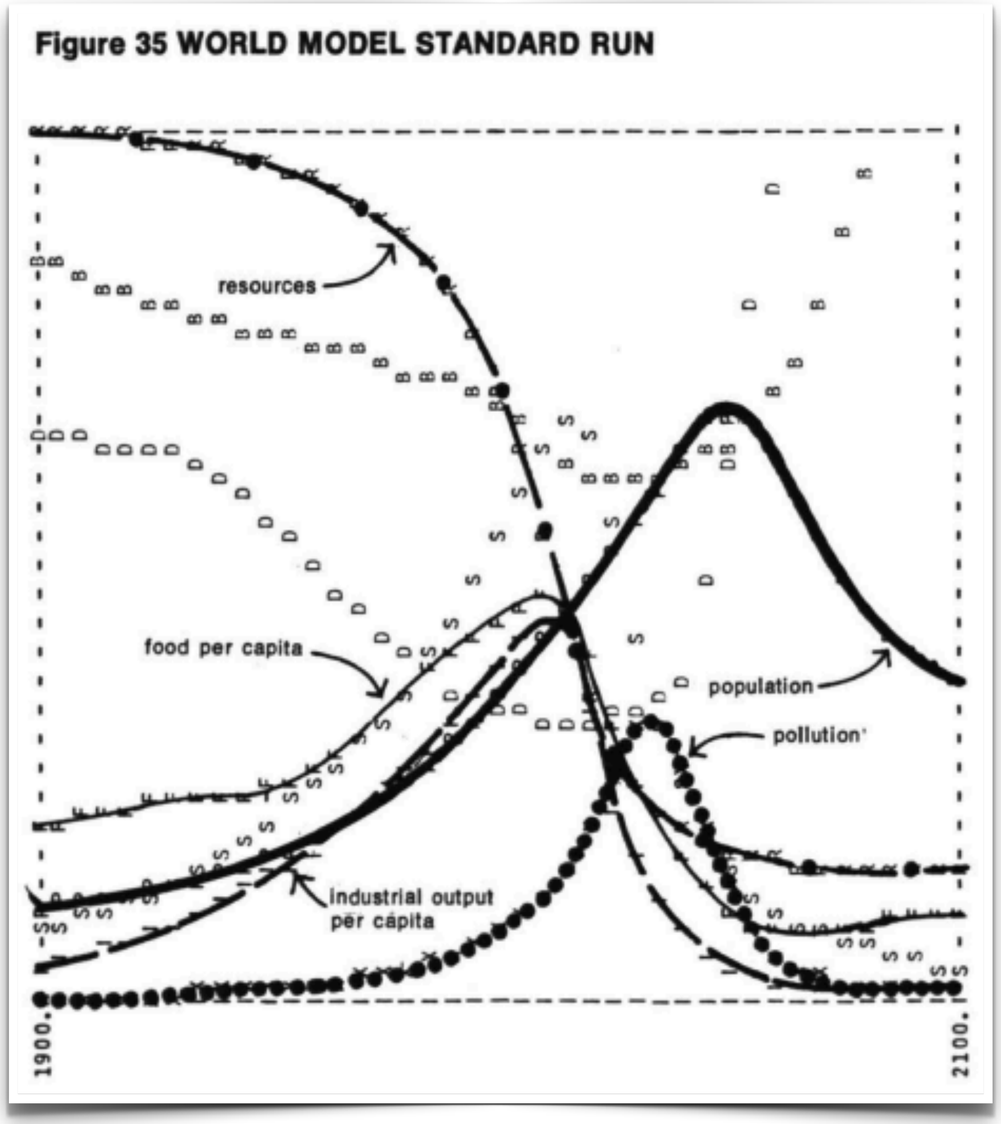
Last Judgment (Jean Bellegambe, 1523)



Sortie de l'opéra en l'an 2000 (Albert Robida, 1902)



Baidu (2021)

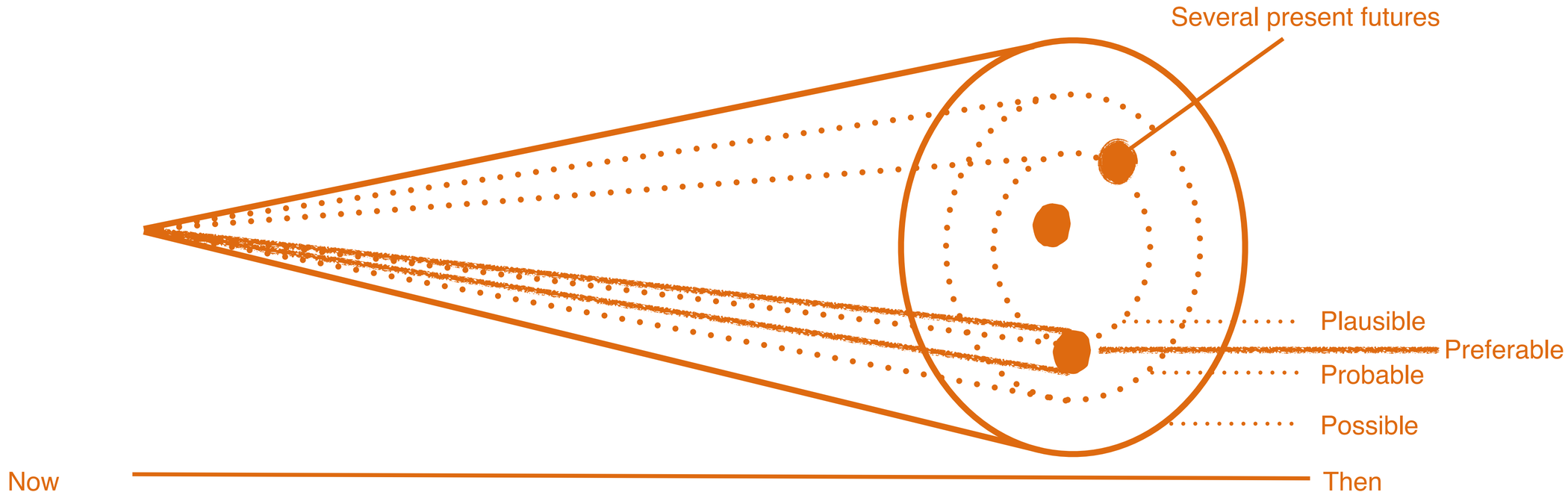


Limits of Growth (Meadows, 1972)

The pluralisation of the future

- **Future Present:**
  A moment in time later than now

- **Present Futures**
  Current images of possible moments, later than now.



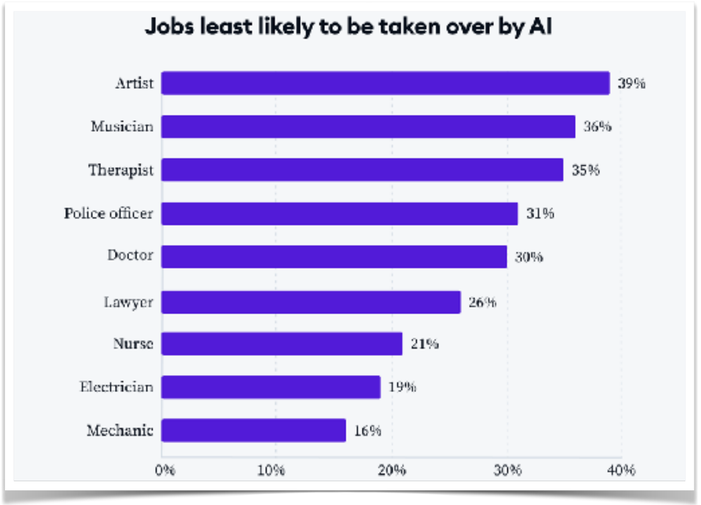
Luhmann, Niklas. 1990. „Die Zukunft kann nicht beginnen: Temporalstrukturen der modernen Gesellschaft“. in Vor der Jahrtausendwende: Berichte zur Lage der Zukunft 1. + 2. Band, Preis JE Buch , herausgegeben von P. Sloterdijk. Frankfurt), Suhrkamp.
Voros, Author Joseph. 2017. „The Futures Cone, Use and History“. The Voroscope. Abgerufen 5. September 2018 (https://thevoroscope.com/2017/02/24/the-futures-cone-use-and-history/).

Technofutures are…

- … **mediated statements** about our world being changed by new sciences or **technologies,** at a time when these technologies **have not yet materialised**.
- They come in the form of presentations, foresight reports, science fiction narratives, advertising, corporate visions, etc.







Technofutures…

- … are **social texts** and vehicles for culturally shared imaginaries. They can be deciphered and thus point to something else that lies beyond technology.
- … are **media representations** of other worlds in which new technologies play a central role and shape society or the environment.
- … have **socio-technical implications**, as, although they are fictional, they shape technological processes and provide models for the development of technologies.

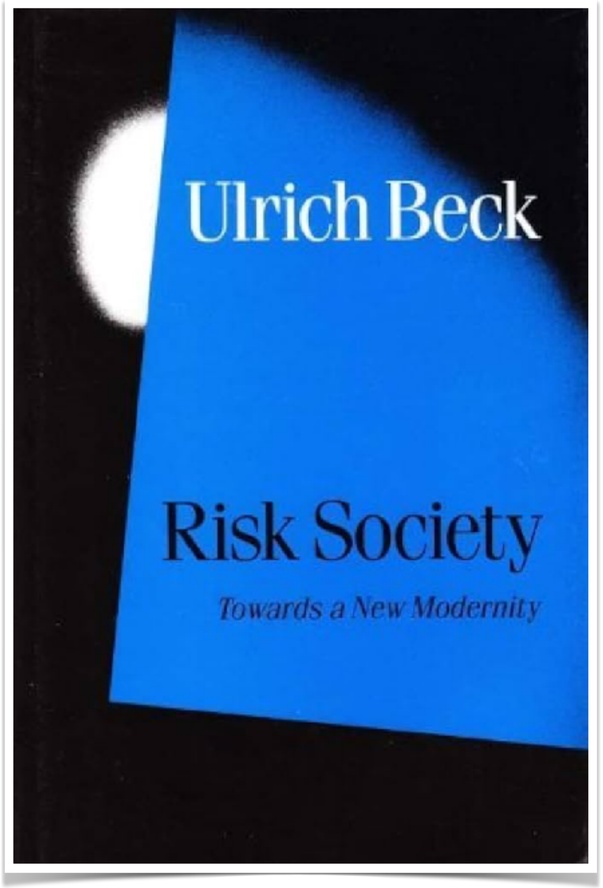
Lösch, Andreas, Knud Böhle, Christopher Coenen, Paulina Dobroc, Reinhard Heil, Dirk Hommrich, Martin Sand, und Christoph Schneider. 2016. „Technikfolgenabschätzung von soziotechnischen Zukünften“. 26.

How to study futures?

Why to study Technofutures?

“The increase in power of technical 'progress' is ever more overshadowed by the production of risks” (Beck 1986, 17 [author’s translation]).

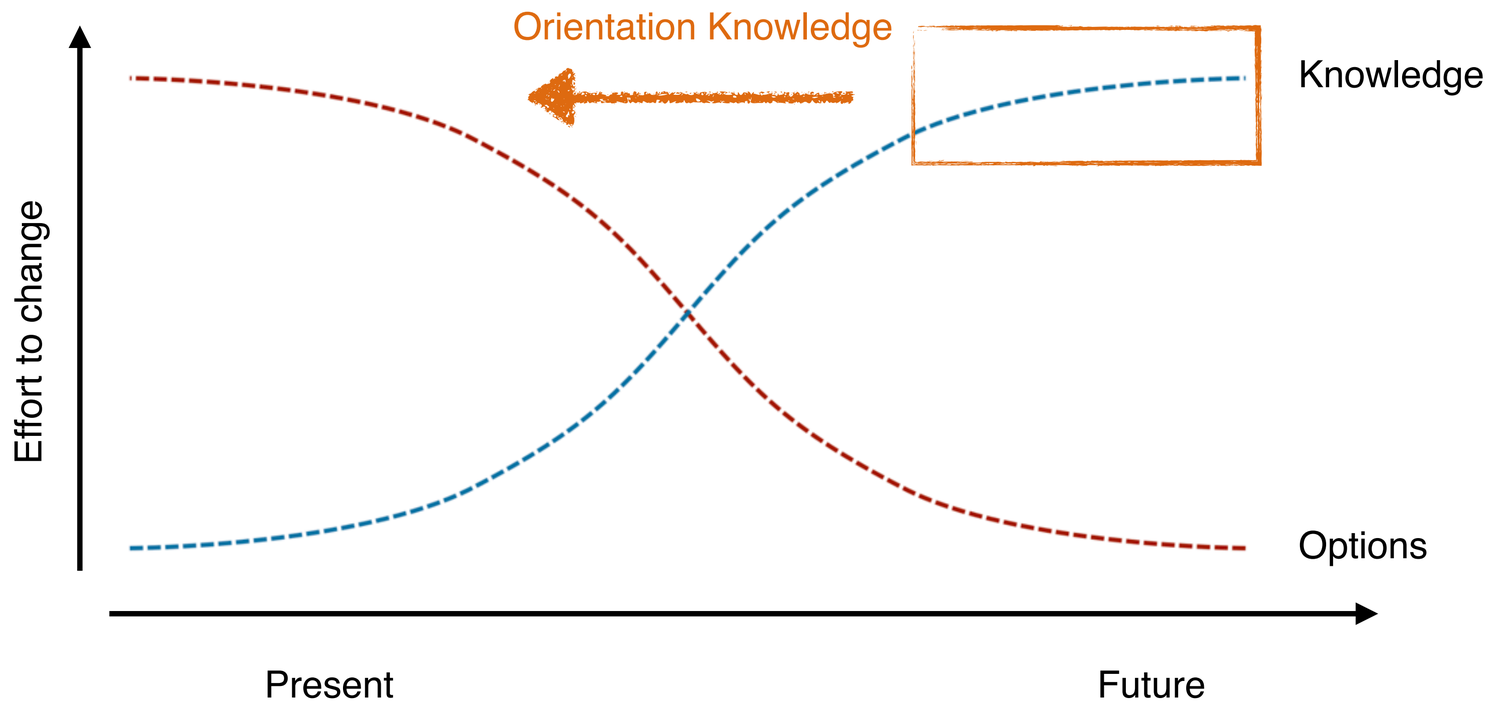
- According to Beck, the development of new technologies is accompanied by **modernisation risks** that pose an irreversible threat to the lives of plants, animals, and humans.
- Unfortunately, if, when and how these risks will manifest cannot be predicted with accuracy.



Collingridge, David. The Social Control of Technology. Palgrave Macmillan, 1981.

Collingridge-Dilemma

“When change is easy, the need for it cannot be foreseen; when the need for change is apparent, change has become expensive, difficult and time consuming.” (Collingridge 1981, 11)



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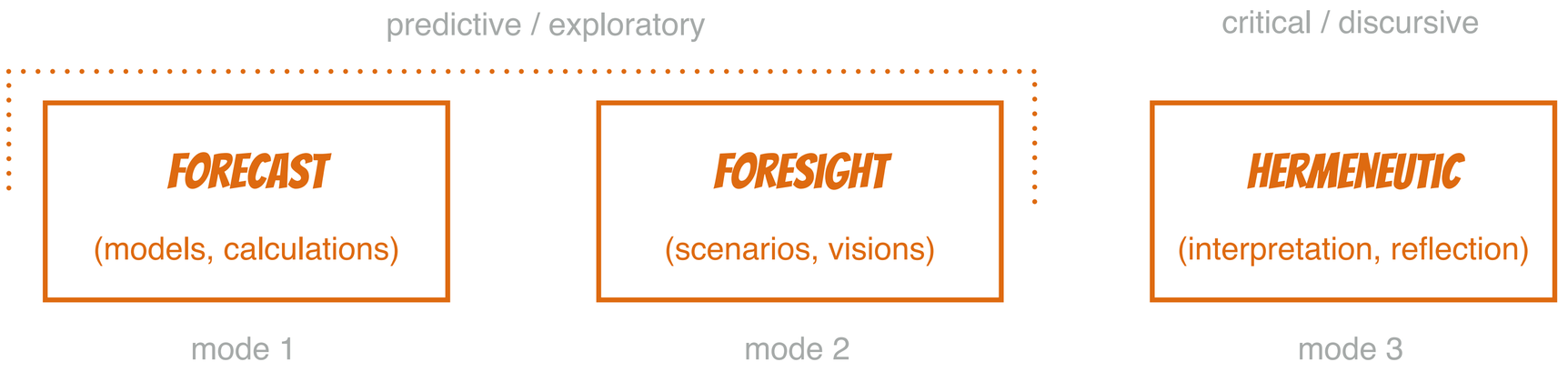
Orientation Knowledge



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Calculating Futures

Calculating Futures

FORECAST

(models, calculations)

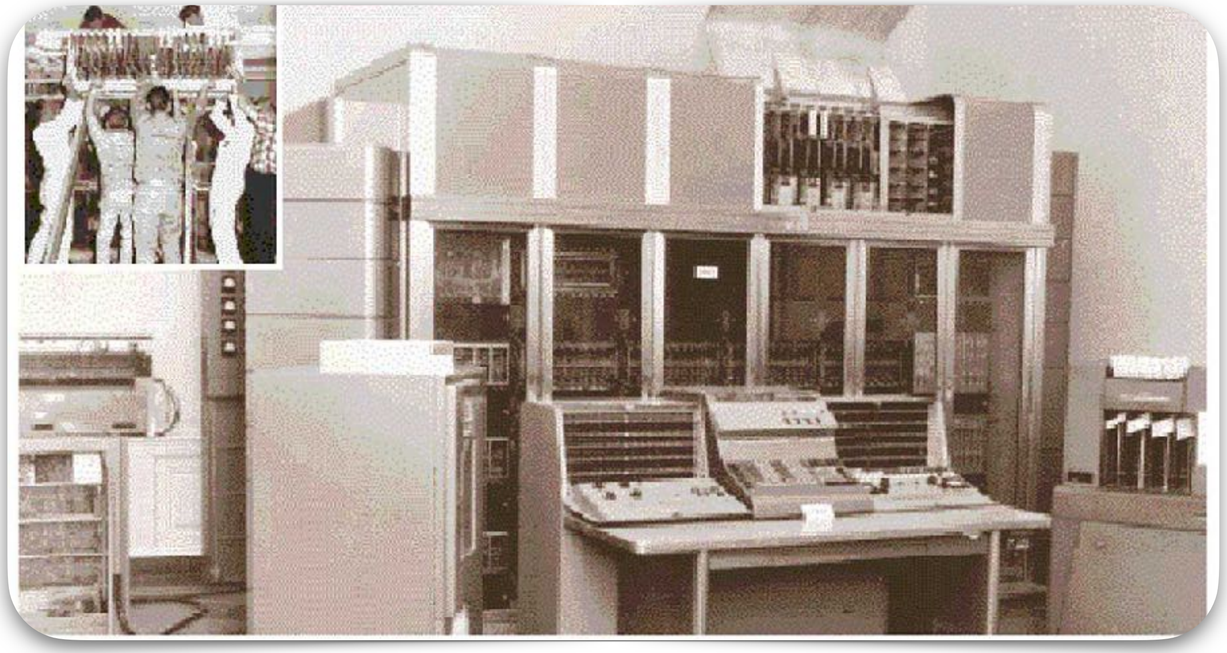
mode 1

Calculating Futures

FORECAST

(models, calculations)

mode 1



Johnniac (1953); RAND Corporation

Calculating Futures

FORECAST

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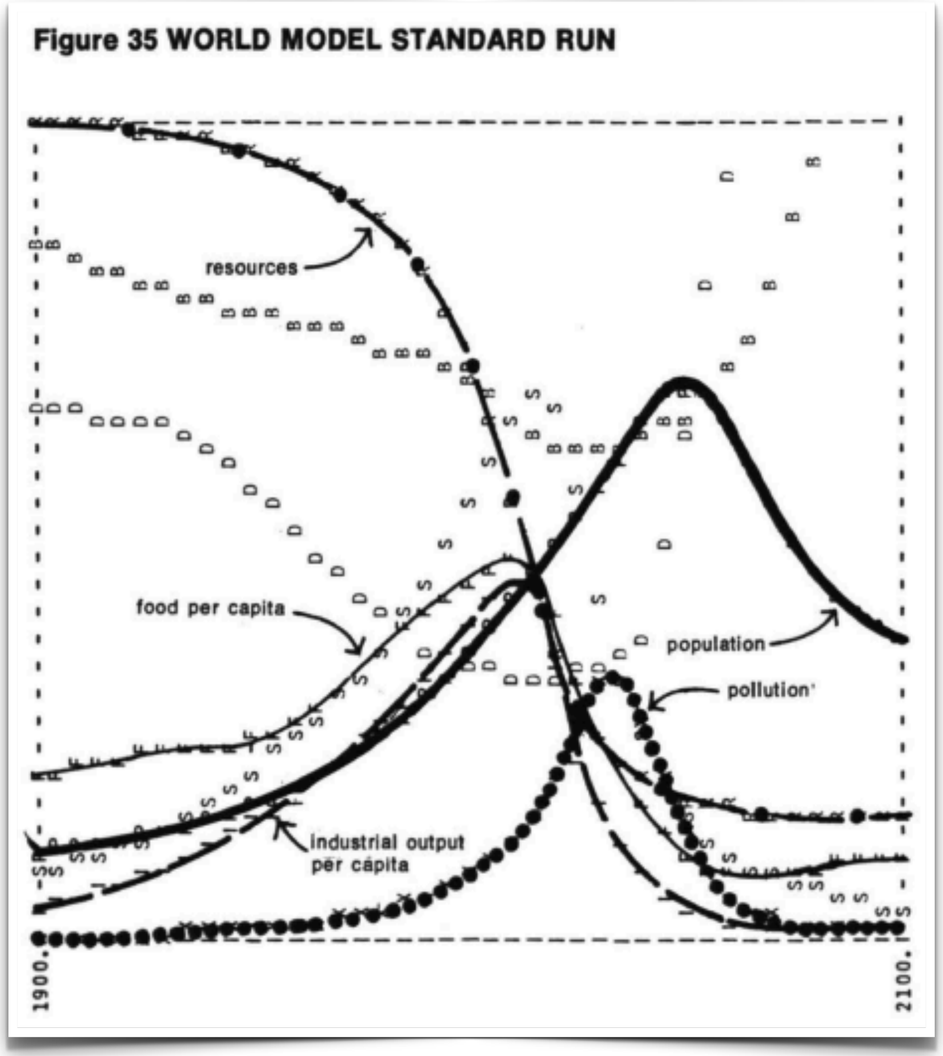

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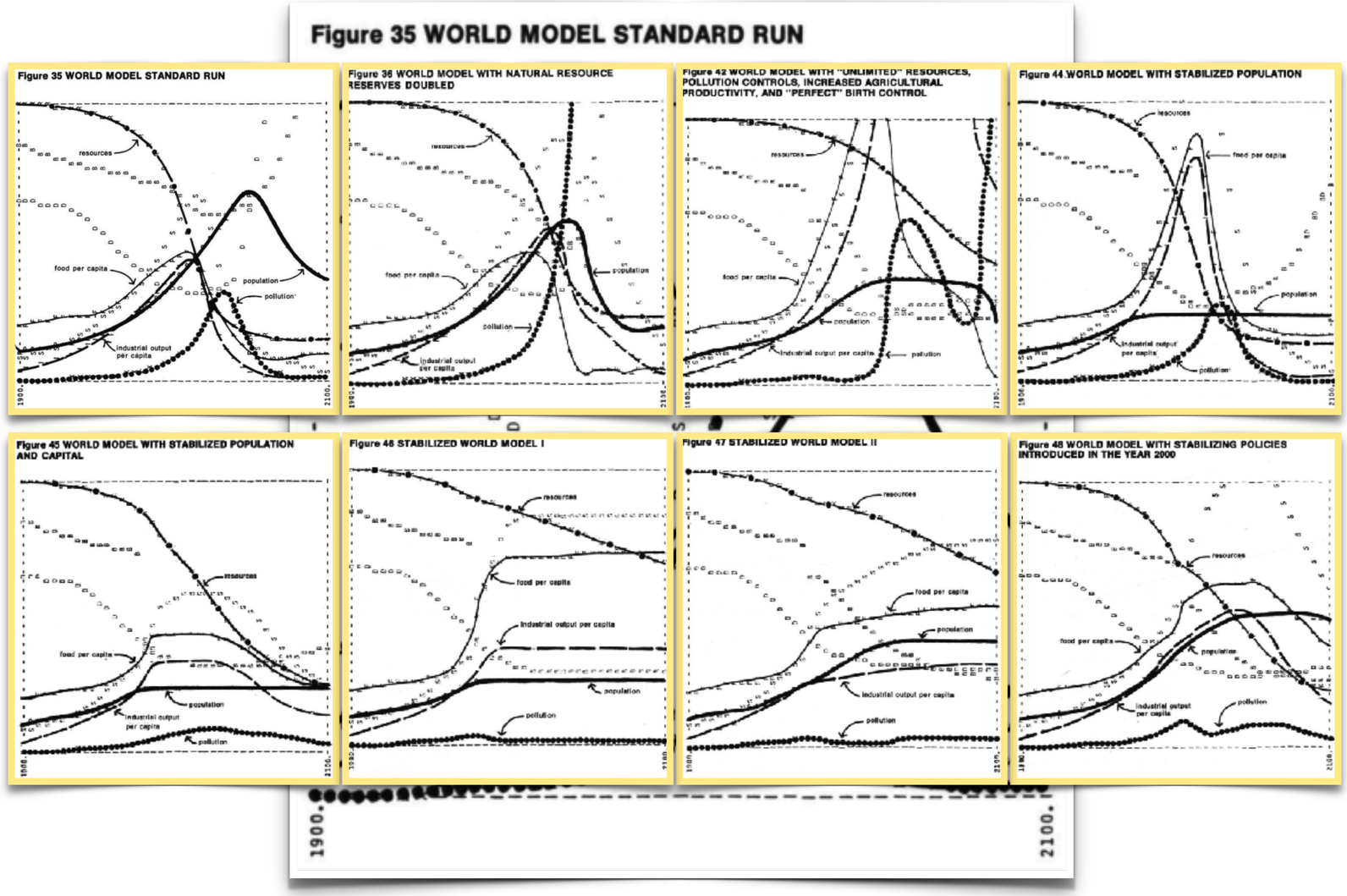

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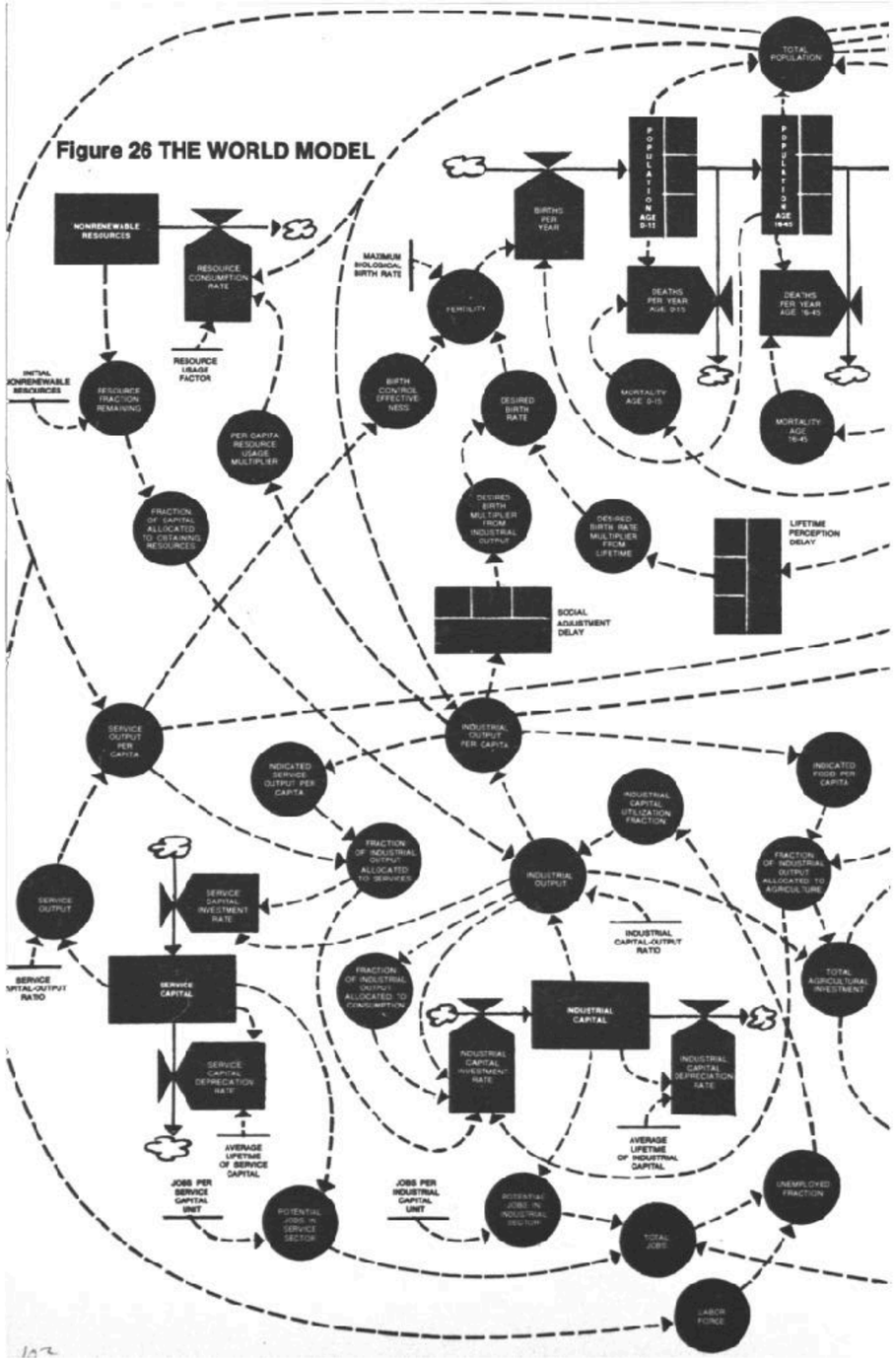
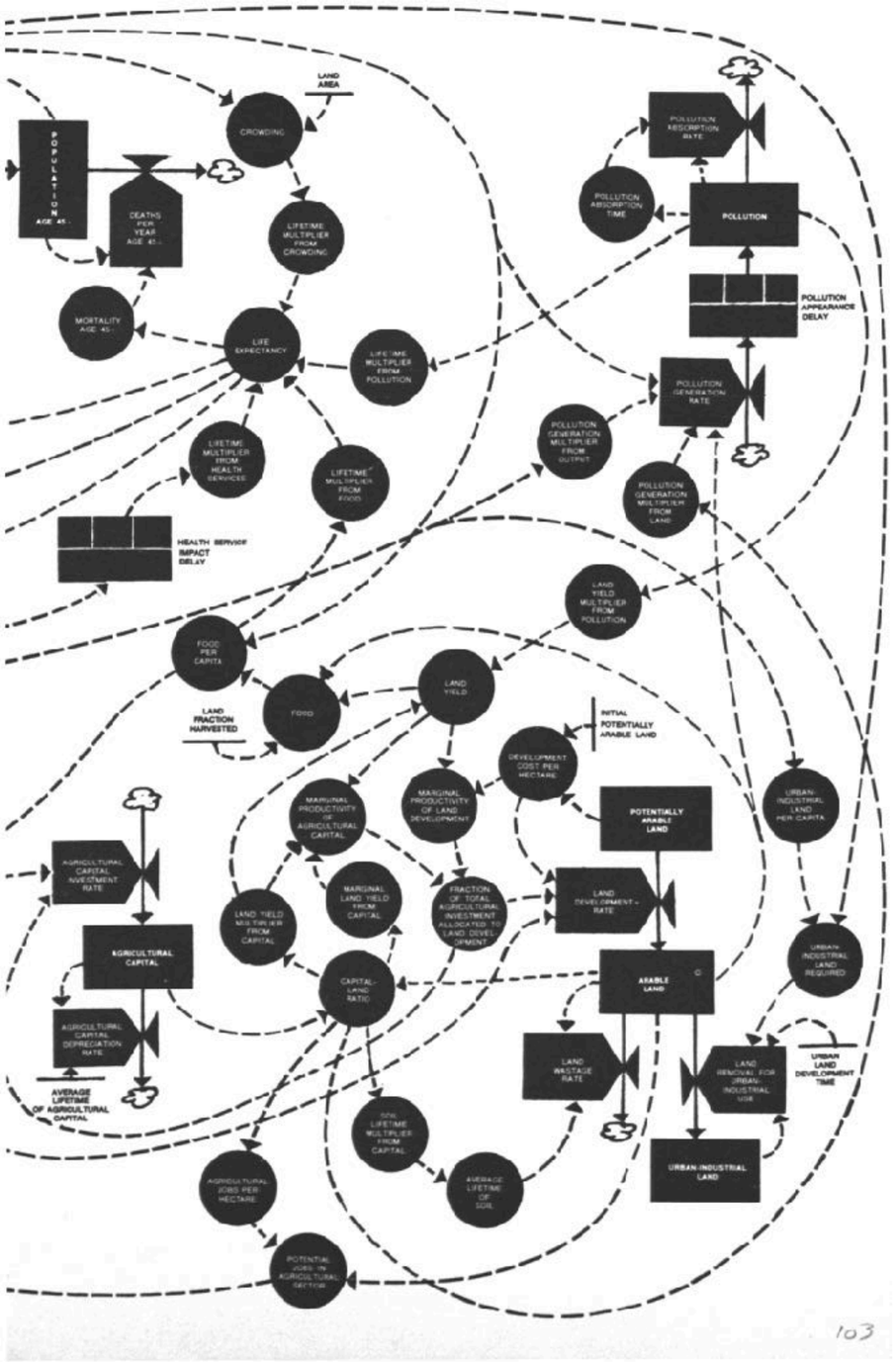
Figure 26 THE WORLD MODEL





Calculating Futures

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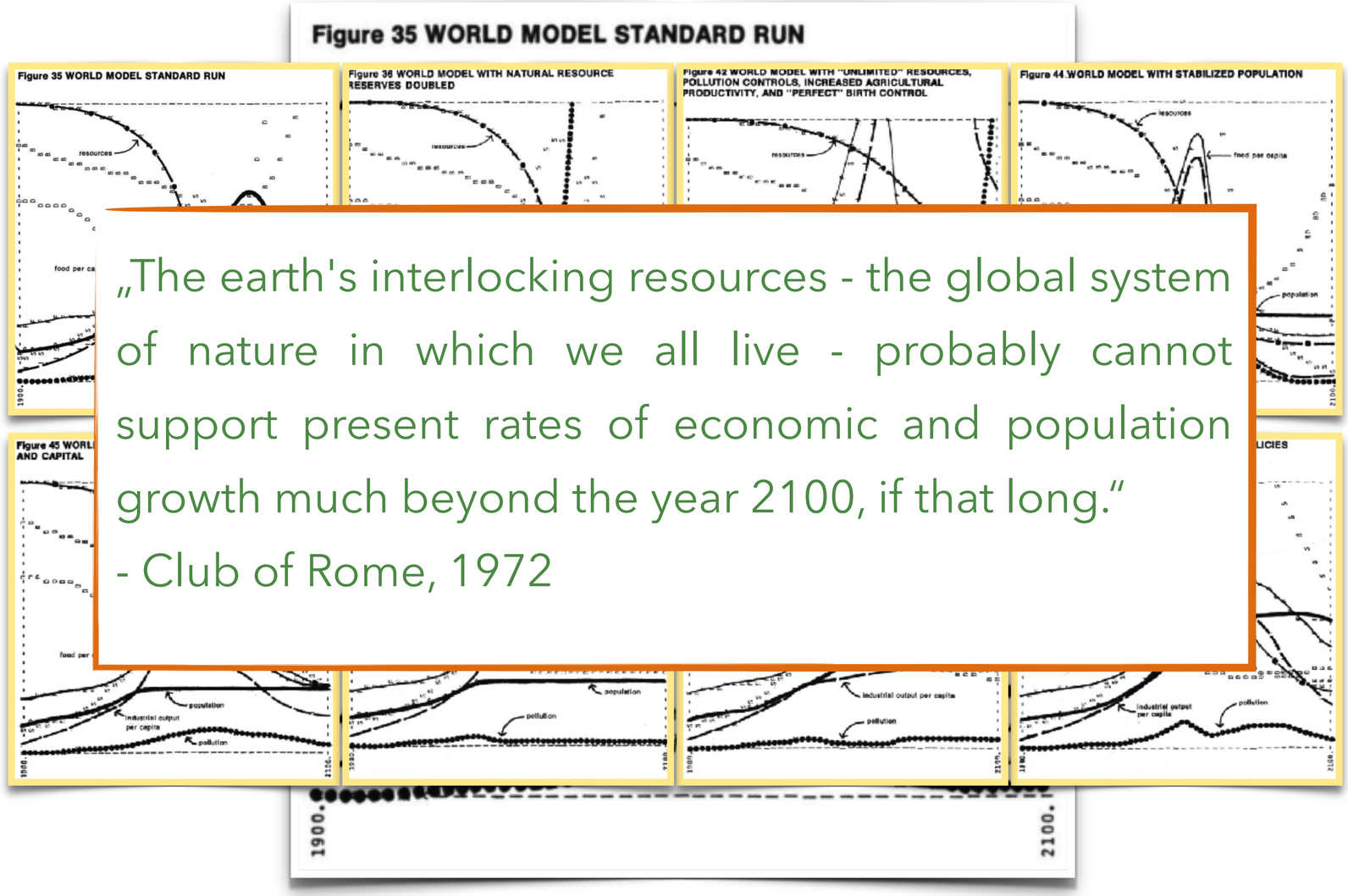


„The earth's interlocking resources - the global system of nature in which we all live - probably cannot support present rates of economic and population growth much beyond the year 2100, if that long."

- Club of Rome, 1972

Meadows, D., Meadows, D. H., Zahn, E., & Milling, P. (1972). Die Grenzen des Wachstums. Bericht des Club of Rome zur Lage der Menschheit. Deutsche Verlags-Anstalt.

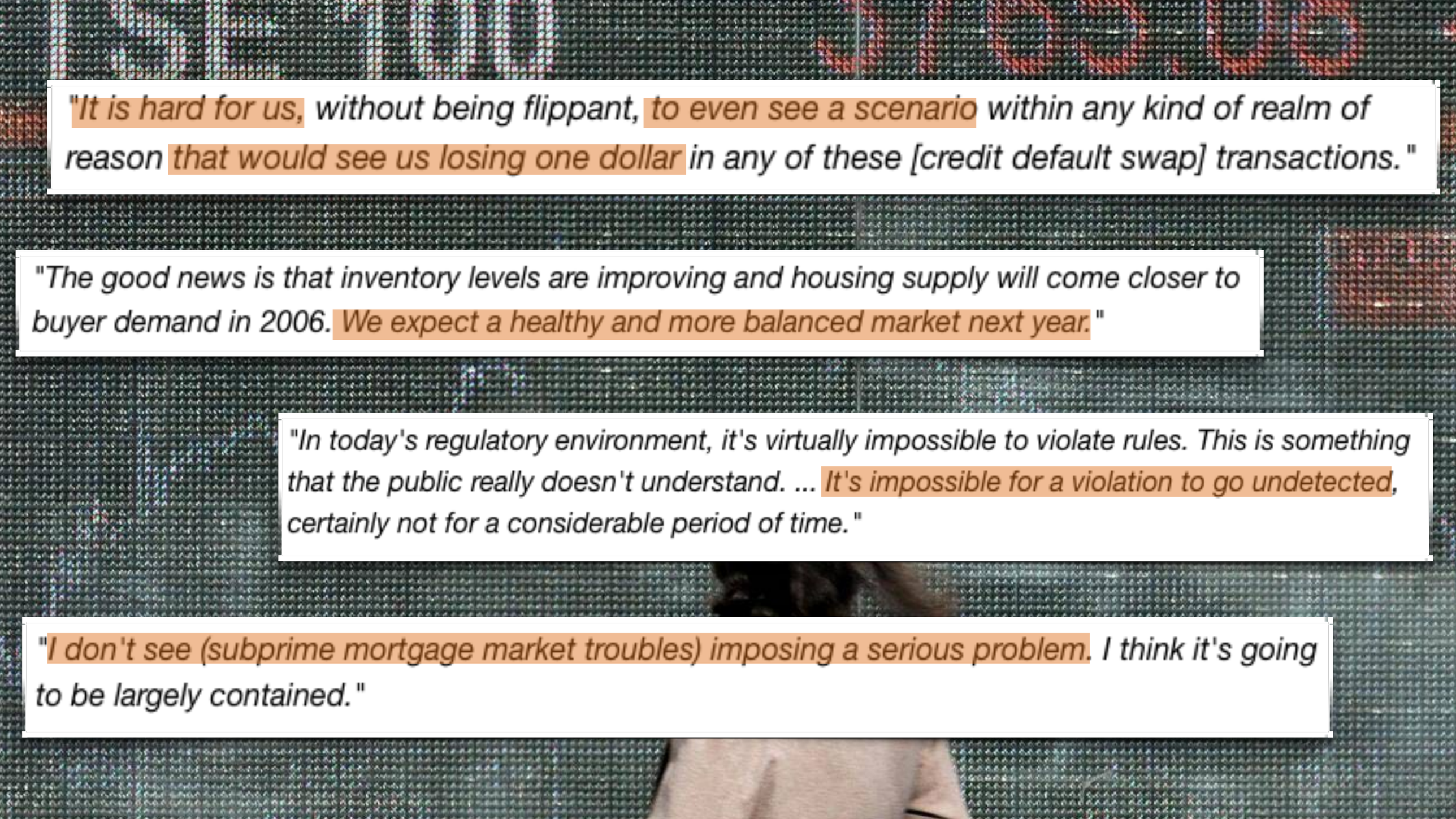
Prophecy Paradoxon (Free Will)

“If the future is predetermined, we can know it in advance.
But if we can know it in advance, we can also change it, so it isn’t predetermined.”

- Bertrand de Jouvenel (1967 [author’s translation])

Jouvenel, B. de. (1967). Die Kunst der Vorausschau. Luchterhand.


FINANCIAL CRISIS IN 2008

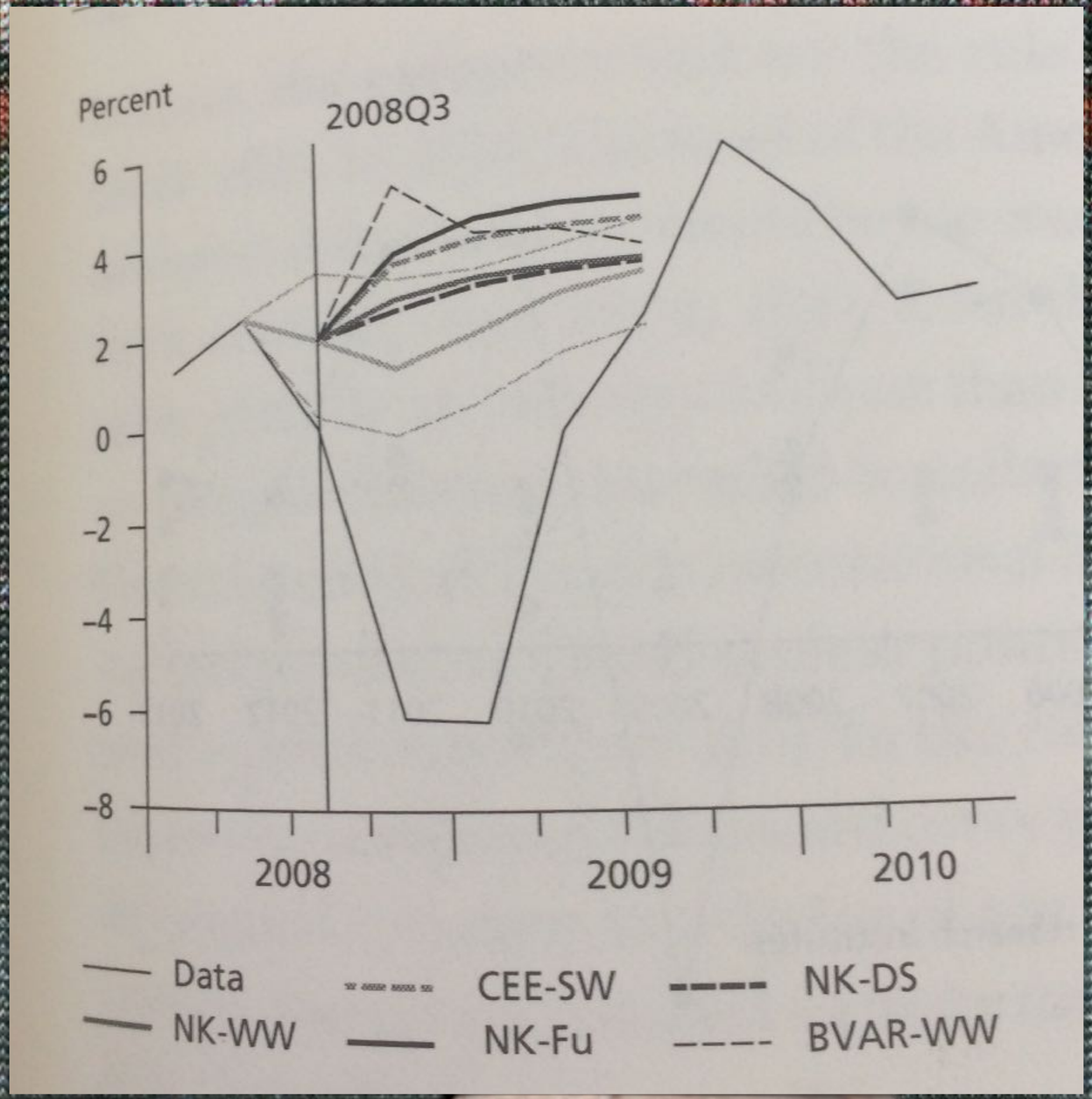


"It is hard for us, without being flippant, to even see a scenario within any kind of realm of reason that would see us losing one dollar in any of these [credit default swap] transactions."

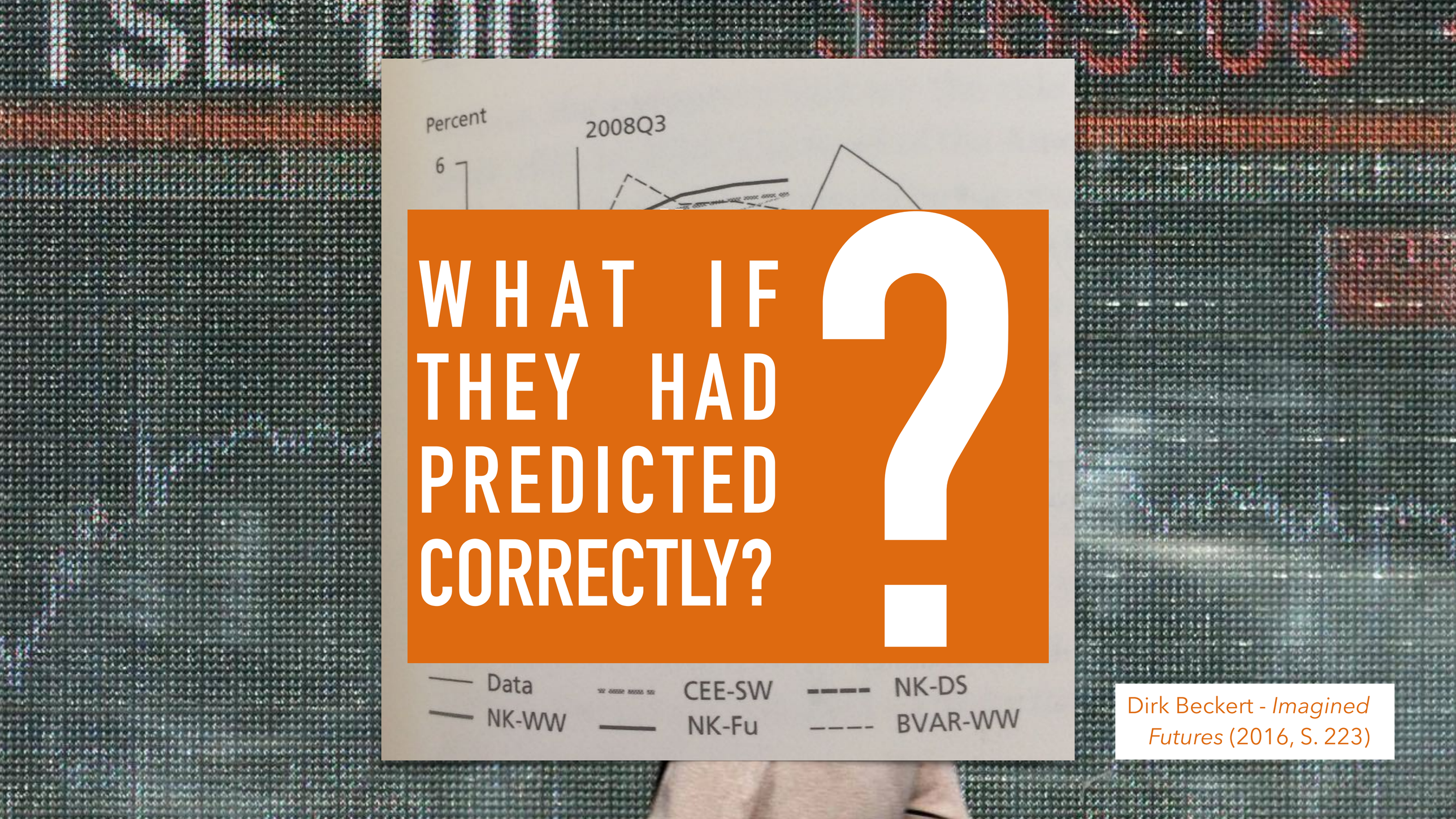
"The good news is that inventory levels are improving and housing supply will come closer to buyer demand in 2006. We expect a healthy and more balanced market next year."

"In today's regulatory environment, it's virtually impossible to violate rules. This is something that the public really doesn't understand. ... It's impossible for a violation to go undetected, certainly not for a considerable period of time."

"I don't see (subprime mortgage market troubles) imposing a serious problem. I think it's going to be largely contained."



Dirk Beckert - *Imagined Futures* (2016, S. 223)



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Immanence of the present

„All this happens within the ‚**immanence of the present**' which can be left neither by logic nor by empiricism." (Grunwald, 2014, p. 30)

Dual Meaning

- All Futures are constructed in the present
- All futures are perceived and acted upon in the present

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"Forecasts are only failures if we define them as attempts to predict the future. As a '**technology of expectation**' (van Lente 1993), they are extremely successful, as they contribute to the **coordination of the economy by guiding and justifying decisions** (…) and protecting decision-makers when they make decisions that turn out to be wrong in hindsight." (Beckert, 2016, p. 242)

Grunwald, A. (2014). Modes of orientation provided by futures studies: Making sense of diversity and divergence. European Journal of Futures Research, 2(1). https://doi.org/10.1007/s40309-013-0030-5

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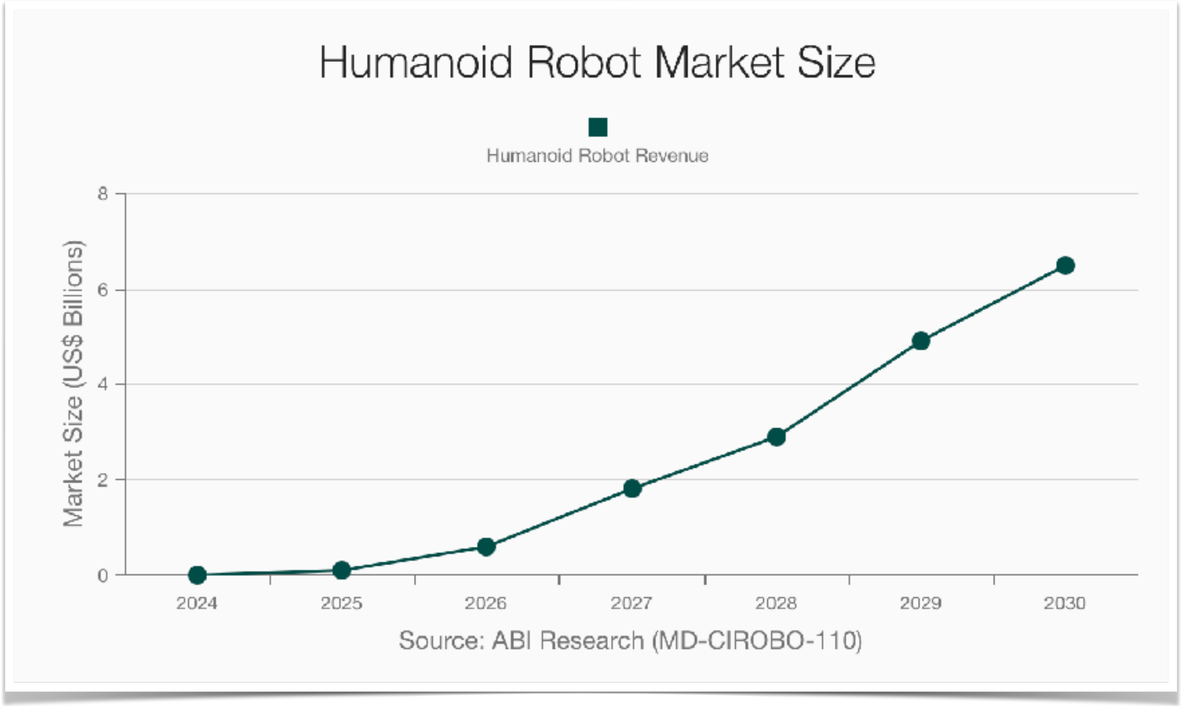
Market prediction & Hypes




RESEARCH

Humanoids: A $5 Trillion Market

May 14, 2025

The number of robots that resemble and act like humans is likely to reach nearly 1 billion by 2050, with China currently leading in development.


AI • ELON MUSK

Elon Musk says that in 10 to 20 years, work will be optional and money will be irrelevant thanks to AI and robotics

By Sasha Rogelberg
Reporter

January 19, 2026, 9:48 AM ET

Add us on

In a decade or two, work will be optional, Elon Musk said at the U.S.-Saudi Investment Forum in Washington, D.C., this week.
STEFANI REYNOLDS—BLOOMBERG/GETTY IMAGES

https://www.abiresearch.com/blog/global-robotics-market-outlook

https://fortune.com/2026/01/19/when-does-elon-musk-say-work-will-be-optional-and-money-will-be-irrelevant-ai-robotics/

https://www.morganstanley.com/insights/articles/humanoid-robot-market-5-trillion-by-2050

Widening Futures

Widening Futures

FORECAST

(models, calculations)

mode 1

FORESIGHT

(scenarios, visions)

mode 2

Difference between Forecast & Foresight

- **Forecast:**
  - **Goal:** Prediction
  - **Method:** Collect data, extrapolate trends, calculate probabilities
  - **Approach:** “What is likely to happen if we carry on as we are?”
  - **Typical fields:** Economics, weather, demography, market research
  - **Example:** “By 2030, the population of Austria will have shrunk by 3%.”

Difference between Forecast & Foresight

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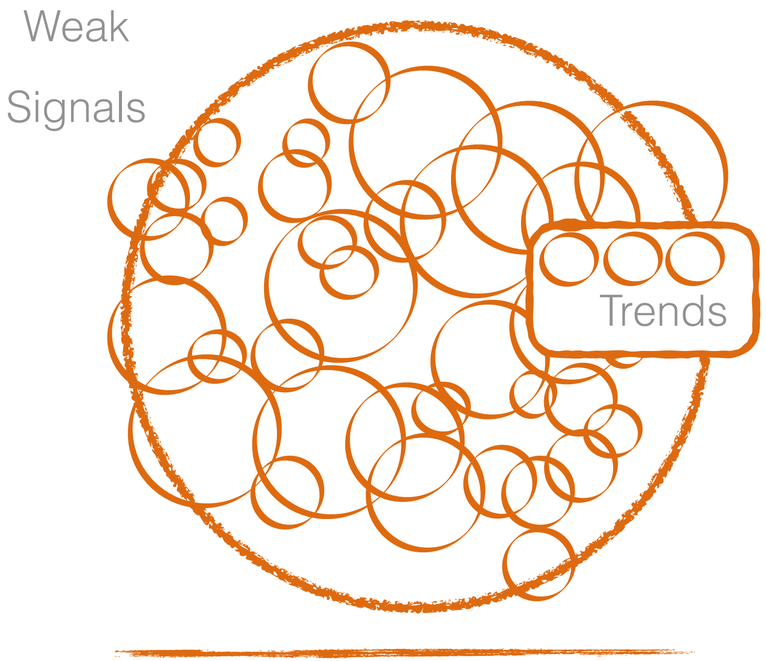
  - **Typical fields:** Economics, weather, demography, market research
  - **Example:** “By 2030, the population of Austria will have shrunk by 3%.”
- **Foresight:**
  - **Objective:** To explore new possibilities
  - **Method:** Scenarios, horizon scanning, developing visions, involving stakeholders
  - **Approach:** “How might the future unfold and what does it mean for us?”
  - **Typical fields:** Policy advice, innovation strategies, cultural programmes, technology assessment
  - **Example:** “How might education look like in an ever growing adaption of LLMs?”

Foresight Process

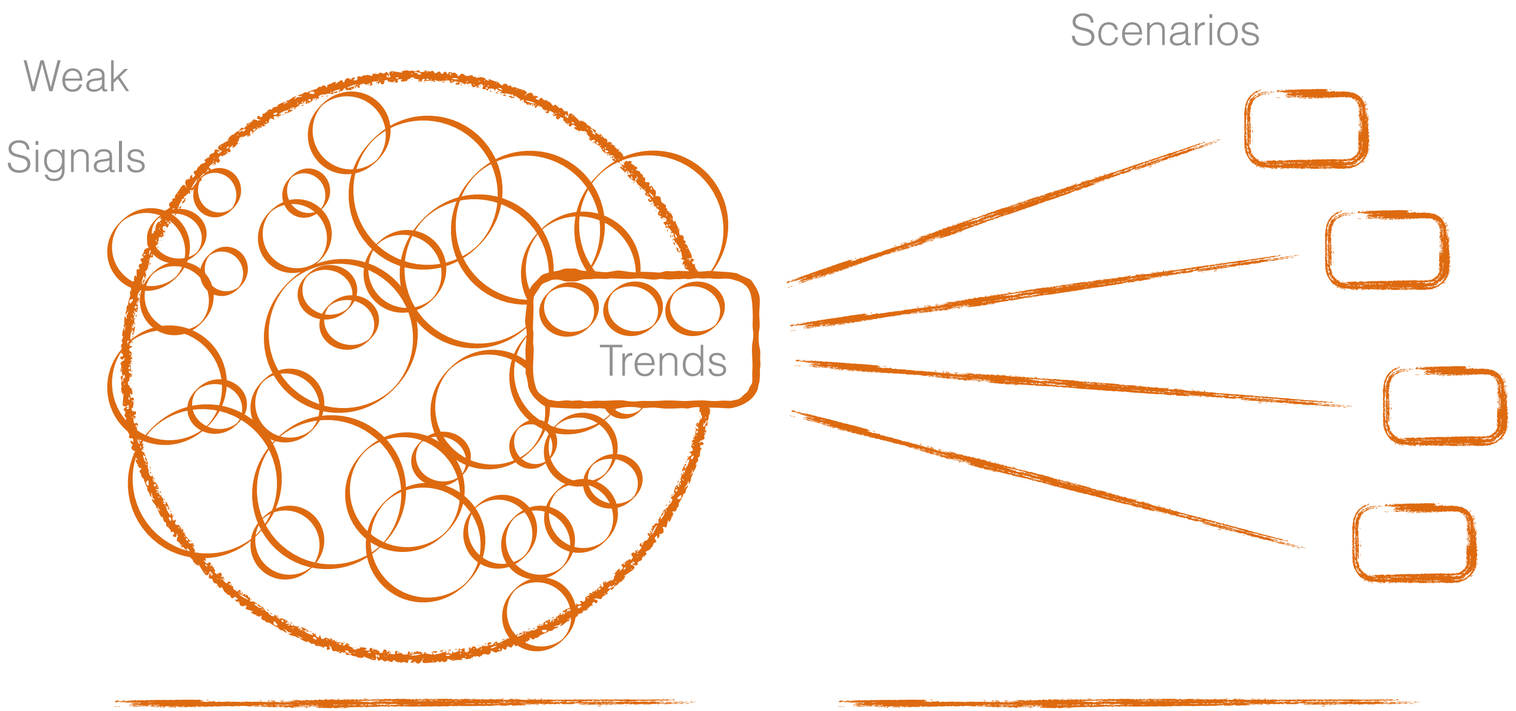


Step 1: Scoping

1. Horizon Scanning & Trends

- **Trends** are clearly discernible patterns.
- **Weak signals** are early indications of a trend that is not yet clear.
  - **Trend:** An increase in mental health issues
    - **Weak signal:** Psychological counselling via AI avatars
    - **Weak signal:** Rising demand for mindfulness apps
  - **Trend:** Shrinking AI adaptation in industries
    - **Weak signal:** Posts on Instagram or LinkedIn about high Token costs
    - **Weak signal:** Reports on AI slop at work

Foresight Process



Step 1: Scoping

1. Horizon Scanning & Trends

Step 2: Exploration

2. Selection of a scenario framework
3. Selection of key factors
4. Development of the scenarios

Examples: Scenarios

- **EU attached to transnational global AGI and ASI networks**
  - In 2040, AI technology is highly advanced and offers general intelligence (AGI) as well as superintelligence (ASI) beyond human understanding and control. The EU makes itself attractive to receive the services of transnational AGI and ASI networks from the US and China.



Examples: Scenarios

- **Europe leads a unique AI revolution**
  - In 2040, the EU's AI technology is more innovative and useful than that developed and applied in other world regions. The EU benefits economically and socially from its massive investments in education to create a new AI paradigm. Old paradigms, like LLMs, have turned out to become a dead end.



Examples: Scenarios

- **Global AI Winter**
  - In 2040, globally, the AI boom of the 2020s is over. The earlier shiny AI promises have not materialised in terms of substantial measurable economic returns and social benefits. AI industry is now mature with ever more shrinking benefits. AI development continues with a slow pace, while larger investments go into other technological directions.



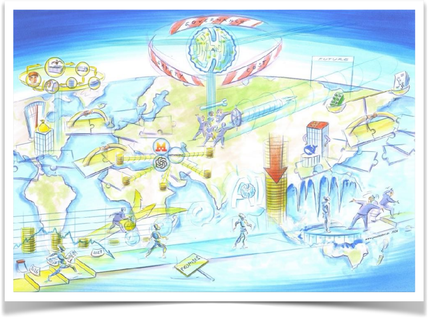
Scenarios as Think Pieces

- **This is not a future present (no prediction)**
  - These are present futures, meant to be judged by the people of today
  - Immanence of the present

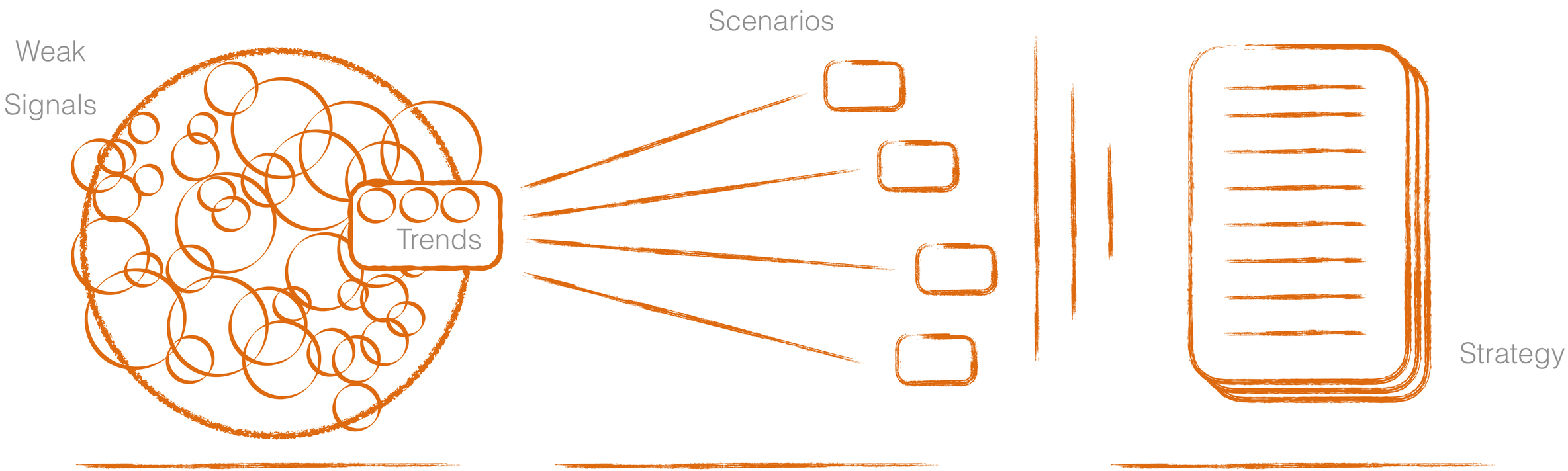
- **Questions to ask:**
  - What do you think is most plausible?
  - What do you think is most preferable?
  - What are strategies we can do, to be best prepared?







Foresight Process



Step 1: Scoping

1. Horizon Scanning & Trends

Step 2: Exploration

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Step 3: Strategy

5. Strategy testing
6. Recommendations for action
7. Strategy revision

Recommendations

1. Strengthening anticipatory governance capacities to navigate persistent uncertainty

2. Enhancing European competitiveness through broader and deeper AI adoption across sectors

3. Shaping a distinct European pathway for AI thatbuilds on trust, sustainability and public interest



European Commission: Directorate-General for Research and Innovation, Mehnert, W., Ferrari, A., Strauka, O., Chachava, M. et al., The futures of artificial intelligence – Implications for Europe's R&I ecosystem. Part 5, Final report, Publications Office of the European Union, 2026, https://data.europa.eu/doi/10.2777/7322666

Reflecting Futures

Reflecting Futures

predictive / exploratory

critical / discursive

FORECAST

(models, calculations)

mode 1

FORESIGHT

(scenarios, visions)

mode 2

HERMENEUTIC

(interpretation, reflection)

mode 3

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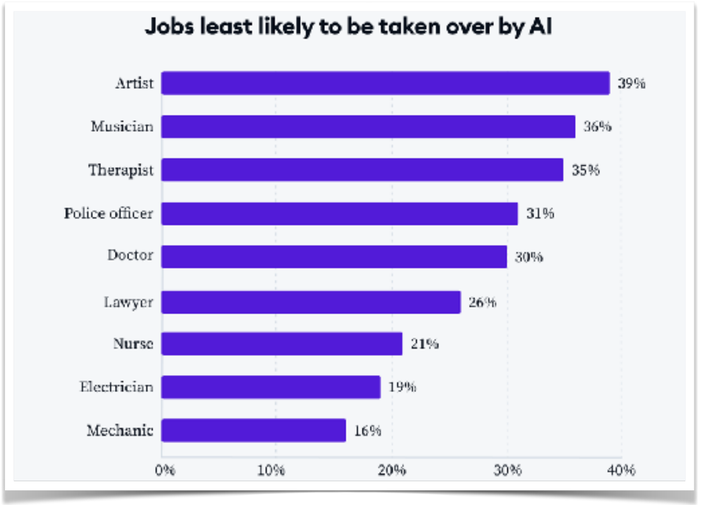

If-and-then statements (Nordmann, 2007)

- Narratives about causal changes
- **If**: Function of an emerging technology
- **Then**: Change brought about by that function

  - **If** a direct interface between brains and machines were created,
    then that would constitute an invasion of privacy (Nordmann, 2007).
  - **If** we can grow meat in a laboratory,
    then we can prevent the climate impacts of meat production (Ferrari & Lösch, 2017).
  - **If** we manufacture autonomous weapon systems,
    then these systems could be hacked and used against us (Mehnert, 2019).

- Often, neither the ‘if’ nor the ‘then’ can be stated with certainty.

Nordmann, A. (2007). If and Then: A Critique of Speculative NanoEthics. NanoEthics, 1(1), 31–46. https://doi.org/10.1007/s11569-007-0007-6

Ferrari, A., & Lösch, A. (2017). How Smart Grid Meets In Vitro Meat: On Visions as Socio-Epistemic Practices. NanoEthics, 11(1), 75–91. https://doi.org/10.1007/s11569-017-0282-9

Mehnert, W. (2019). The Future is Near: Schnittstellen einer negativen Zukunft. In K. D. Haensch, L. Nelke, & M. Planitzer (Eds), Uncanny Interfaces (pp. 54–69). textem Verlag.

Attribution of societal meaning

- Technofutures attribute societal meaning to an emerging technology.
- **Then**: Ethical, cultural, economic, social, political or ecological changes (Lösch et al., 2016).
- Emerging technologies become socially meaningful and require actors to **position themselves** in relation to the alleged changes (Grunwald, 2019, p. 105).



- Attribution of meaning becomes decisive for **social acceptance or rejection**
  - Technology futures forge alliances (Ferrari & Lösch, 2017)
  - Decide on promotion and regulation of the technology (Grunwald, 2019, p. 106)

Lösch, A., Böhle, K., Coenen, C., Dobroc, P., Heil, R., Hommrich, D., Sand, M., & Schneider, C. (2016). Technikfolgenabschätzung von soziotechnischen Zukünften. 26.

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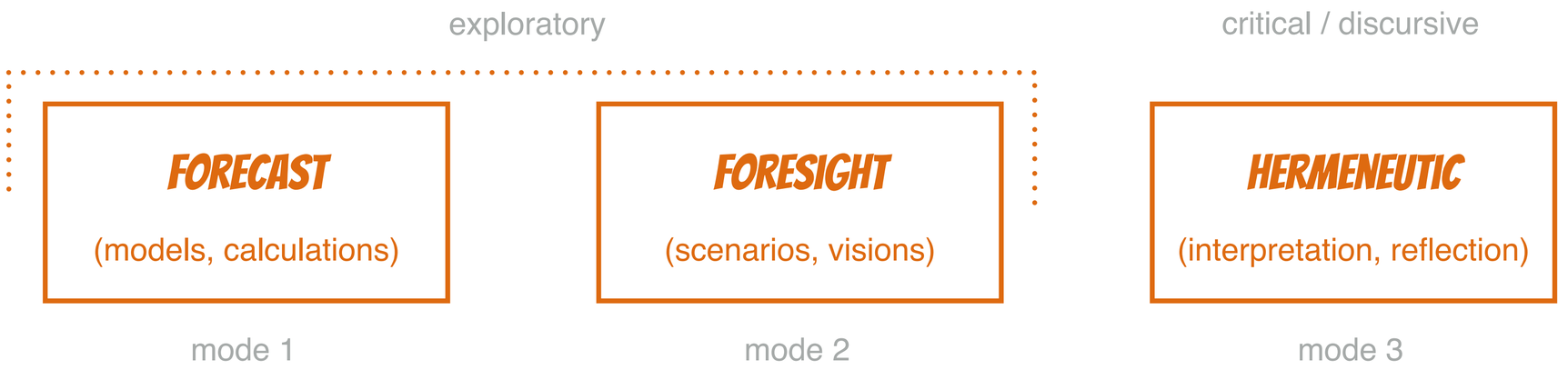
Reflecting Futures

„The hermeneutic approach (...) will contribute to the development and application of **a new type of reasoning and policy advice in debates on future technology** beyond traditional consequentialism. Its objective is **to allow deciphering the meanings assigned to NEST developments** as early as possible in order to allow and support more transparent and enlightened debate.“ (Grunwald, 2016, p. 4-5)“



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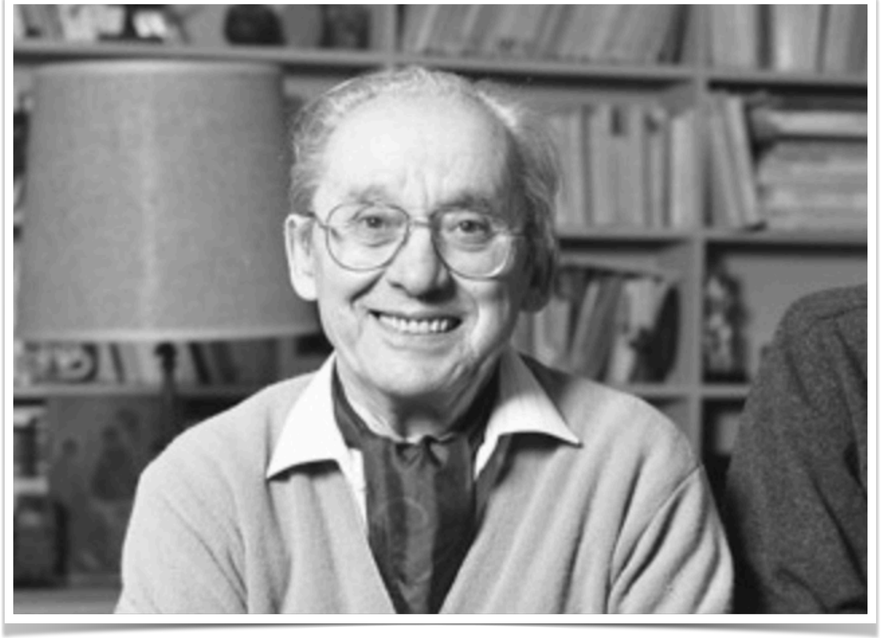
Narrative Hermeneutics

- **Paul Ricoeur – Time and Narrative (1984)**

- „Hermeneutics (...) is concerned with reconstructing the entire arc of operations (…) What is at stake, therefore, is the concrete process by which the textual **configuration** mediates between the **prefiguration** of the practical field and its **refiguration** through the reception of the work.“ (Ricoeur 1984, p. 53)



Ricoeur, P. (1984). Time and Narrative, Volume 1. University of Chicago Press.

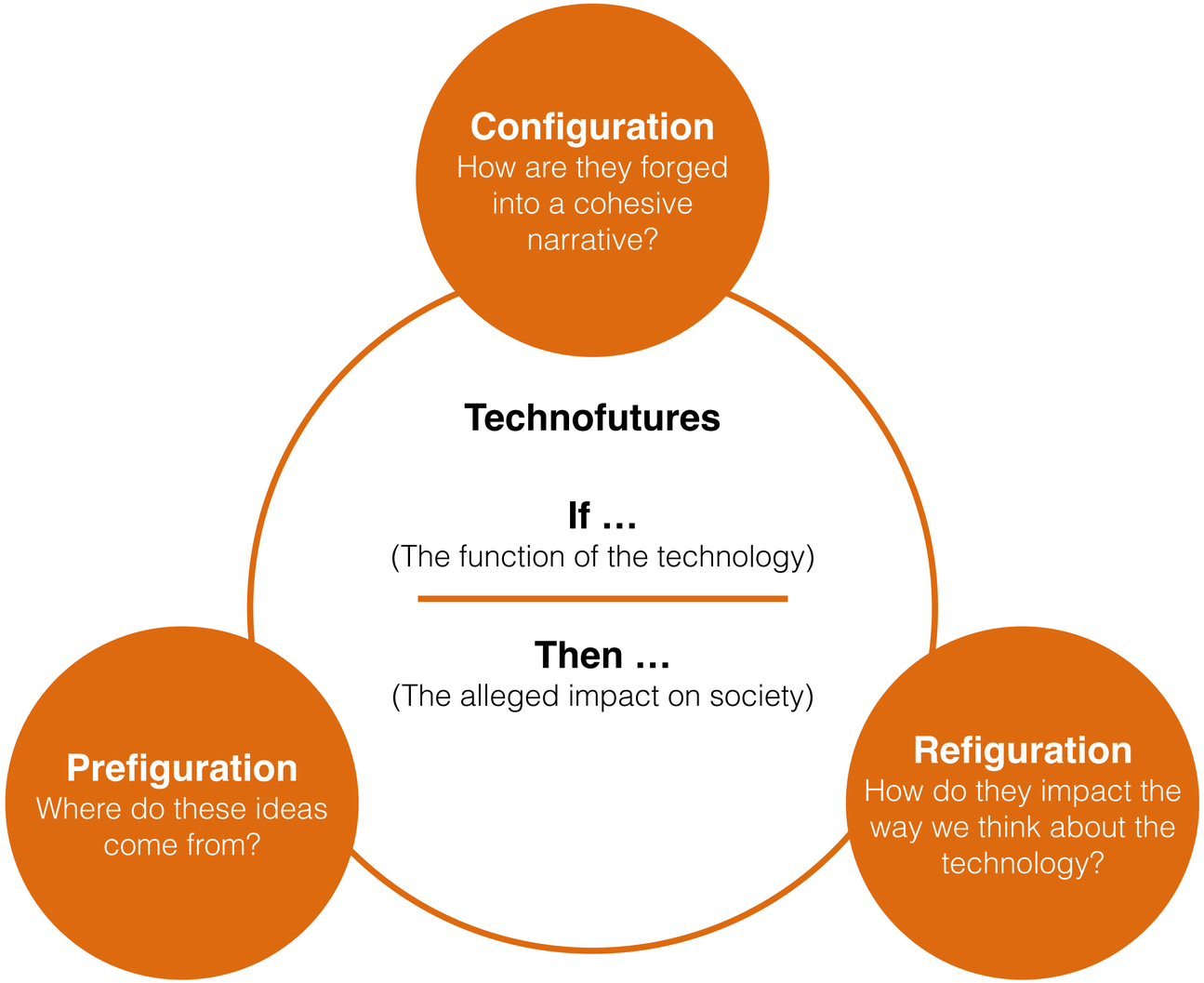
Technofutures as narratives

- **(1) Prefiguration** Looks at the content of technofutures, how they are entangled in cultural presumptions and informed by culturally shared imaginaries; reflecting on desires, hopes, fears and needs that are inscribed into the respective futures. [**How meaning is drawn from culture**]

- **(2) Configuration** Looks at the way they are constructed and reflects on the form (e.g., the role of the medium, the performance, the context in which it is embedded), the rhetoric (e.g., the language, narratives and verbal or visual metaphors used), as well as illustrative material (e.g. tables, pictures, movies or other pieces of art). [**How meaning is constructed**]

- **(3) Refiguration** Focusses on the impact of technofutures and the way they change present discourses or change already established concepts. This perspective includes, among others, the way that stakeholders position themselves towards the proposed future but also how technofutures impact other discourses and diffuse through society. [**How meaning is attributed by others**]

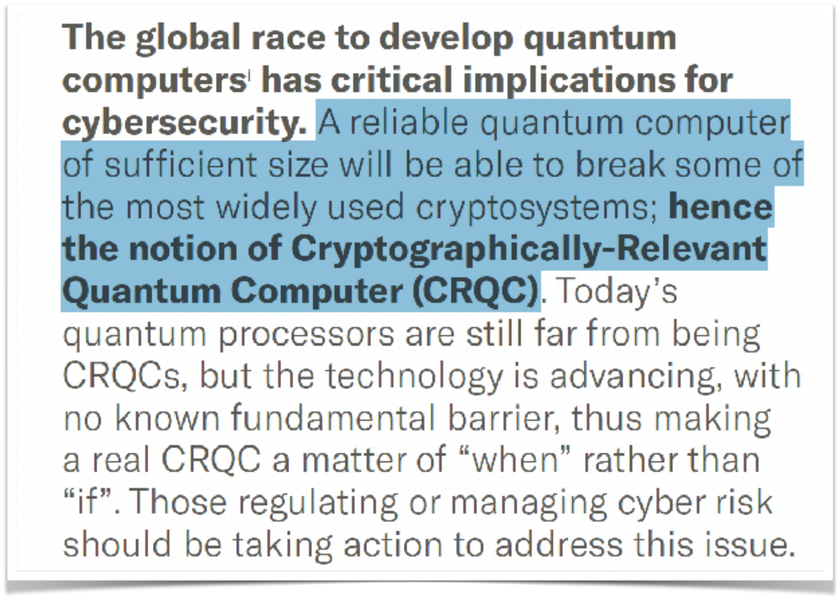
Futures Circle for Hermeneutic TA



Mehnert, W. (2024). The Futures Circle—A Framework for Hermeneutic Technology Assessment. Technology and Language, 14(1), 129–151. https://doi.org/10.48417/technolang.2024.01.10


cisco
The
Quantum Threat
Is Already Here:
We Just Can't
See It Yet

Quantum Threat (Michele Mosca)



The global race to develop quantum computers has critical implications for cybersecurity. A reliable quantum computer of sufficient size will be able to break some of the most widely used cryptosystems; **hence the notion of Cryptographically-Relevant Quantum Computer (CRQC)**. Today's quantum processors are still far from being CRQCs, but the technology is advancing, with no known fundamental barrier, thus making a real CRQC a matter of "when" rather than "if". Those regulating or managing cyber risk should be taking action to address this issue.

- **Basic Narrative**
  - **If** there will be a fully functional [**Cryptographic-Relevant Quantum Computer**] (CRQC), **then** bad actors will misuse it and hack critical data infrastructures
    - **Variation**: Bad Actors can already collect data today and decrypt it in the future.
    - **Addition:** To prepare against this risk, it becomes necessary to fund research on [**Post-Quantum-Cryptography**] (PQC) and invest in PQC-infrastructure within companies and governments immediately.

Mosca, M. (2018). Cybersecurity in an Era with Quantum Computers: Will We Be Ready? IEEE Security & Privacy, 16(5), 38–41. https://doi.org/10.1109/MSP.2018.3761723

Mosca, M., & Piani, M. (2024). Quantum Threat Timeline Report 2024. Global Risk Institute. https://globalriskinstitute.org/publication/2024-quantum-threat-timeline-report/

Prefiguration Tech Race Risk

- **Shor's algorithm** Designed for QCs in 1997 to decrypt standard decryption algorithm (RSA-2048)
- **Modernization Risk** (Beck, 1986)
  - „It's a systematic threat to the global economy, and it's real enough that you definitely have to plan for it now." (Mosca cited in Mone, 2020)
- „**Quantum Race**"
  - technological development as an arms race
  - e.g. space race, atomic bomb, AI superiority

- Firstly, how long do you need your cryptographic keys to be remain secure? Denote this number by x, the *security shelf-life*. We may have $x = 0$ years for applications requiring only real-time security. Or maybe $x = 10, 20, 100$ years when protecting your personal health information, trade secrets, or national security information. The value of x is in general a personal or business or policy decision.
- Next, how long will it take to deploy a set of tools that are quantum-safe? Denote this number by y, the *migration time*. For example, we may have $y = 0$ years if this is simply a matter of deploying an auto-update that replaces AES-128 with AES-256 within a system fully controlled by a single vendor. However, we may have $y \geq 15$ years if it involves a relatively untested public-key encryption method that has to be adapted for a constrained environment with many players who must agree on a standard.
- Lastly, how long will it be before a quantum computer, or some other method, breaks the currently deployed public-key cryptography tools? Let z denote this number, the *collapse time*.

If $x + y > z$, we have a serious problem today [Mos13] , since information protected by quantum-vulnerable tools at the end of the next y years can be broken by quantum attacks in less than x years from then.

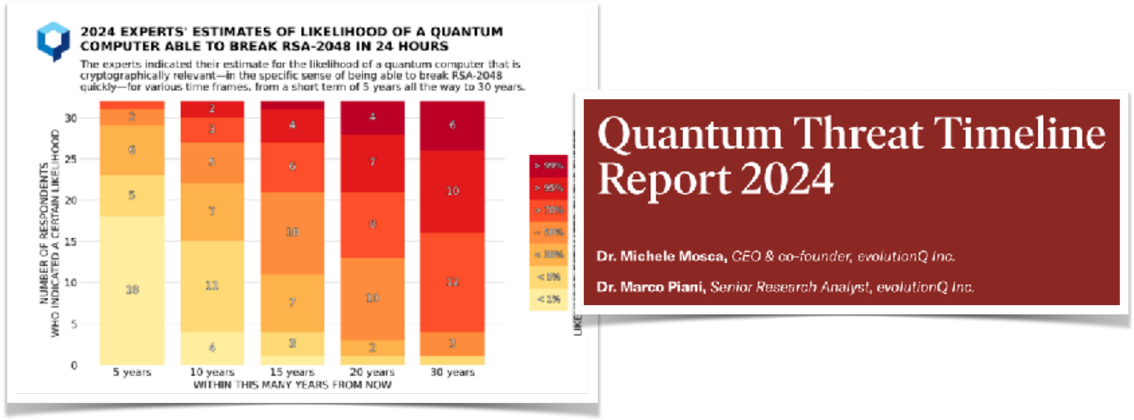
Shor, P. W. (1997). Polynomial-Time Algorithms for Prime Factorization and Discrete Logarithms on a Quantum Computer. SIAM Journal on Computing, 26(5), 1484–1509. https://doi.org/10.1137/S0097539795293172

Mone, G. (2020, Juli 1). The Quantum Threat – Communications of the ACM. https://cacm.acm.org/news/the-quantum-threat/

Beck, U. (1986). Risikogesellschaft: Auf dem Weg in eine andere Moderne (1. Aufl.). Suhrkamp Taschenbuch Verlag.

Configuration Cryptocalypse (Lindsay, 2020)

- **Bad Actor Narrative**
  - Responsibility gets shifted down the innovation chain
  - Basic research > Engineering > mischievous User



- **Hype**
  - Fear mongering
  - Surveys that ask „when does it happen“, not „if“ or „how likely is it“?
  - *Harvest Now, Decrypt Later* (HNDL attack)



- **Call to Action** Act now or you will regret later
  - „Assess your risk“
  - „Learn how to make your data Quantum Safe with [**Post-Quantum-Cryptography**]
  - Policy level: „Fund PQC now to protect national / global economy“

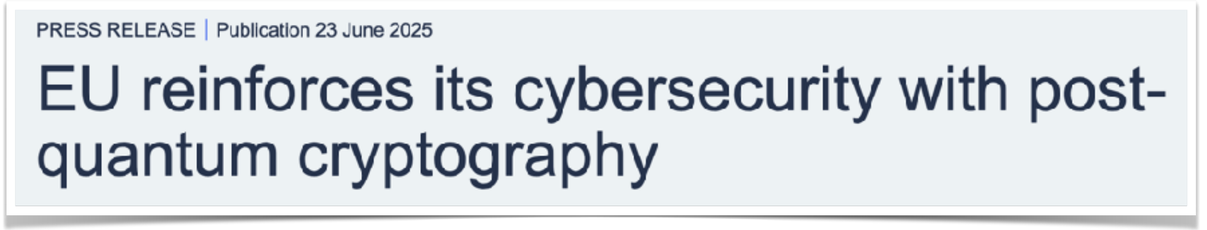
Lindsay, J. R. (2020). Demystifying the Quantum Threat: Infrastructure, Institutions, and Intelligence Advantage. Security Studies, 29(2), 335–361. https://doi.org/10.1080/09636412.2020.1722853
Mosca, D. M. (2024). Quantum Threat TImeline Report 2024.

Refiguration Policy follows fear mongering

- „While the **full range of applications** of quantum computers **is still unknown**, (…) quantum computing also poses significant risks to the economic and national security of the United States. Most notably, a quantum computer of sufficient size and sophistication — also known as a [**cryptanalytically relevant quantum computer (CRQC)**] — **will be capable of breaking much of the public-key** cryptography used on digital systems across the United States and around the world.“ (The White House, 2022)
  - Why not a moratorium?


AUGUST 13, 2024

FACT SHEET: Biden-Harris Administration Continues Work to Secure a Post-Quantum Cryptography Future


PRESS RELEASE | Publication 23 June 2025

EU reinforces its cybersecurity with post-quantum cryptography

European Commission. (2025). EU reinforces its cybersecurity with post-quantum cryptography | Shaping Europe's digital future. https://digital-strategy.ec.europa.eu/en/news/eu-reinforces-its-cybersecurity-post-quantum-cryptography
The White House. (2024, August 13). FACT SHEET: Biden-Harris Administration Continues Work to Secure a Post-Quantum Cryptography Future | OSTP. The White House. https://bidenwhitehouse.archives.gov/ostp/news-updates/2024/08/13/fact-sheet-biden-harris-administration-continues-work-to-secure-a-post-quantum-cryptography-future/

Conclusion So what?!

- **Should I act as a policy maker?**
  - The risk is higher than the investment costs, you have to act (Possati, 2023)
- **Artificial Demand?**
  - "According to a long-running joke (or not-quite-joke) in our field, one of the central applications of quantum computing will be to create demand for quantum cryptography!" (Aaronson, 2018)
- **Technology Mafia**
  - „Just look at your beautiful global trade system. It would be a shame, if something happens to it, no?“



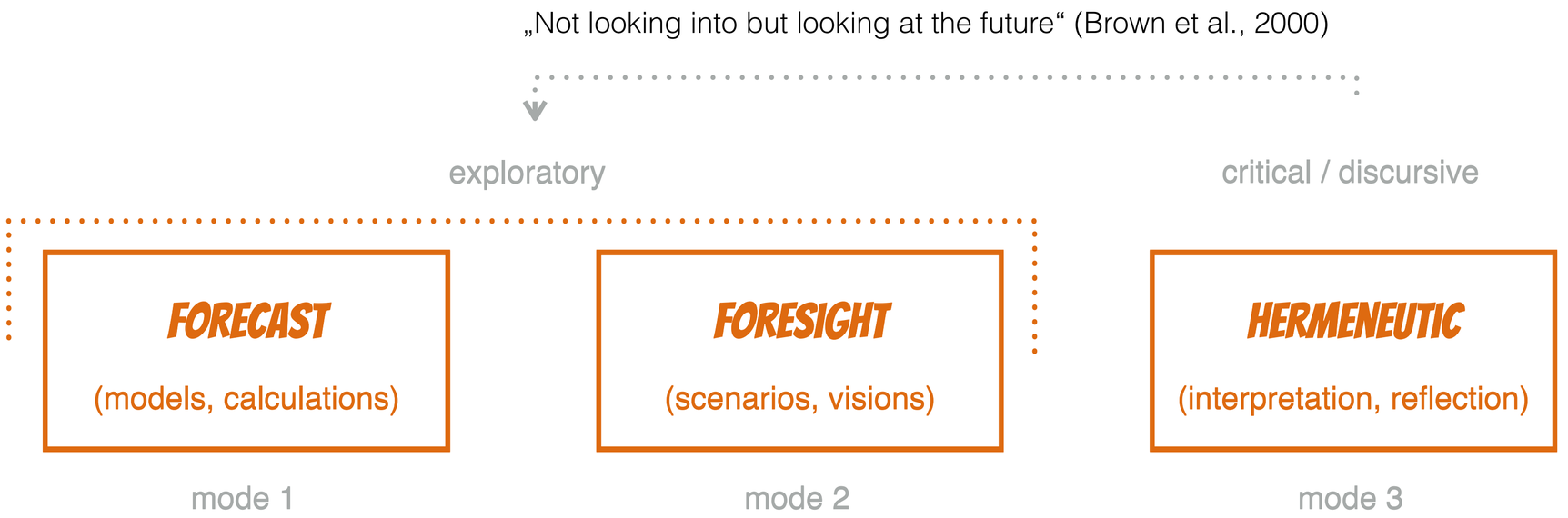
Critical Hype Studies

- **Becoming aware of the construction of Technofutures**
- Narratives, contexts, purpose, resonance, and more.
- Sam Altman to the question:
  - „What keeps you up at night?“
  - „There’s a bad guy gets [**superintelligence**] and misuses it before the rest of the world has a powerful enough version to defend.“



Reflecting Futures

- Understanding the role of futures in our society and how they impact / shape policy regulations



Grunwald, A. (2016). The hermeneutic side of responsible research and innovation. ISTE; Wiley.
Grunwald, Armin. 2014. „Modes of Orientation Provided by Futures Studies: Making Sense of Diversity and Divergence“. European Journal of Futures Research 2(1). doi: 10.1007/s40309-013-0030-5.
Brown, Nik, Brian Rappert, und Andrew Webster, Hrsg. 2000. Contested Futures: A Sociology of Prospective Techno-Science. Aldershot, England; Burlington, VT: Ashgate Publishing Limited.

Conclusion & Take Away

Different ways of studying Futures

- **Forecast**
  - Extrapolates on current or past events and attempts to predict what might happen
- **Foresight**
  - Develops alternative visions of the future to make us think about different pathways
- **Hermeneutic**
  - Analyses the role of futures in our society, how they attribute meaning to change and for what purpose and whose interest

Take Aways

1. **There is no Future**
   - There is only the present. All that we have are images of the future.

2. **Images of the Future guide our action in the present**
   - Although images of the Future are fictional, they are also powerful.

3. **While the Future does not exist yet, it can be designed**
   - Designing the Future starts with designing the images that guide our actions.

Xie Xie !

Wenzel Mehnert

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