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Six models for thinking about our future

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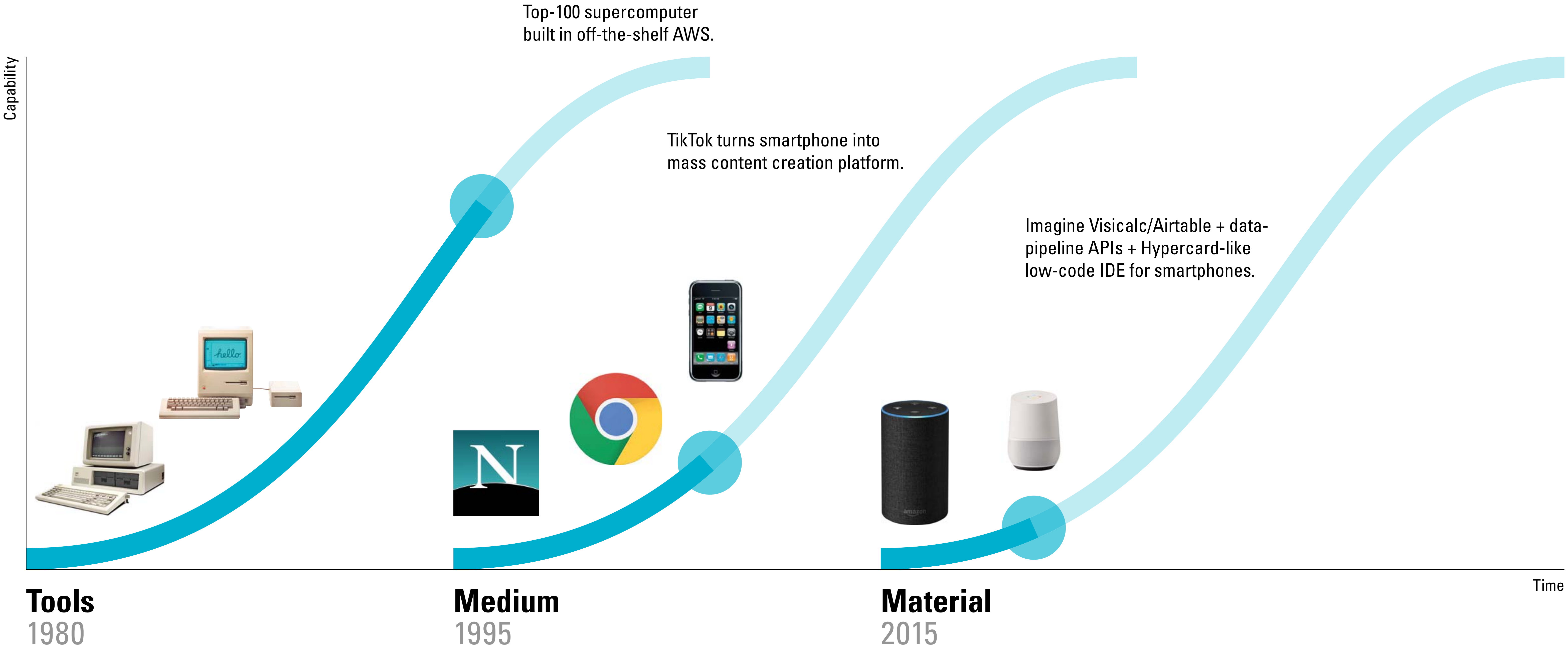
Technology adoption follows "learning curves"; each of these "digital transformations" is still evolving.



Cf. Google chief economist Hal Varian on "combinatorial innovation".

The current wave has several facets, but no standard name;
we might use **"Metaverse"*** as short-hand for the combination of:

- Ubiquitous sensing (physical + virtual data gathering)
- Smart, connected products, e.g., IoT + IIoT (bandwidth rising)
- Edge + cloud computing (cost drops; scales on-demand)
- Digital threads (location + provenance for everything)
- Statistics + AI, e.g., ML, DL, CV, NLP (predictive models)
- Digital twins of everything + everyone (learning engines)
- AR glasses, plus overlays for everything + everyone
- Distributed ledgers

*Cf. Neal Stephenson, "Snow Crash," 1992; William Gibson, "Neuromancer," 1984; also Daniel Suarez, "Daemon," 2006.

Four eras of data: Shifting from scarce to abundant heralds new ways of doing science.

1. **Era of data scarcity**—origins of data science, early 19th century	2. **Era of small data sets**—classical statistics developed, late 19th century	3. **Era of mass-produced data**—late 20th century, "macroscopes" emerge	4. **Era of measuring everything**—early 21st century, "macroscopes" become ubiquitous
Data sets were few + infrequent (e.g., census)	Individual scientists working independently	Teams of scientists using computer-controlled instruments	A few large organizations assemble immense data sets (e.g., Google, NSA)
Based on manual sampling	Collect few samples and make many measurements (noise becomes a problem)	Automatic sampling, producing digital data	Millions of measurements of millions of things (much data goes unused)
Producing analog data	Questions remain simple but important (e.g., Which treatment is better?)	Multivariate analysis becomes important	Computing power and band-width gate analysis
Applied to simple but important questions	Correlating an effect with change in a single variable becomes standard of proof	Number and complexity of questions increases	Machine learning comes into its own (overfit becomes a risk)

Cf. Jeff Leek and Brad Efron, "The Four Eras of Data," (2016).

Stages of data-enabled products

New Kind of Nature

Autonomous / self-driving
Semi-autonomous
Model driven / data animated
Data driven
Data informed
Data aware

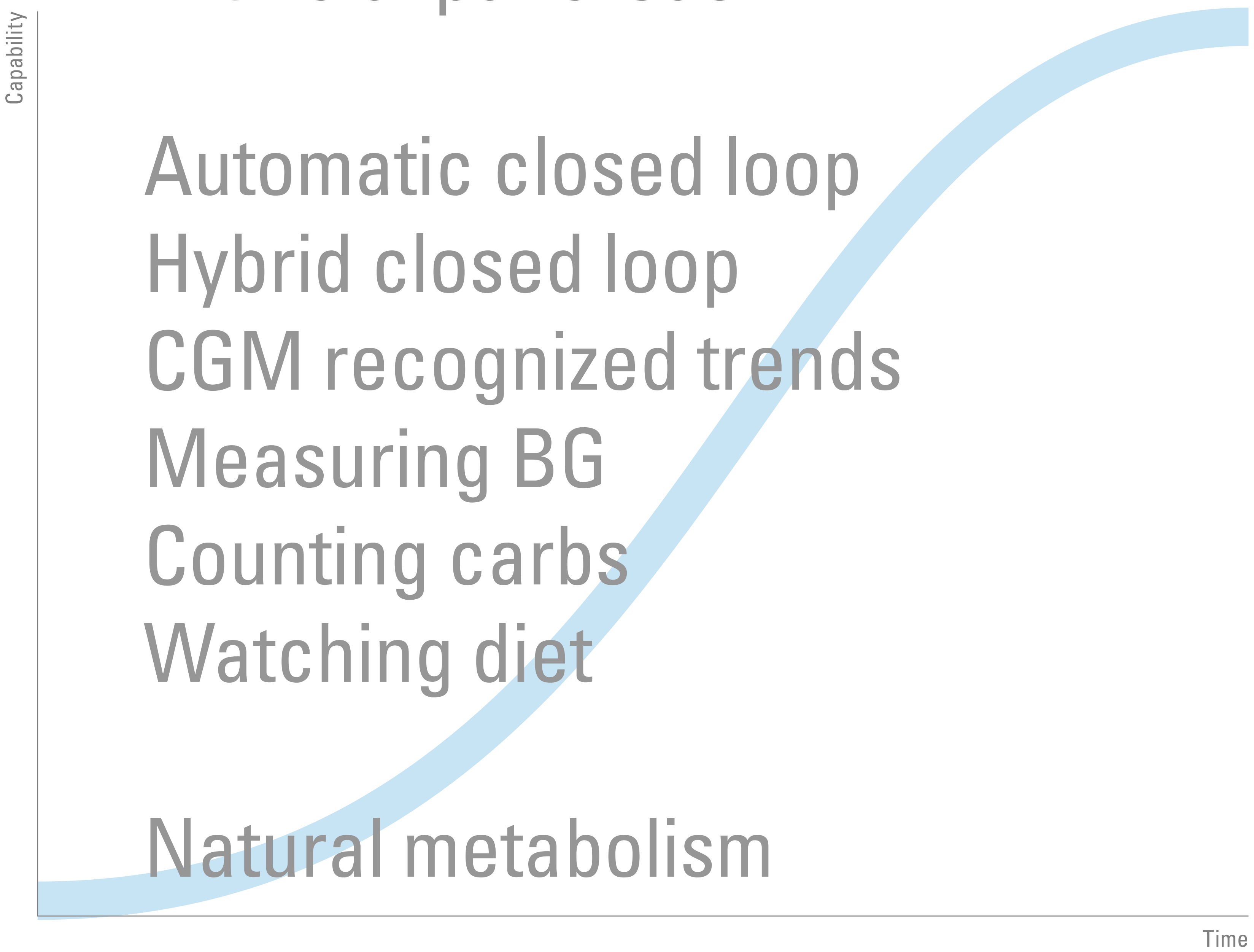
State of nature

For example:

Artificial pancreas

Automatic closed loop
Hybrid closed loop
CGM recognized trends
Measuring BG
Counting carbs
Watching diet

Natural metabolism



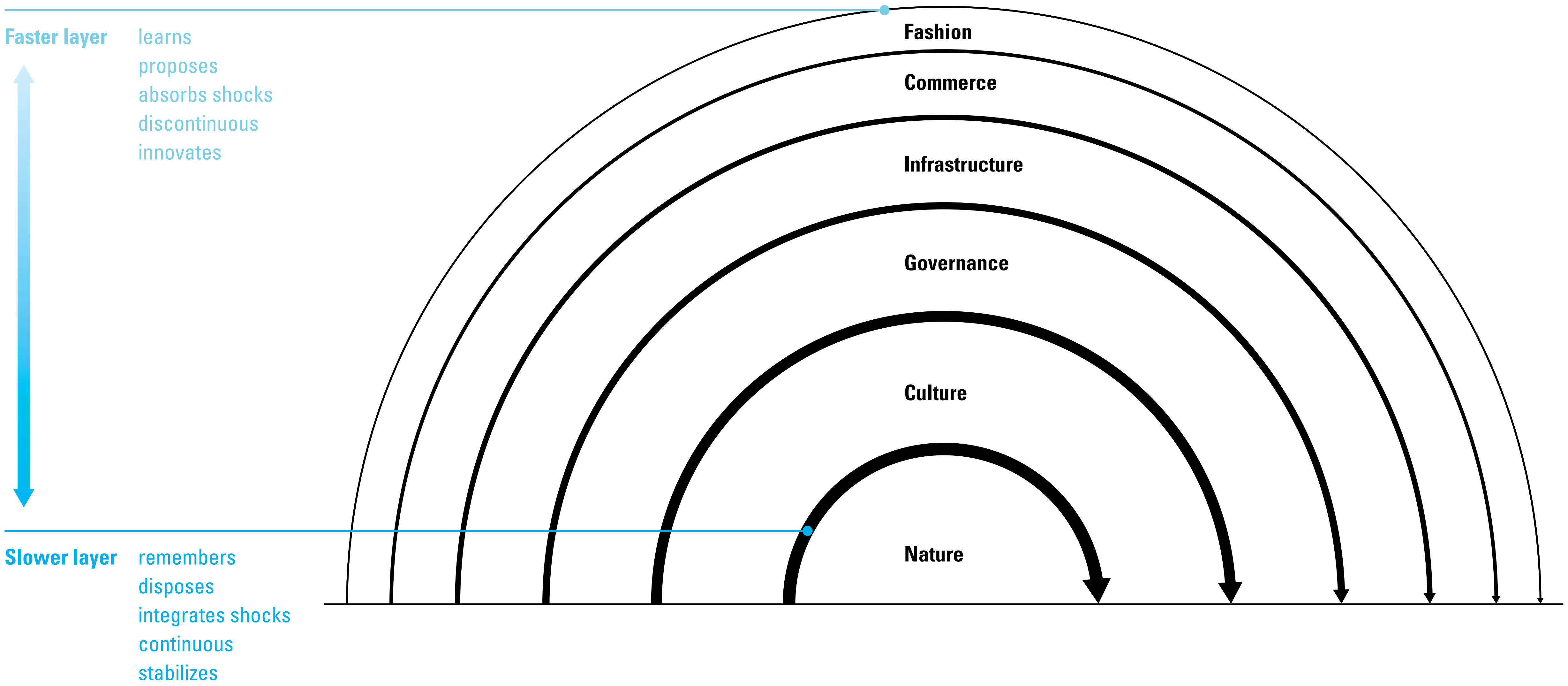
What are our goals? and thus what will we conserve? for whom?

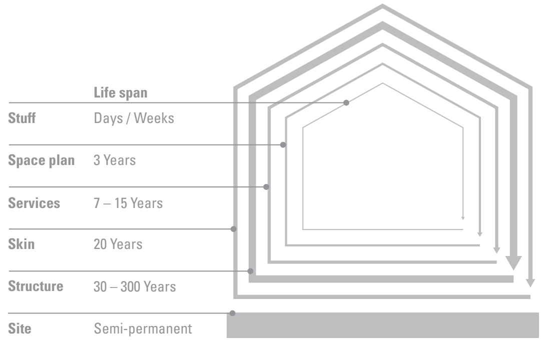
(Choices need not be exclusive.)

Prosperity	Stability	Happiness	Health
Surveillance Capitalism	**Confucian Big Brother**	**Digital Socialism**	**Quantified Self**
Facebook + FICO	Social Credit Score	A modern CyberSyn	Ubiquitous testing + feedback
Sales machine	Control machine	Planning machine	Experiment machine

Cf. Suzanna Zuboff (2018); Evgeny Morozov (2014) + Eden Medina (2011).
https://www.newyorker.com/magazine/2014/10/13/planning-machine

Systems evolve at different rates, through linked “pace layers”.





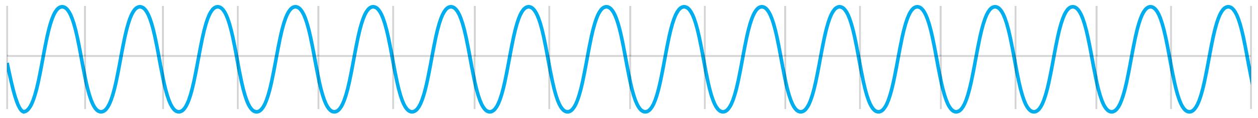
Cf. Stewart Brand on “Pace Layers” in “How Buildings Learn” (1994), adapted from Frank Duffy’s “Shearing Layers”.

Organizations need mechanisms for evolving both quickly + slowly.

Faster
More Volatile

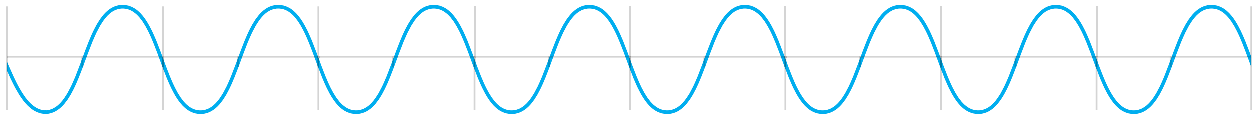
Form

User interfaces through which people interact with products and services—where structure is articulated...



Structure

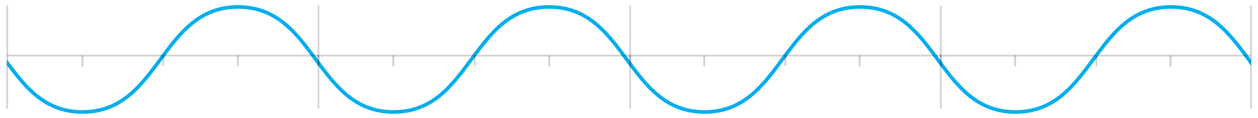
The relationships between particular semantic elements that will inform end products and services.



Designers tend to operate in these layers

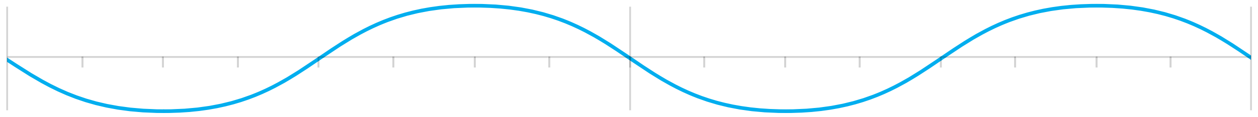
Governance

How the organization shapes itself to implement its strategy. The rules and means of engagement...



Strategy

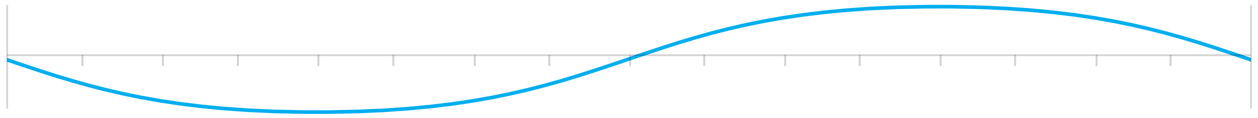
How the organization aspires to do things differently to strive towards its purpose; how it's going to compete.



Slower
More Stable

Purpose

Why the organization, team, or product exists.
An aspiration, not a goal since it can never be achieved...



Cf. Jorge Arango, "Living in Information," 2018.

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