Principles of Management

Angel Marchev

Evolution of the Management Theory

1. Ancient pre-cursors
2. Managerial thought in the pre-industrial societies.
3. Industrial Revolution and the Development of Managerial Thought.
4. Classical Theory of the Management.
    1. Administrative School of Management.
    2. School of Scientific Management.
5. Behavioral management theories.
    1. The School of Human Relations.
    2. Behavioral School
6. Quantitative approach to management.
    1. Operations research
    2. System theory & Cybernetics
    3. Normative reasoning Decision Approach
    4. Information theory
7. Organizational theory
    1. Process approach to Management.
    2. Situational approach to management.
8. Management Gurus

MANAGEMENT UNTIL THE INDUSTRIAL REVOLUTION

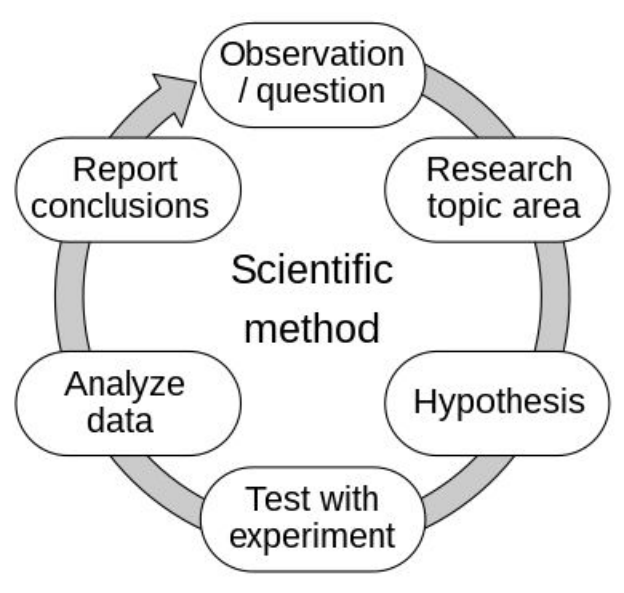
- Background (formulation of goals)
- https://www.youtube.com/watch?v=2xtI1t-VVDA (16:00-19:30)

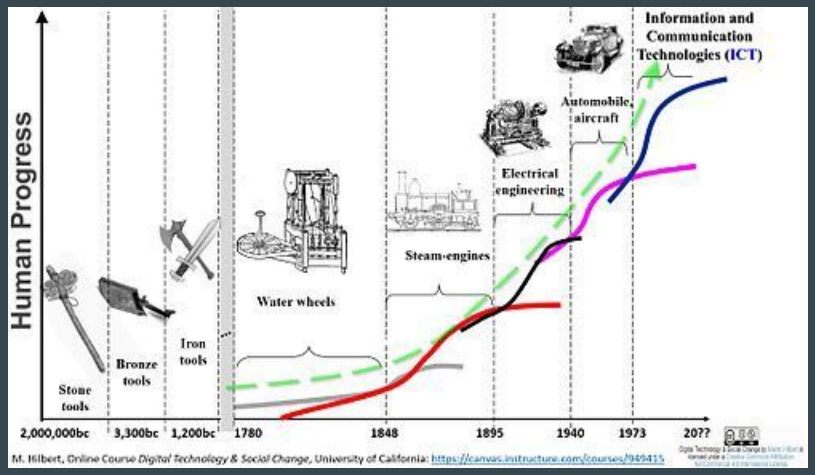
-
https://www.youtube.com/watch?v=ypEaGQb6dJk (6:00 – 9:30)

The management practice is known to be as old as the organization.

MANAGEMENT UNTIL THE INDUSTRIAL REVOLUTION

- **The scientific method**

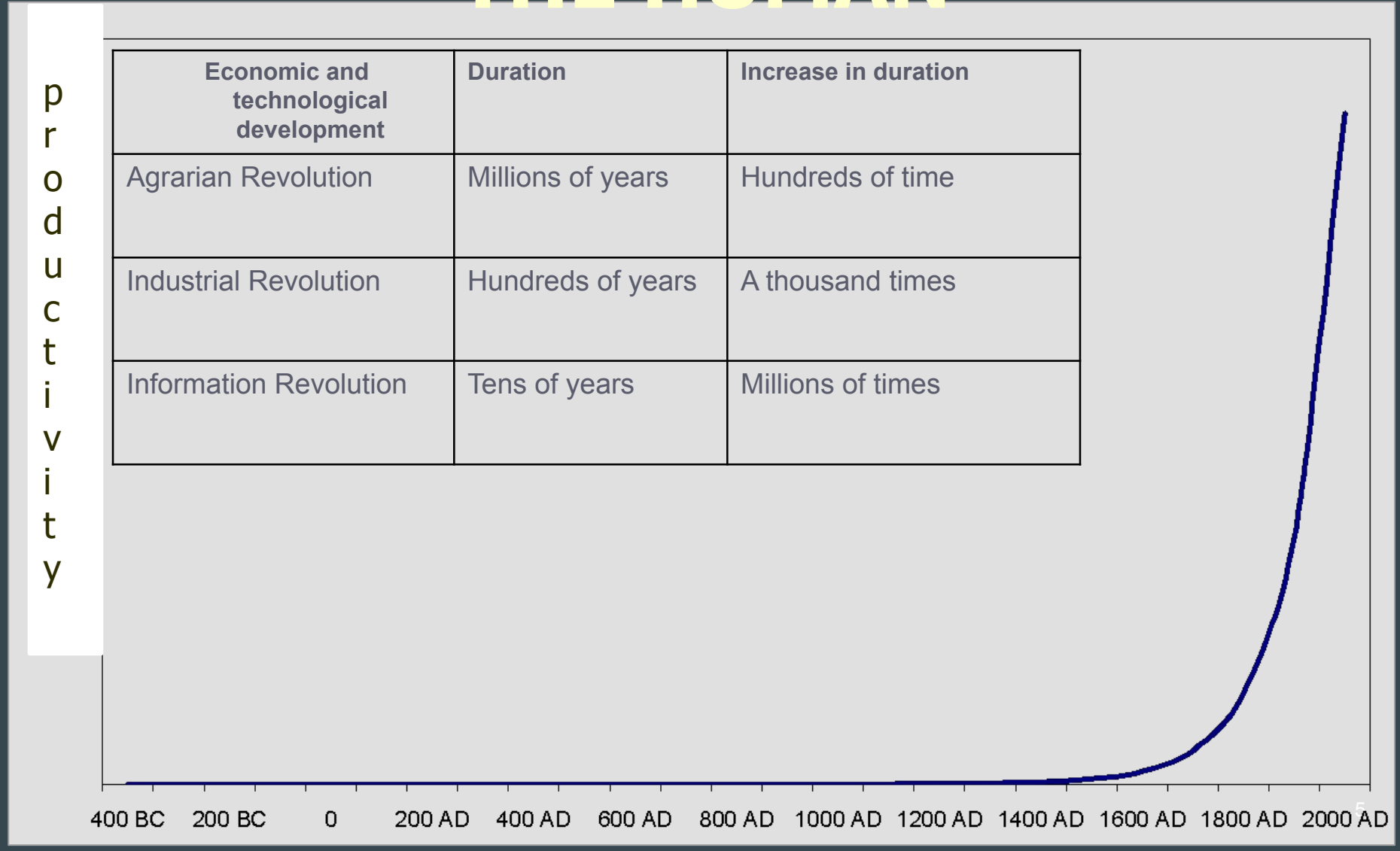




- The idea of management, as a scientific discipline, profession and research area is relatively new. Through the Industrial Revolution management has become a separate area of human knowledge

ECONOMIC DEVELOPMENT OF THE HUMAN

Economic and technological development	Duration	Increase in duration
Agrarian Revolution	Millions of years	Hundreds of time
Industrial Revolution	Hundreds of years	A thousand times
Information Revolution	Tens of years	Millions of times



Complete the TRUTH

Entity A has received a letter from entity B.
In the letter it says: “I received the hand from entity C and destroyed it”

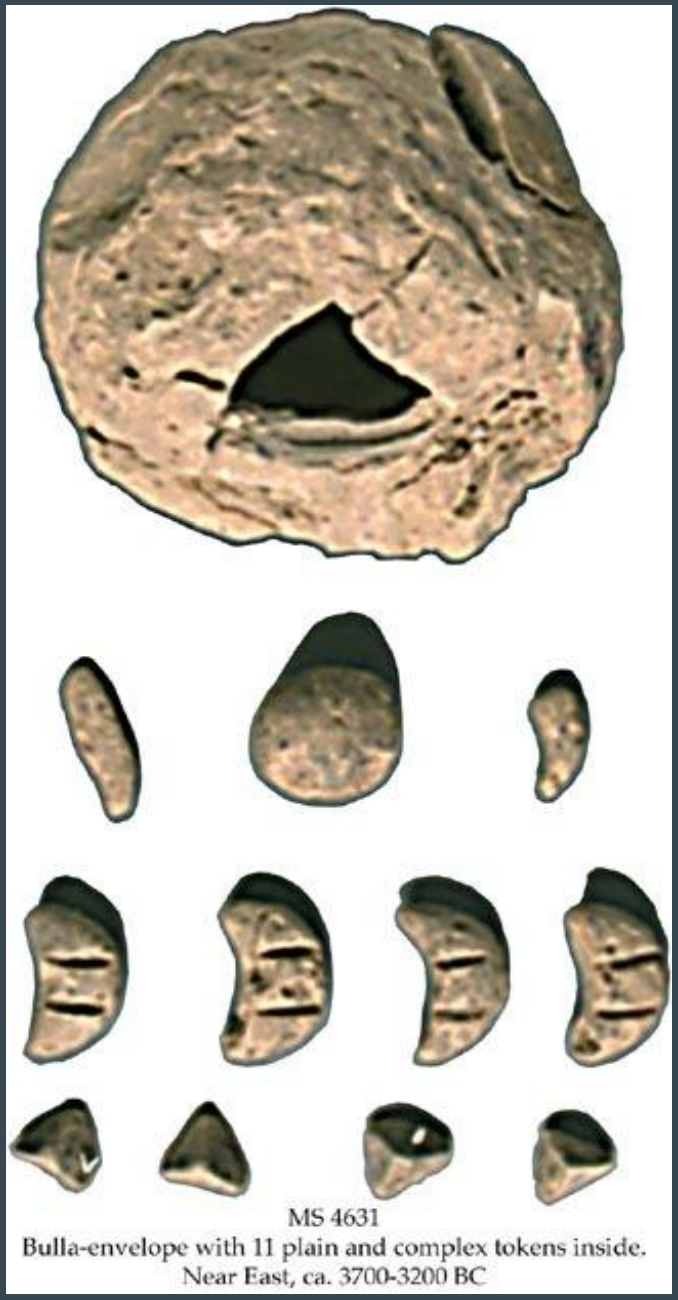
Only Yes/No questions…

Practice the scientific method

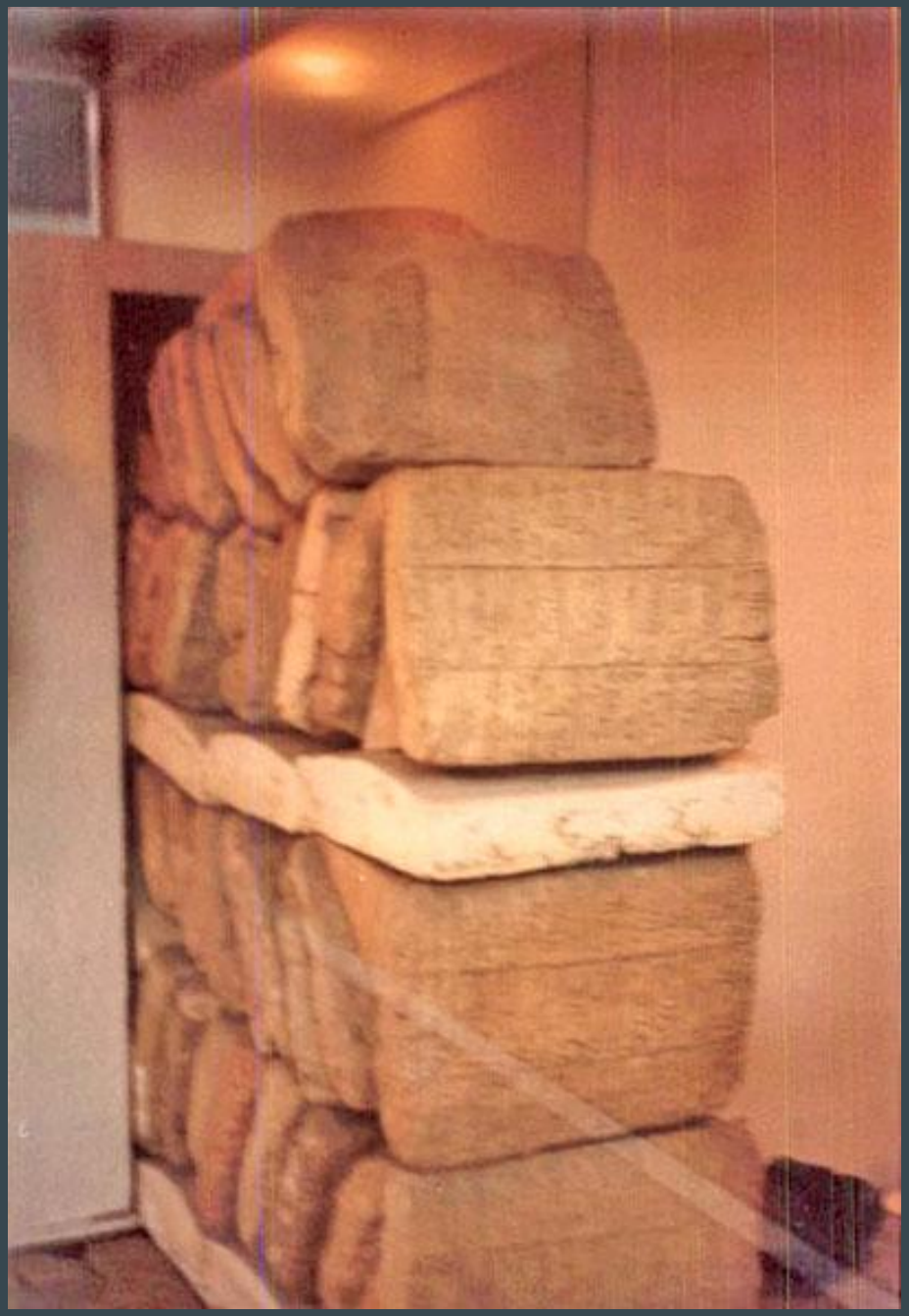
Babylon

Ur

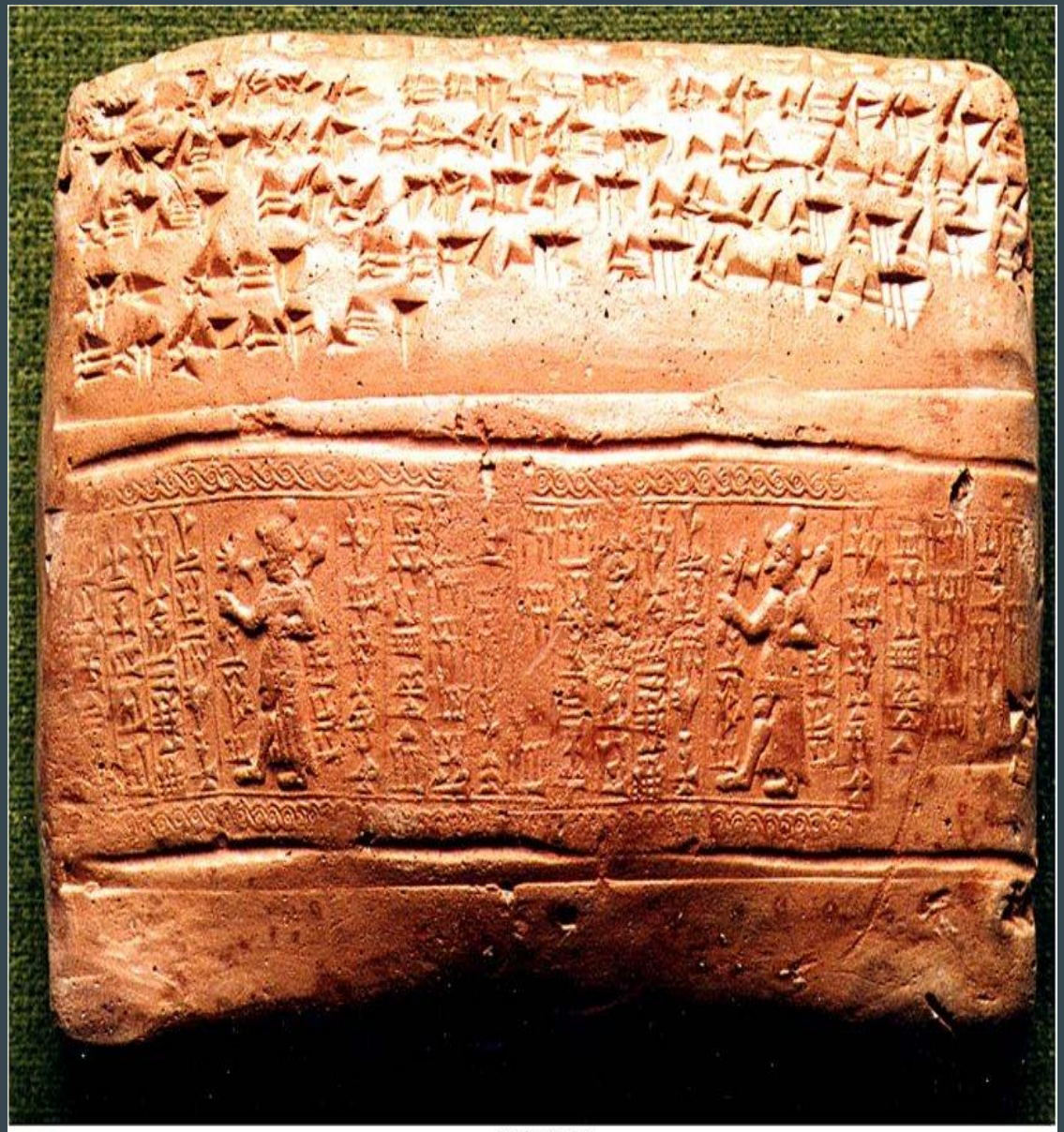
MS 4638
Bulla-envelope with 1 plain token inside.
Near East, ca. 3700-3200 BC



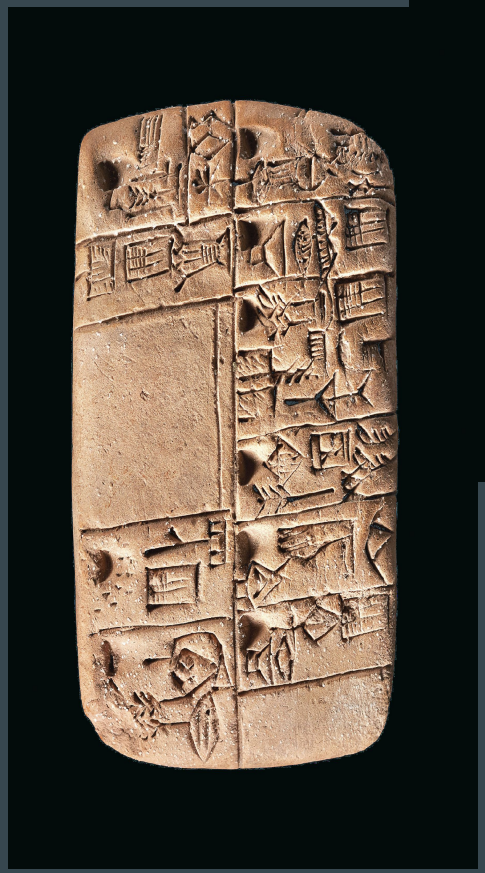
MS 4631
Bulla-envelope with 11 plain and complex tokens inside.
Near East, ca. 3700-3200 BC




corbis



MS 1955/1
International judgement made before Initeshshub, King of Carchemish and Shaushgamuwa King of Amurru.
Rollseal depicting the deity Sharruma advancing left, holding a double axe and a sceptre.
Carchemish, Syria, 1250-1240 BC.



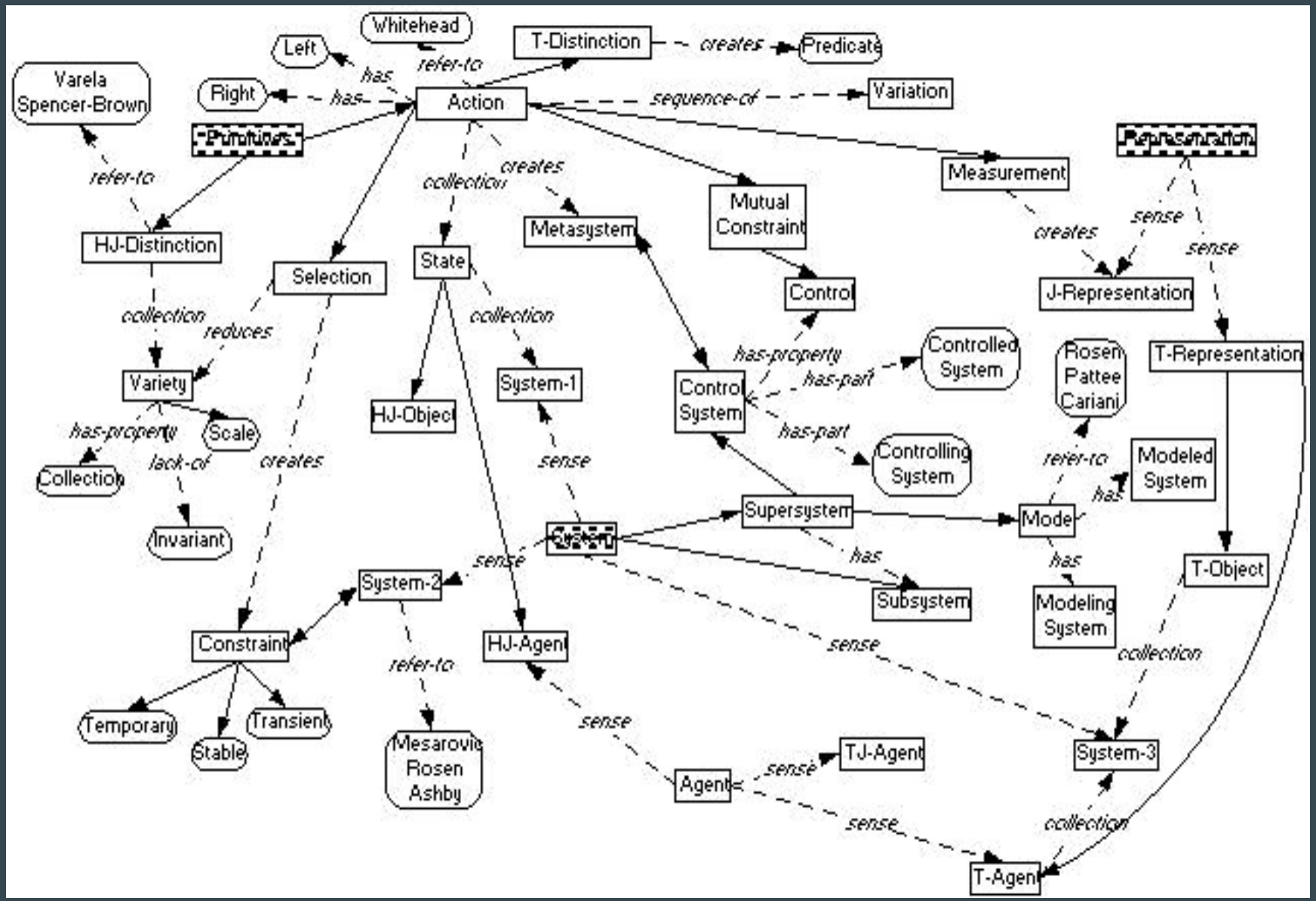
What is the name of the Trader`s daugther today? http://bit.ly/daily-quiz

Make a registration for Chat.OpenAI.com

Semantic network Assignment

https://basaga.org/basaga_files/semnet/index_en.html

http://pespmc1.vub.ac.be/SYSCONC.html

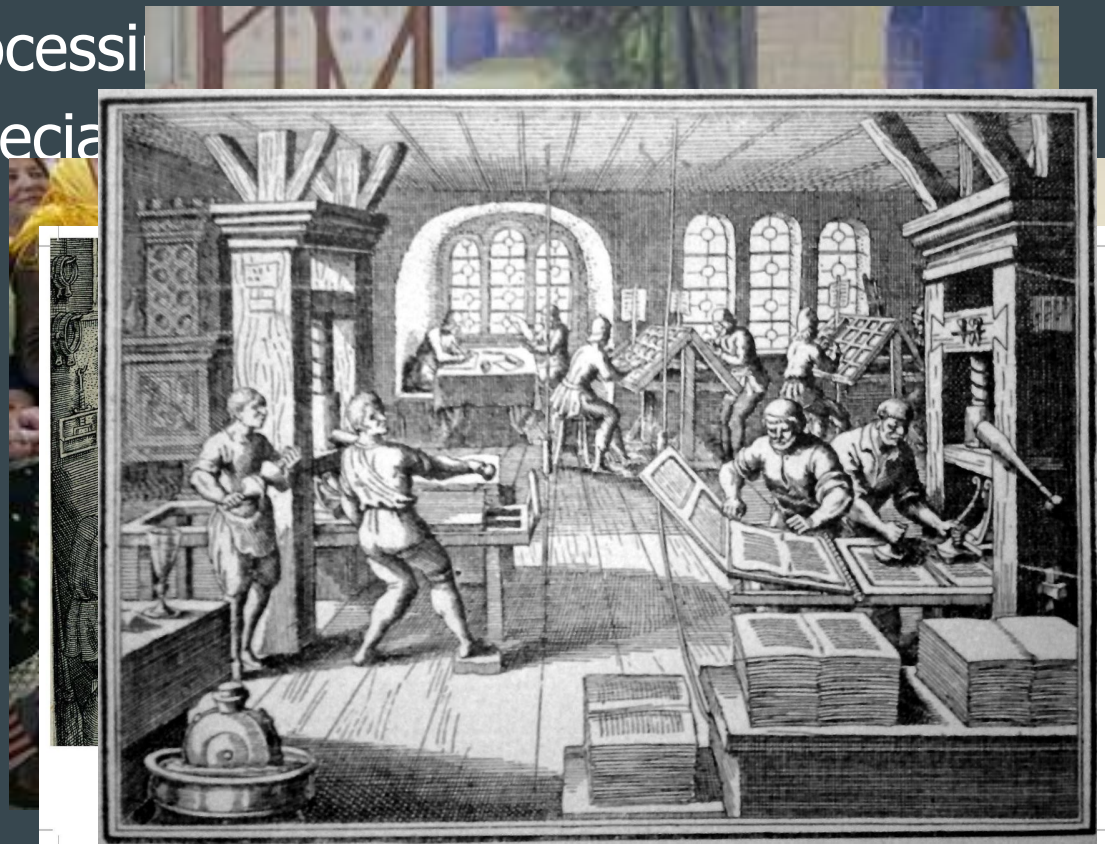


The Inevitable Transition From Scholasticism to Gamification

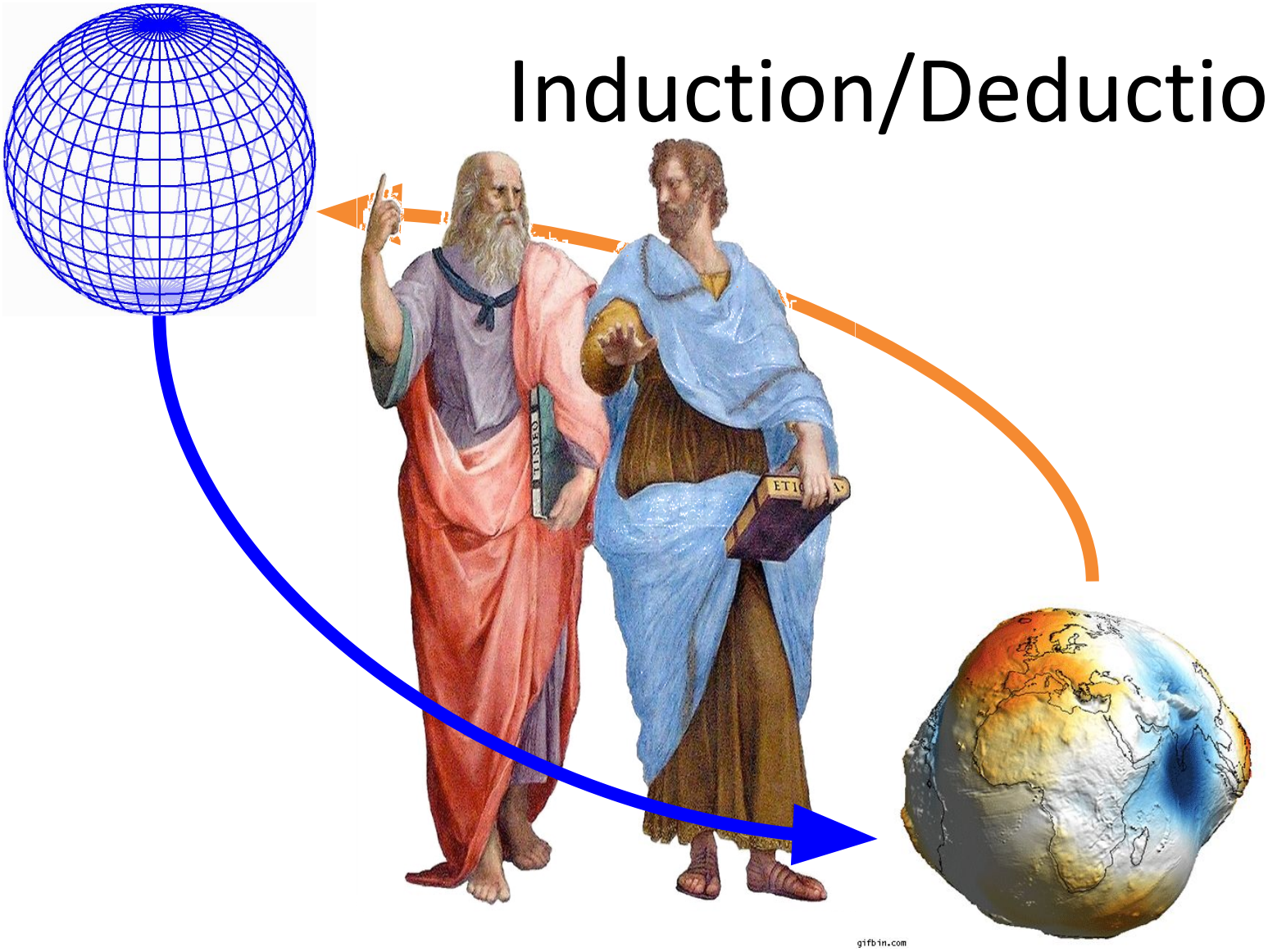
MANAGEMENT UNTIL THE INDUSTRIAL REVOLUTION

- Primitive organization
- https://www.youtube.com/watch?v=Wl1R8Y03714
- https://www.youtube.com/watch?v=-iB0B8J-yxE
- From Crops picking to Processi
- From Manual labour to specia
- From Simple manufacture

- Coordination
- Division of labour
- Specialization (incl. tools)
- Hierarchy
- Mass products

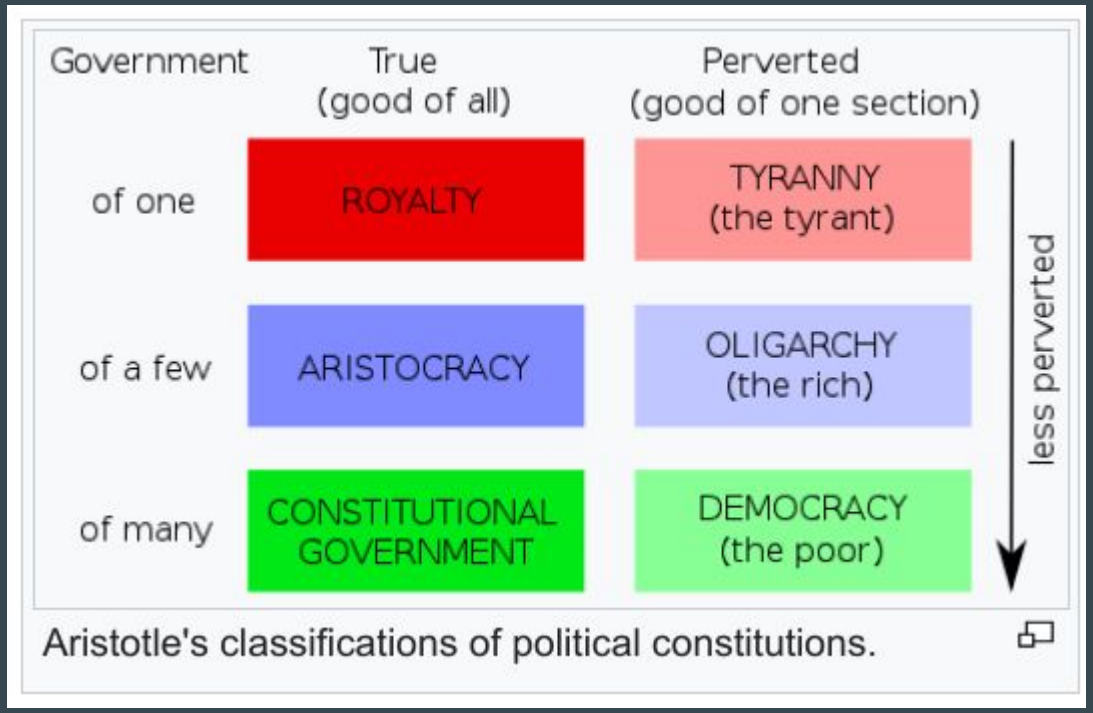


Induction/Deduction



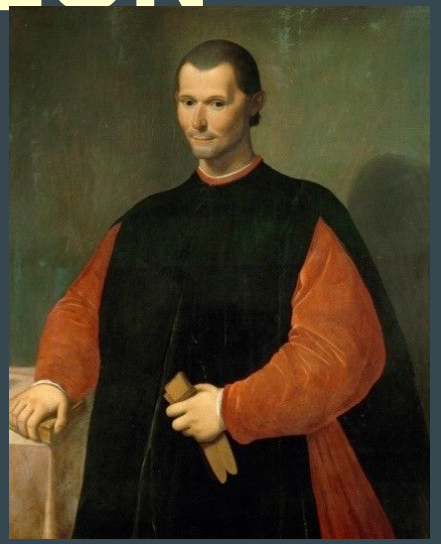
MANAGEMENT UNTIL THE INDUSTRIAL REVOLUTION

- Plato and Aristotle
  - Deduction & Induction
  - Government, private property, trade/retail, origin of money, interest (***Politics***)
  - Eudaimonia - ***Nicomachean Ethics*** (Ἠθικὰ Νικομάχεια)



Aristotle's classifications of political constitutions.

MANAGEMENT UNTIL THE INDUSTRIAL REVOLUTION



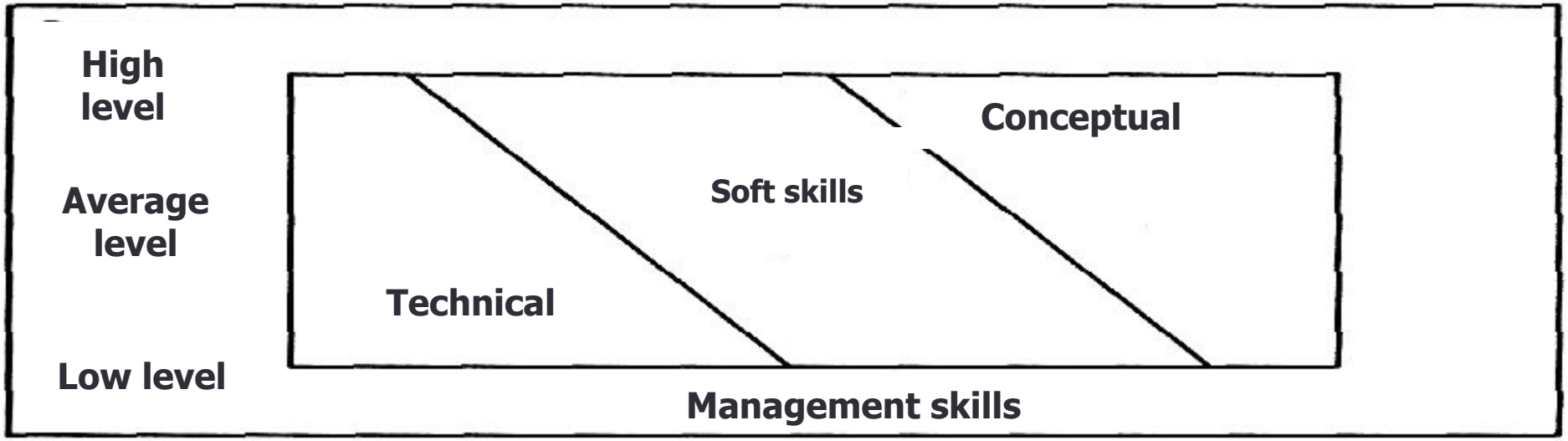
- Niccolò Machiavelli
  - "Reflections on the first decade of Titus Livius"
  - "The Prince" (1513)
- Historical Context: Renaissance thinker.
- Core Principles: Realism, power dynamics, and political pragmatism.
- Contributions to Management:
  - Leadership: Advocated for adaptability, decisiveness, and the importance of appearance in leadership.
  - Strategy: Emphasized the significance of understanding the terrain (market or operational environment) and the use of strategic flexibility.
  - Organizational Politics: Introduced the concept that personal and political interests can influence organizational dynamics and outcomes.
- Legacy: Machiavelli's insights into human nature, power, and strategy have influenced modern management theories, particularly in areas of leadership, organizational behavior, and strategic planning.

Organization as a subject of Management

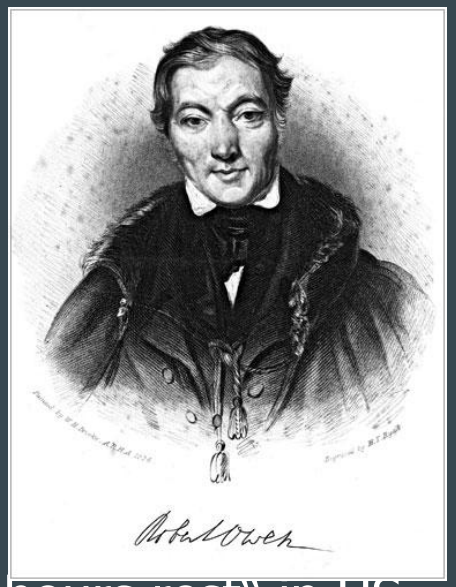
- A set of human elements and tools coordinated with a goal to achieve efficiently, objectives of common interest.
- Organization management helps to extract the best out of each employee so that they accomplish the tasks within the given time frame.
- Management is an (informative) purposeful way of influencing an organization's behavior to achieve predetermined goals.

AUTHORITY AND MANAGEMENT SKILLS

- A set of interrelated means of impact.
- Potential that is available to the manager.
- A relationship between the one who uses it and the one to where it is directed.
- The person to whom the power is directed needs to have good judgment

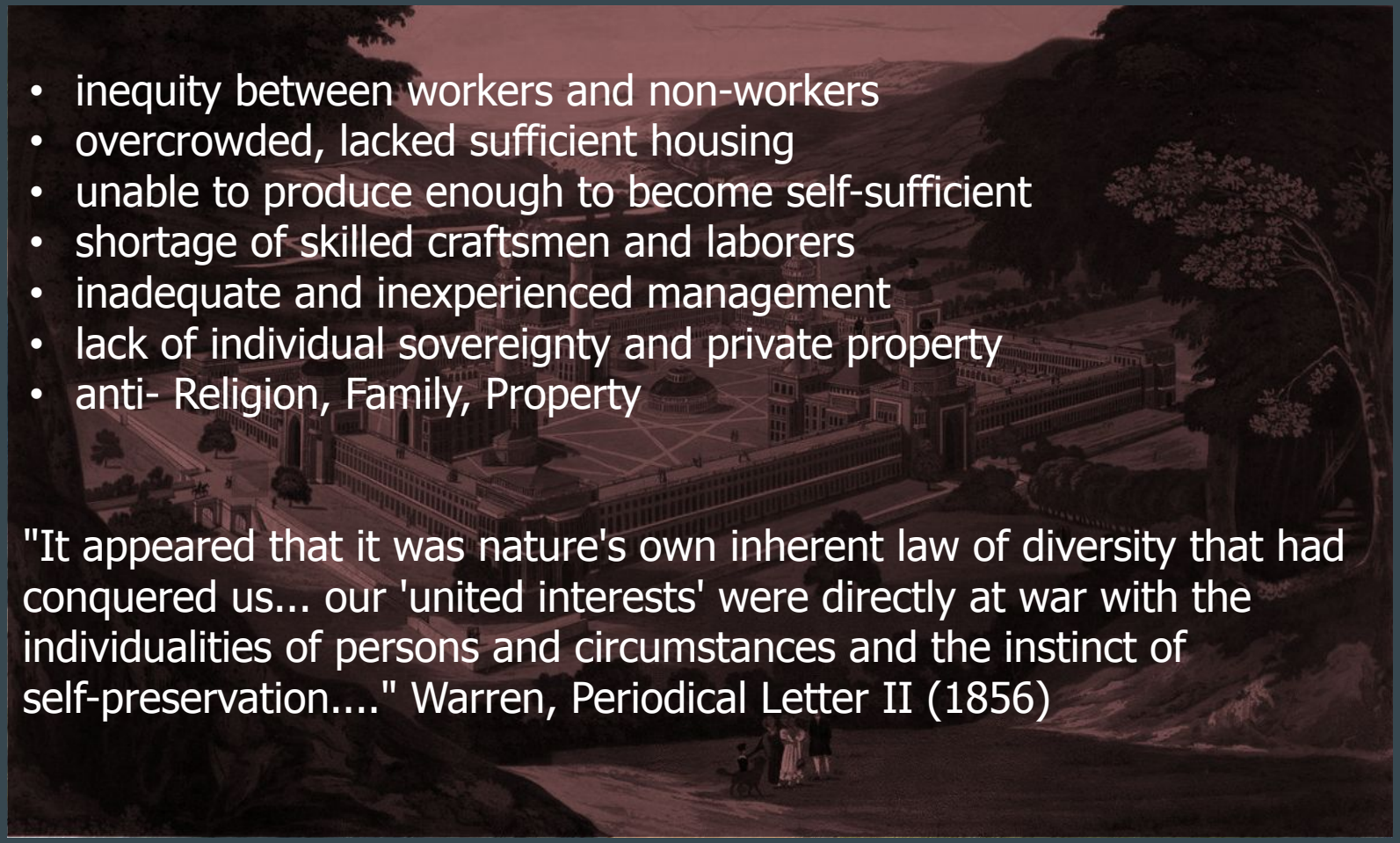


INDUSTRIAL REVOLUTION AND MANAGEMENT



- Robert Owen (1771 -1858)
  - Textile factory in New Lanark, Scotland
  - Meaning of Human Resources
  - "Too radical" for its time:
    - at least ten years of age;
    - maximum ten and a half hours of work (Europe);
    - "eight hours labour, eight hours recreation, eight hours rest" in US
    - improved working conditions;
    - housing for workers;
    - fair systems for rewarding the work of the worker.
  - New Harmony, Indiana (1824)
  - Pre-cursor of Human Resource Theories in Management

Utopian socialism

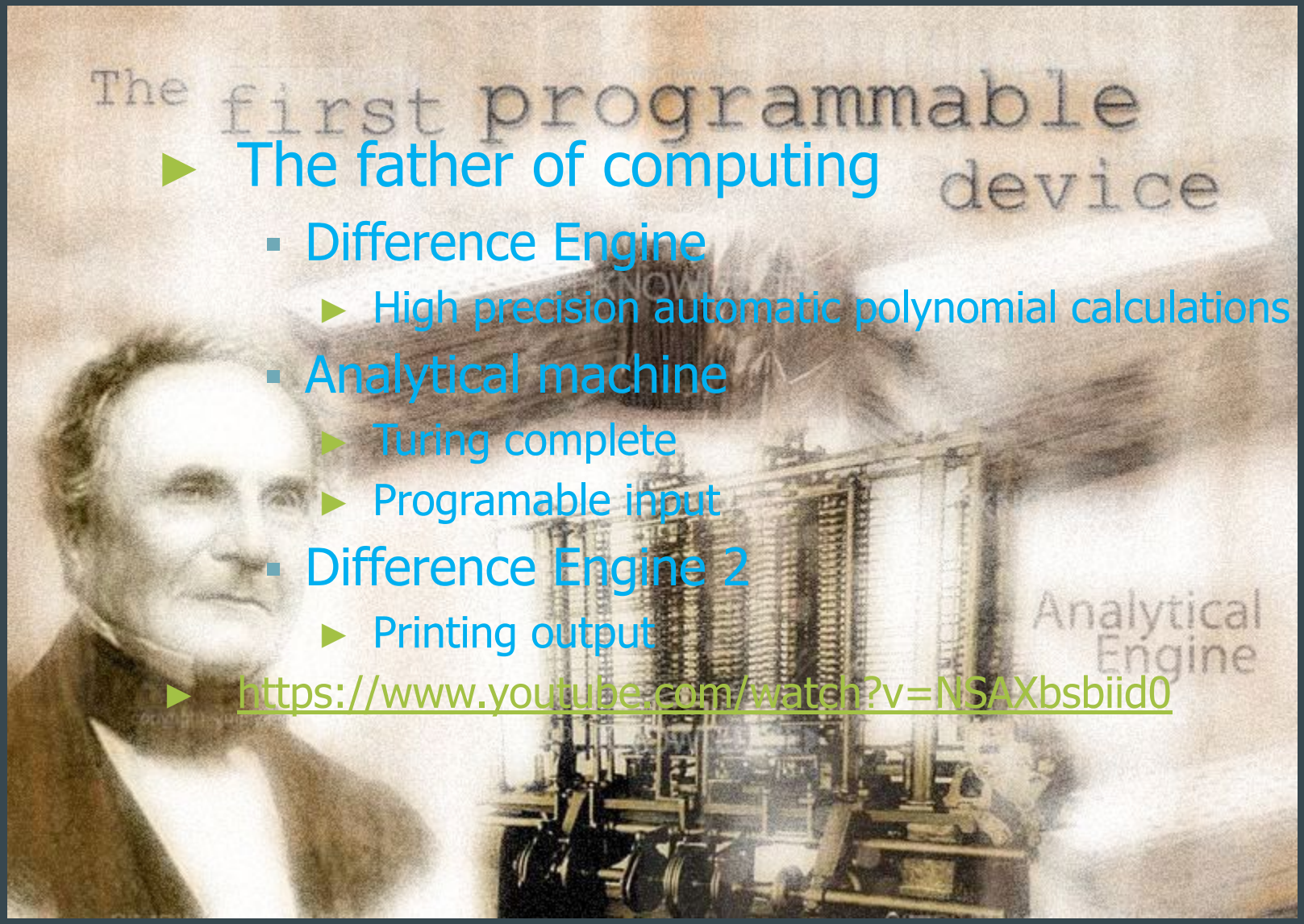


- inequity between workers and non-workers
- overcrowded, lacked sufficient housing
- unable to produce enough to become self-sufficient
- shortage of skilled craftsmen and laborers
- inadequate and inexperienced management
- lack of individual sovereignty and private property
- anti- Religion, Family, Property

"It appeared that it was nature's own inherent law of diversity that had conquered us... our 'united interests' were directly at war with the individualities of persons and circumstances and the instinct of self-preservation...." Warren, Periodical Letter II (1856)

INDUSTRIAL REVOLUTION AND MANAGEMENT

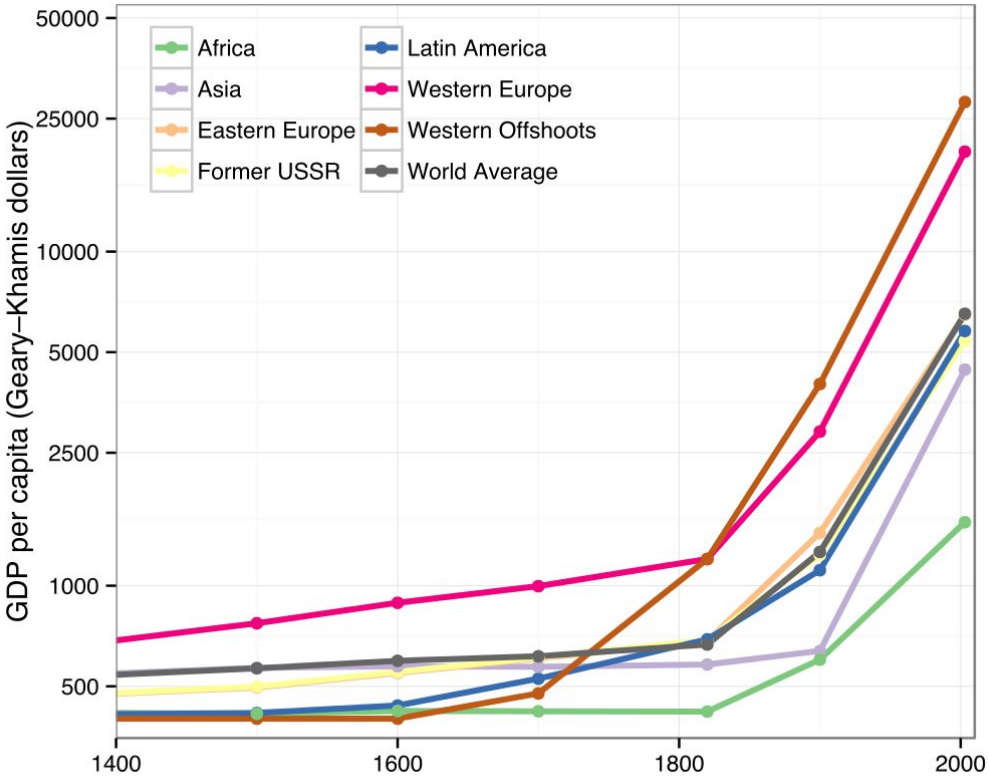
- Charles Babbage (1792 -1871)
  - Mathematical Principles in Management.
  - "On the Economy in the machinery and manufacturers"
    - "Babbage principle" – division of labour based on qualification
    - favouring the factory system
    - detailed breakdown cost structure
    - training as fixed (permanent) costs
    - standardisation of tasks
    - Efficiency and incentive (bonus system and profit-sharing plans)
  - Pre-cursor of quantitative approach in management.



- The father of computing
  - Difference Engine
    - High precision automatic polynomial calculations
  - Analytical machine
    - Turing complete
    - Programable input
  - Difference Engine 2
    - Printing output
- https://www.youtube.com/watch?v=NSAXbsbiid0

INDUSTRIAL REVOLUTION AND MANAGEMENT

- Ownership separation from management.
  - Sebastian Cabot, Joint Stock Company (1553)
  - Moscow company
  - East India Company
- Key technological developments:
  - Textiles
  - Steam power
  - Iron making
  - Machine tools
  - Concrete (portland cement)
- Labour & Social organization
  - Factory system
  - Standard of living
  - Literacy
  - Industrialisation



EVOLUTION OF MANAGEMENT AS A SCIENCE

- Prerequisites for new management attitude:
  - Second wave of Industrial Revolution
  - The USA is the largest single market in the world.
  - There was no state regulation in business.
  - The evolution has always been dependent on successes in other management related areas. Such as math, psychology, sociology, engineering and so on.
  - Has formed after a series of consistent steps forward (several approaches have emerged ideas, which are still used today)
  - The big changes at the beginning of the XX century are forces, that are outside the organization (environment)

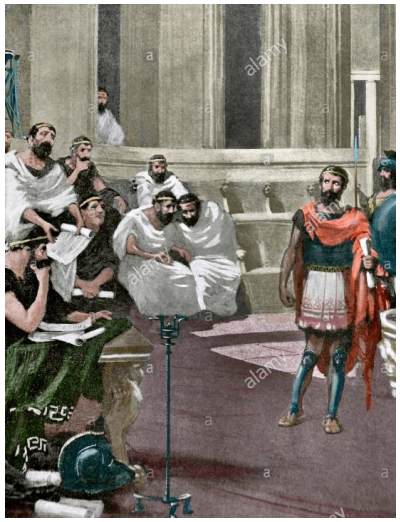
Share of Total World Manufacturing Output

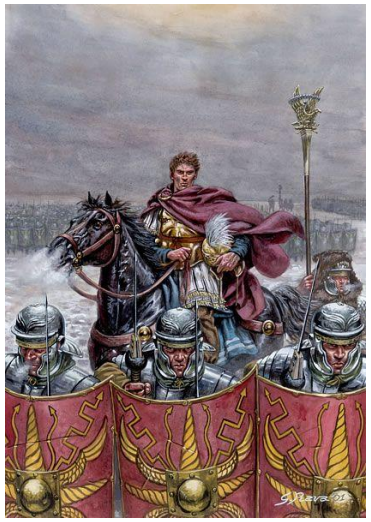
(Percentage)

	1750	1800	1860	1880	1900
Europe	23.2	28.1	53.2	61.3	62.0
United States	0.1	0.8	7.2	14.7	23.6
Japan	3.8	3.5	2.6	2.4	2.4
The Rest of the World	73.0	67.7	36.6	20.9	11.0

ADMINISTRATIVE SCHOOL IN THE MANAGEMENT

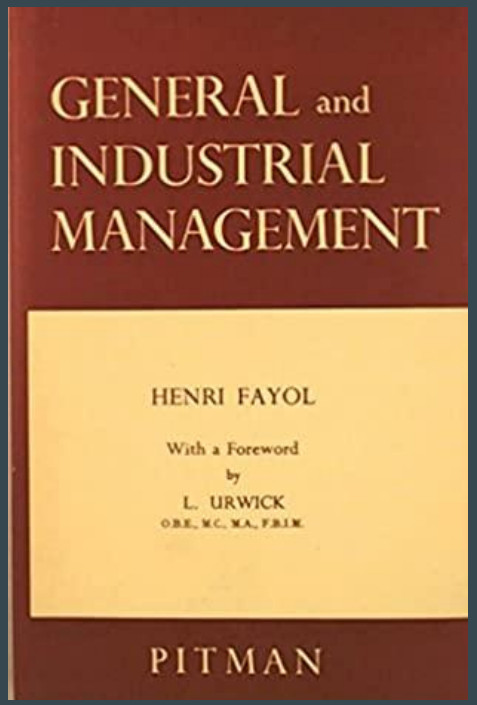
- Improving management of the organization as a whole.
- Focus on managers, not on workers
- Separate administration from other operations
- Strategic management

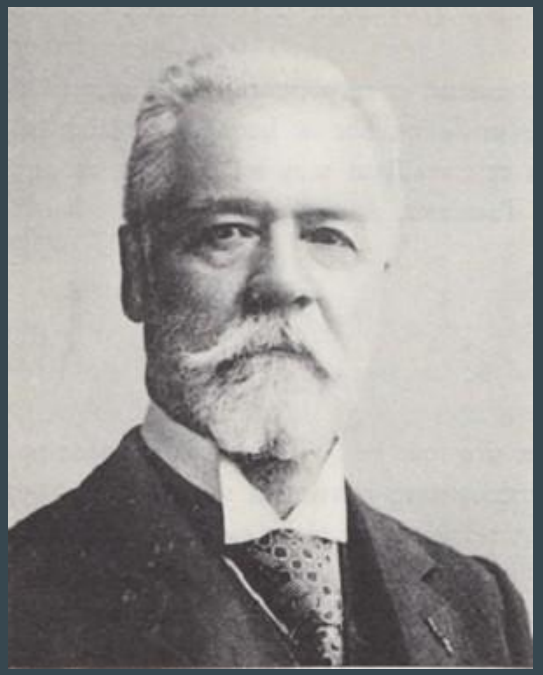




ADMINISTRATIVE SCHOOL IN THE MANAGEMENT

- Henri Fayol (1841 -1925)
  - "General and Industrial Management"
  - Universal principles of effective management.
  - Define basic management functions.
    - Planning
    - Organizing
    - Command
    - Coordinating
    - Controlling





① **Division of Work**
Specialization allows individuals to gain experience and continuously improve skills. This makes the individual more productive.

② **Authority**
Responsibilities and responsibilities for each task.

③ **Discipline to establish discipline**
Employees should follow orders. But there are two aspects to this: Employees follow their orders when management plays a role in good leadership.

④ **Unity of Command**
Each operator receives orders only from one correlator.

⑤ **Unity of Direction**
Those involved in the same kind of activity must have the same goal in a single plan. This is essential for ensuring unification and coordination in the enterprise. The unification of orders does not exist without the unification of command. But it does not necessarily come from command unification.

⑥ **Subordination of individual interest to the total profit of individual profits**
Management must always prioritize corporate goals.

⑦ **Principle of proper compensation (Remuneration)**
Although Fayol has analyzed many possibilities but pointed out that there is no such thing as a perfect system, wages are an important motivating factor.

⑧ **Centralization or decentralization.**
This depends on the quality of the staff and the conditions of the business.

⑨ **Scalar chain principle**
The hierarchy is necessary for command unification. Lateral communication is also fundamental. However, the caretaker must know that such communication is taking place. Hierarchical organization refers to the number of steps in the hierarchy from the highest authority to the lowest person in the organization. The hierarchical organization is too numerous and should not consist of too many steps.

⑩ **Order maintenance principle (Order)**
Both material and social order are needed. Material order minimizes waste of time and unnecessary handling. Social order is achieved through organization and election.

⑪ **Fairness principle (Equity)**
Business operations need a combination of kindness and justice. Good treatment of employees is important in achieving fairness.

ADMINISTRATIVE SCHOOL IN THE MANAGEMENT

- Max Weber (1864-1920)

"Bureaucratic administration means fundamentally domination through knowledge"

- "Ideal Bureaucracy": rationality against nepotism
- "The theory of social and economic organization"
- Principles of the rational bureaucracy
  1. Formulation of governance principles.
  2. Description of management functions.
  3. Integrated approach to managing any organization

Max Weber's Ideal Bureaucracy

1. A division of labor and specific allocation of responsibility based on functional specialization.
2. Exact hierarchical levels of graded authority.
3. A system of rules covering the rights and duties of employees.
4. Written policies, rules, and regulations that guide behavior.
5. An impersonal, bureaucratic environment.
6. The development of longevity of administrative careers, with selection and promotion based on technical competence.

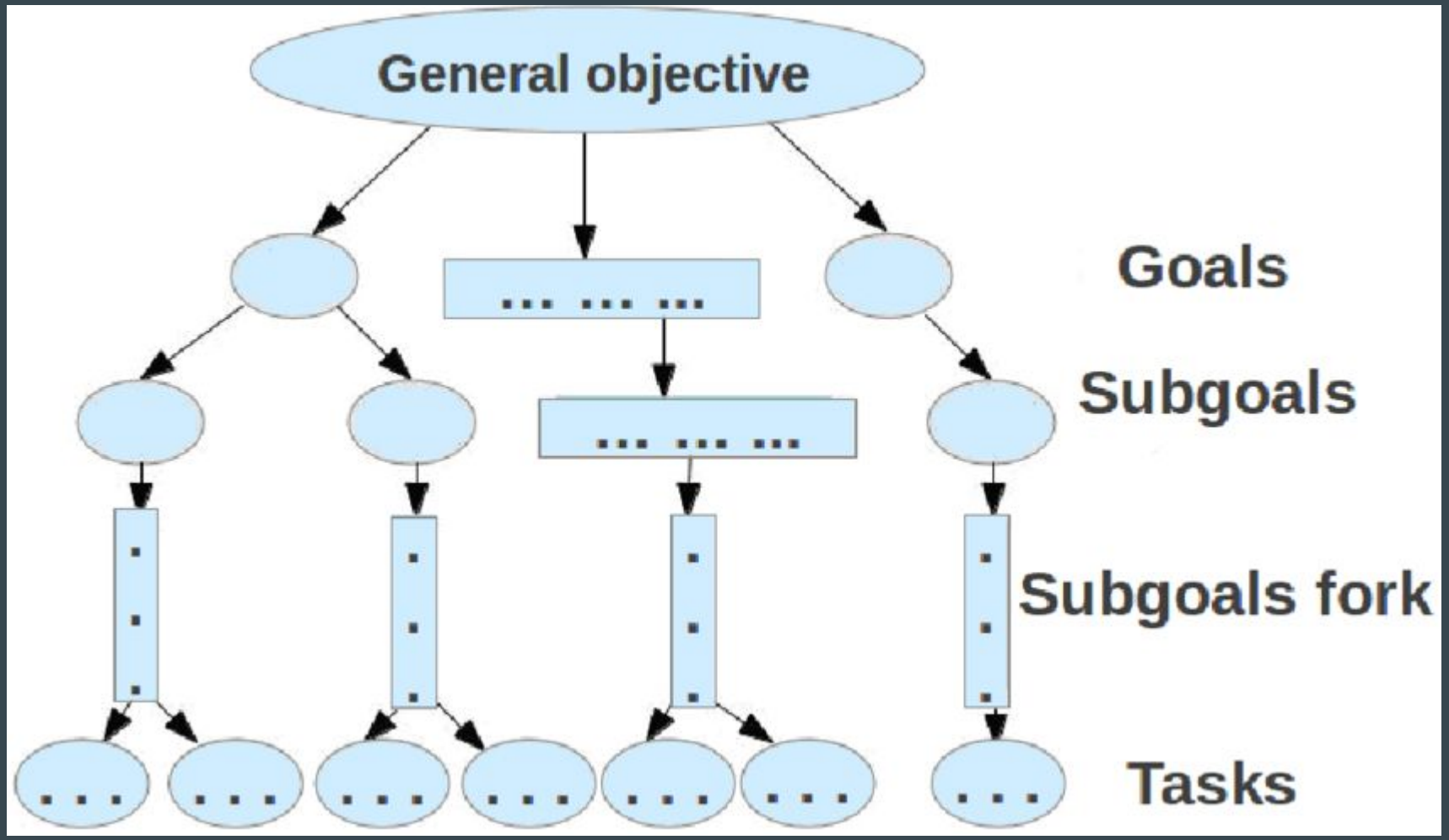
Mission and purpose of the organization

- Goal orientation in the organization's activities:

1. General objectives of the organization.
2. Individual goals of people in the organization.
3. People outside the company interacting with the organization.

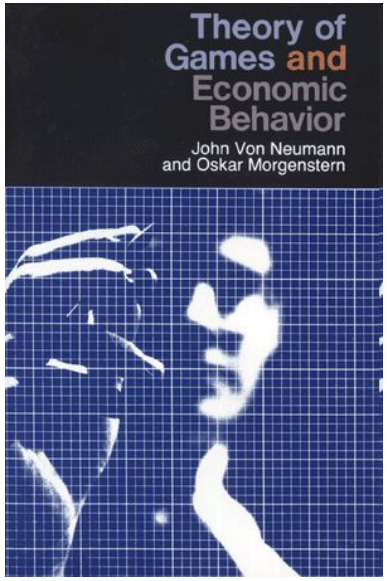
- Mission of the organization
  - A statement about why or for what reason the organization exists.
  - Reveals the meaning of its existence.
  - Highlight the difference between it and other organizations.

The Tree of Goals

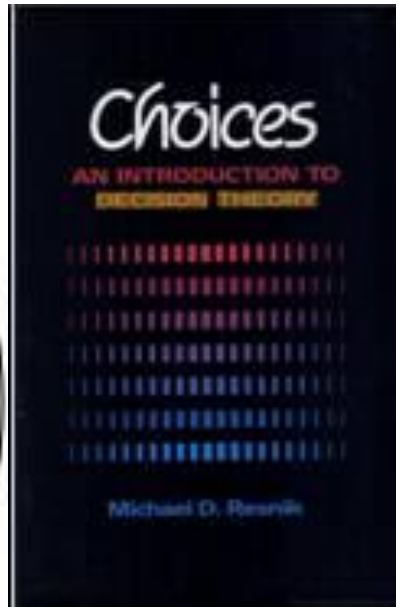


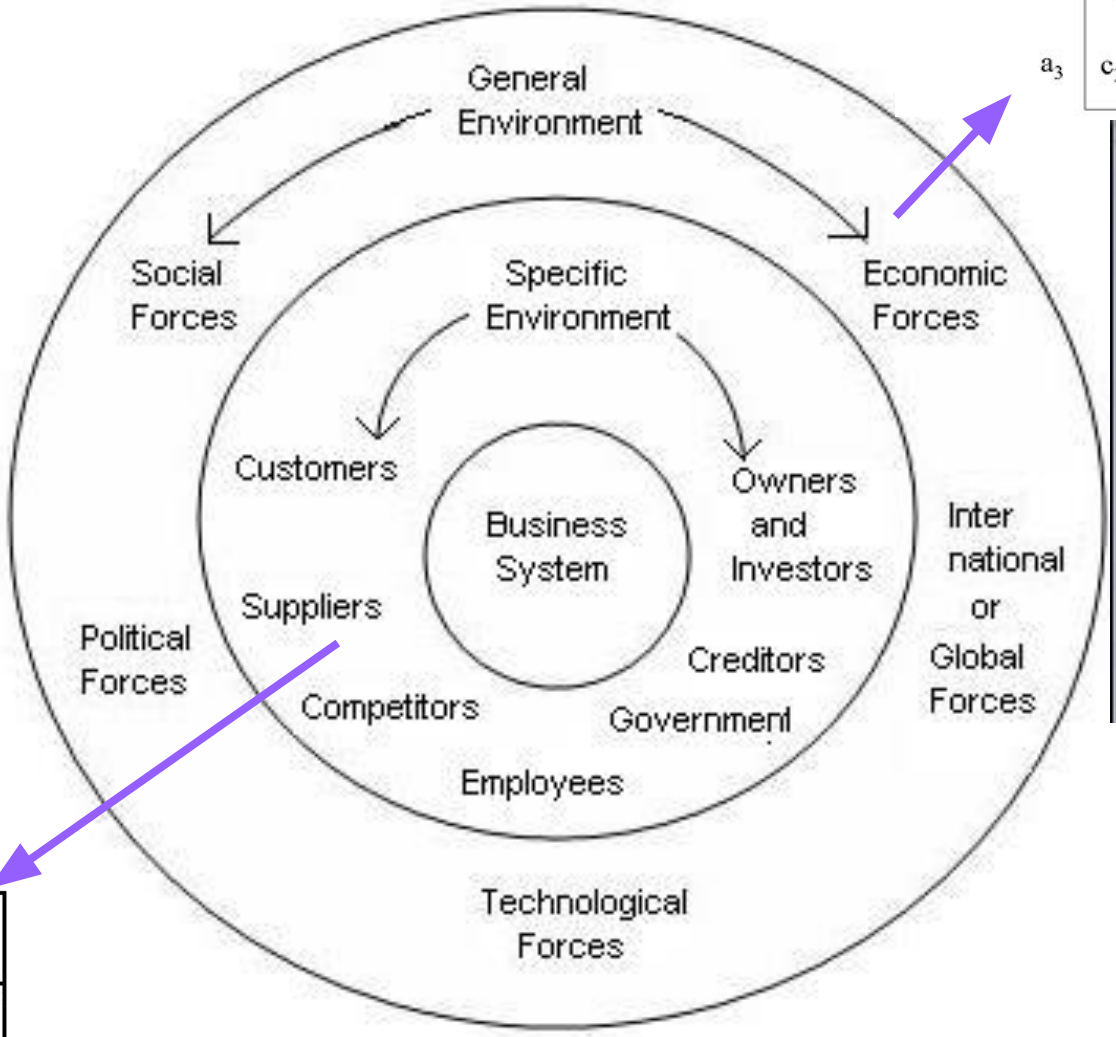
General and specific environment

General and Specific Environments



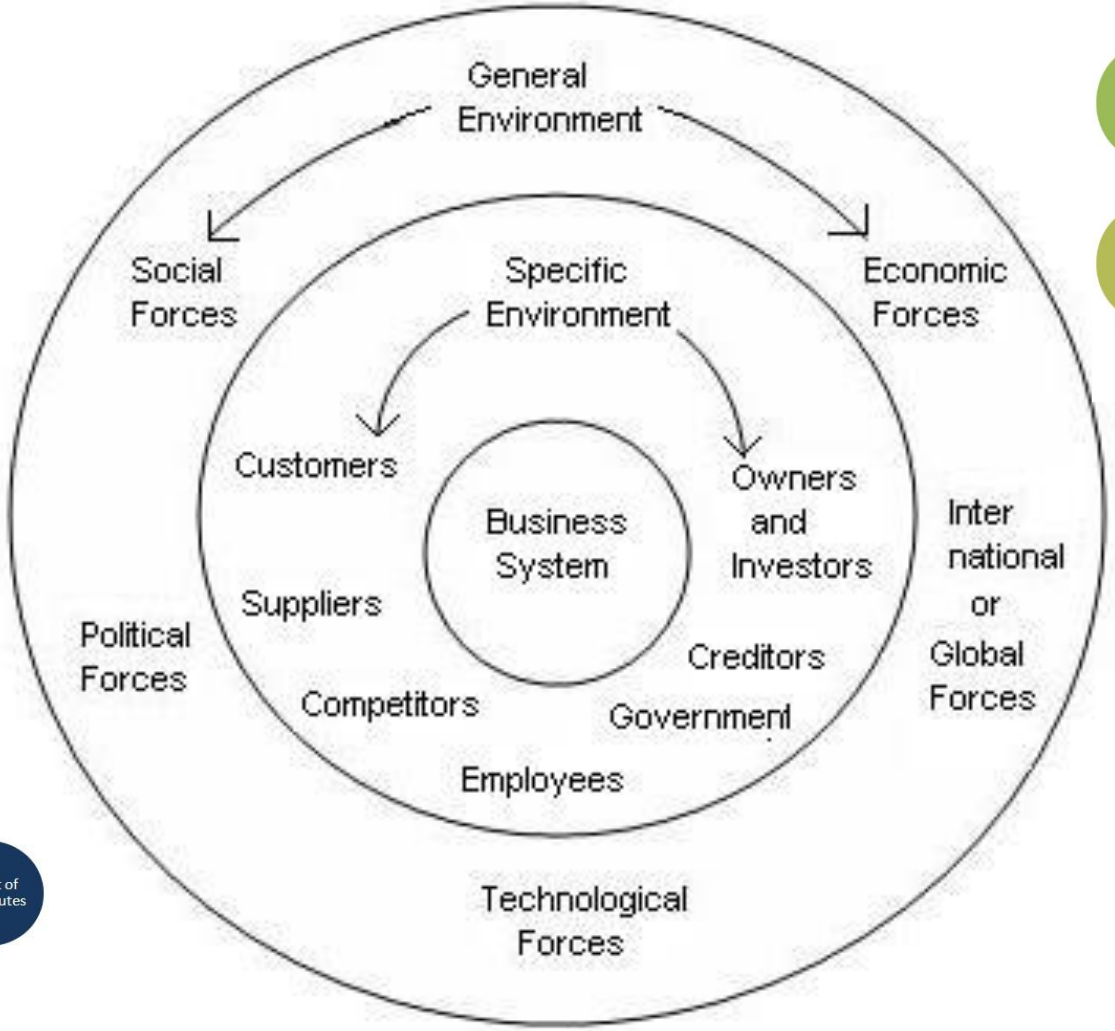
Alternatives$_i$ \ States of Nature$_j$	s_1	s_2	s_3	s_4
a_1	c_{11}	c_{12}	c_{13}	c_{14}
a_2	c_{21}	c_{22}	c_{23}	c_{24}
a_3	c_{31}	c_{32}	c_{33}	c_{34}



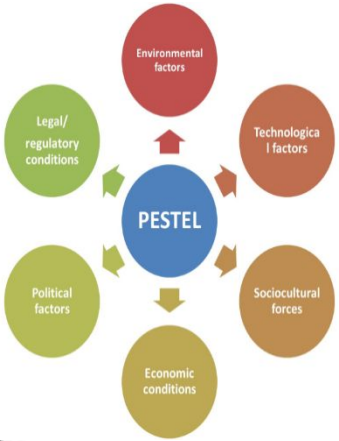


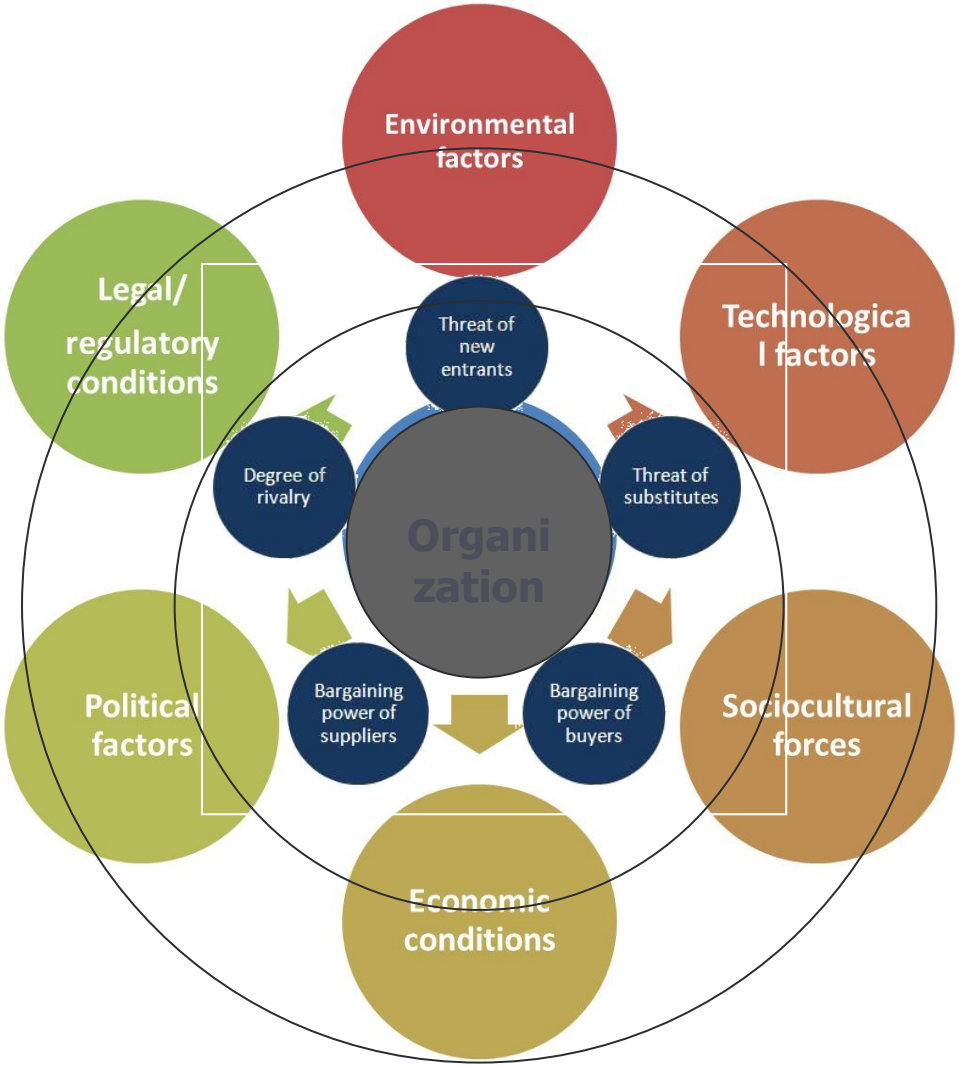
General and Specific Environments

Firm A \ Firm B	Low Price	High Price
Low Price	10, 10	5, 25
High Price	25, 5	20, 20



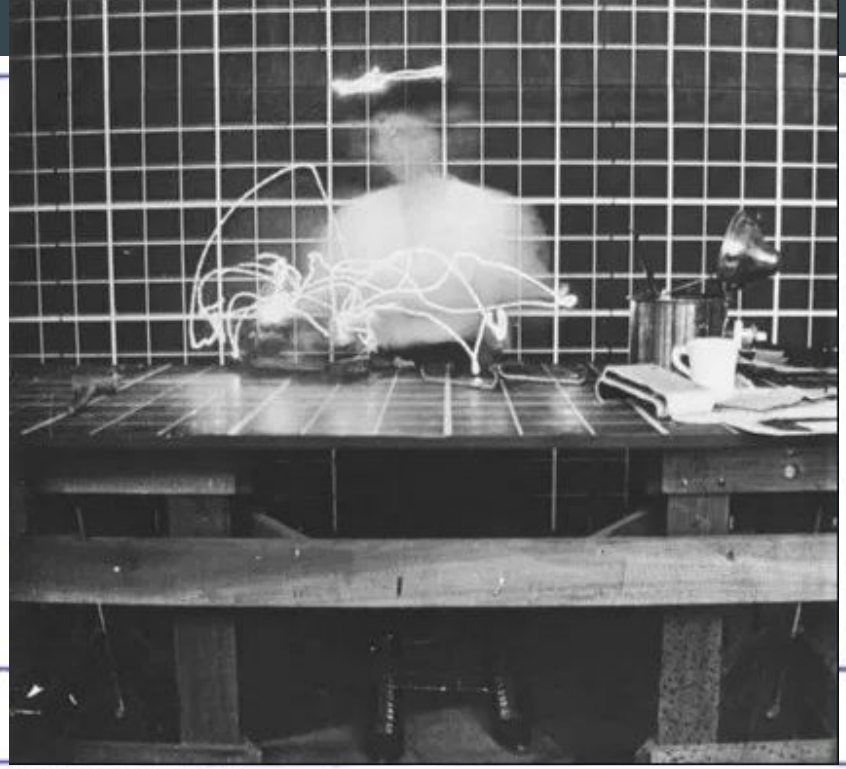
General and Specific Environments

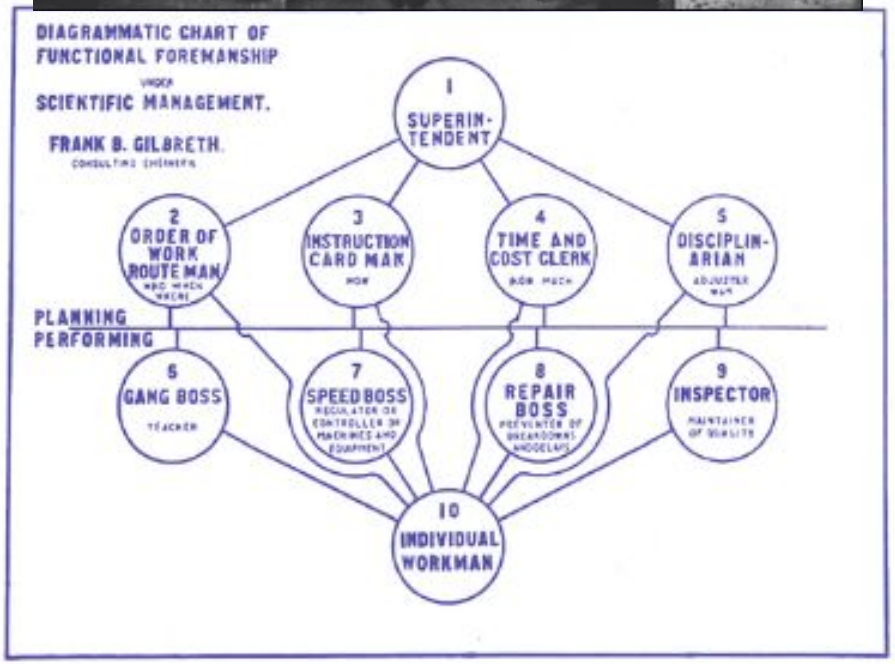



Environmental factors
Legal/ regulatory conditions
Technological factors
Threat of new entrants
Degree of rivalry
Threat of substitutes
Organi zation
Bargaining power of suppliers
Bargaining power of buyers
Political factors
Sociocultural forces
Economic conditions

SCHOOL OF SCIENTIFIC MANAGEMENT

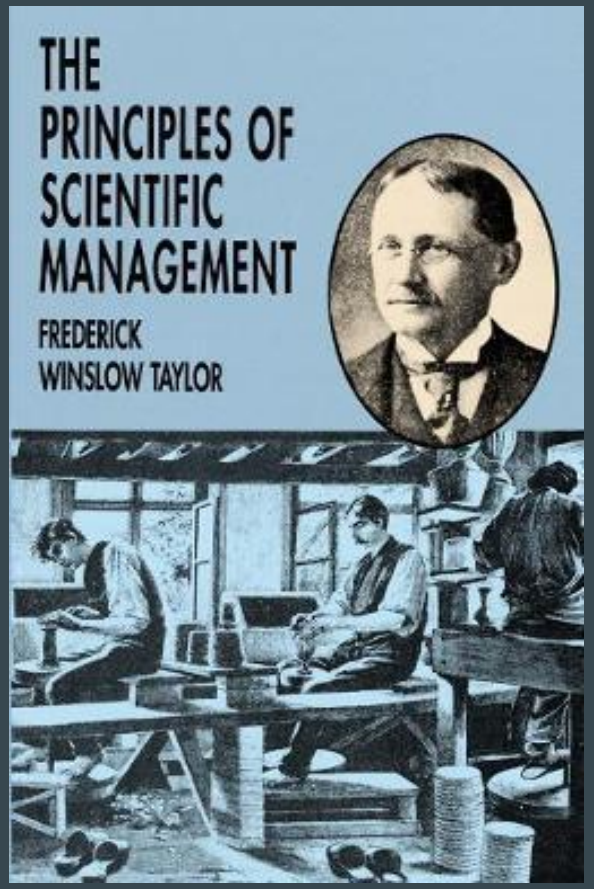
- Lillian and Frank Gilbreth
  - Whidden Construction Company
  - "Cheaper by the dozen"
  - The search for single best way
  - Microfilm of the movements
  - Scientific Analysis
  - Fatigue curve
  - Domestic management
  - Many rationalizations of everyday items
- Managerial Consultancy
- First PhD in Management




DIAGRAMMATIC CHART OF
FUNCTIONAL FOREMANSHIP
UNDER
SCIENTIFIC MANAGEMENT.
FRANK B. GILBRETH.
CONSULTING ENGINEER
1
SUPERIN-
TENDENT
2
ORDER OF
WORK
ROUTE MAN
3
INSTRUCTION
CARD MAN
HOW
4
TIME AND
COST CLERK
5
DISCIPLIN-
ARIAN
PLANNING
PERFORMING
6
GANG BOSS
TEACHER
7
SPEED BOSS
8
REPAIR
BOSS
9
INSPECTOR
10
INDIVIDUAL
WORKMAN

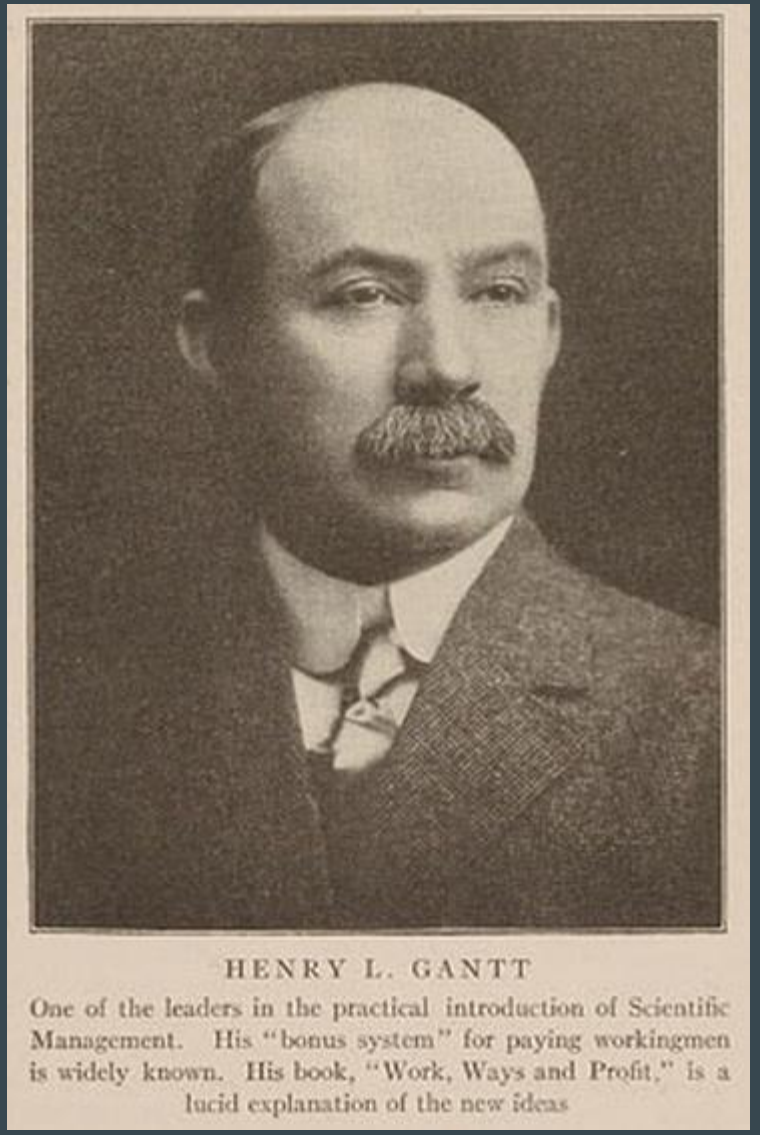
SCHOOL OF SCIENTIFIC MANAGEMENT

- Frederick Taylor (1856 -1915)
  - "Principles of scientific management" - 1911
  - Determine the best way for each job, through observations, measurements, logic and analysis.
  - Scientifically-grounded selection of contractors, tools, methods of work
  - Financial incentives: a sub-system ("People who produce more - get a higher salary")
  - Functional managers.
- The Case of the Ford Conveyor



SCHOOL OF SCIENTIFIC MANAGEMENT

- Henry Gantt (1861 -1919)
  - Improved on Taylor's Ideas
  - Calendar planning
  - Gantt charts
  - A semi-premium system

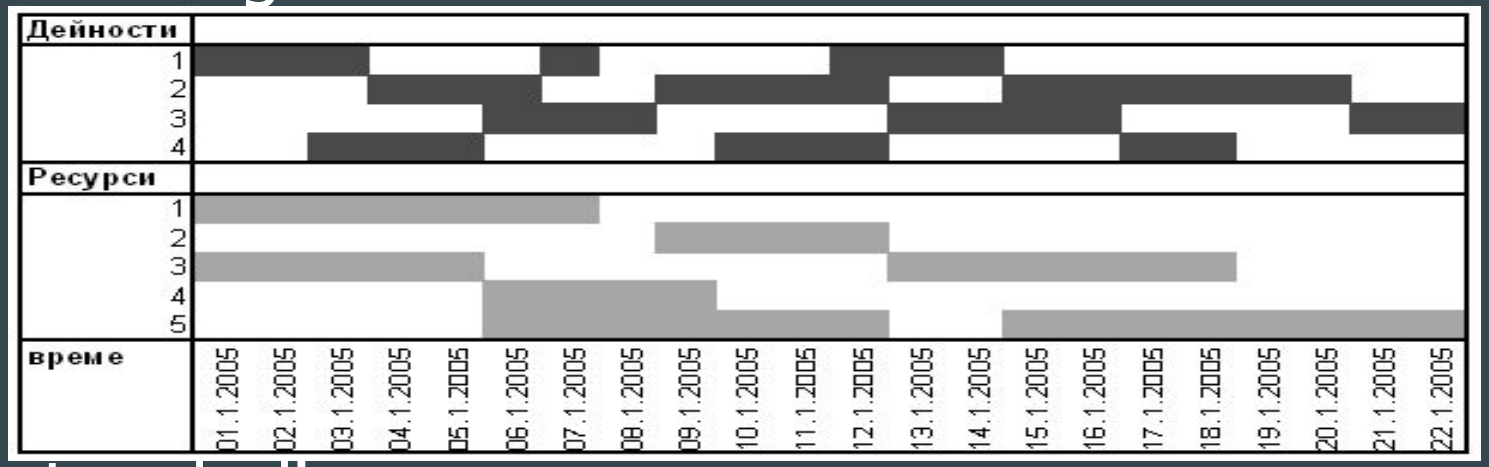


HENRY L. GANTT

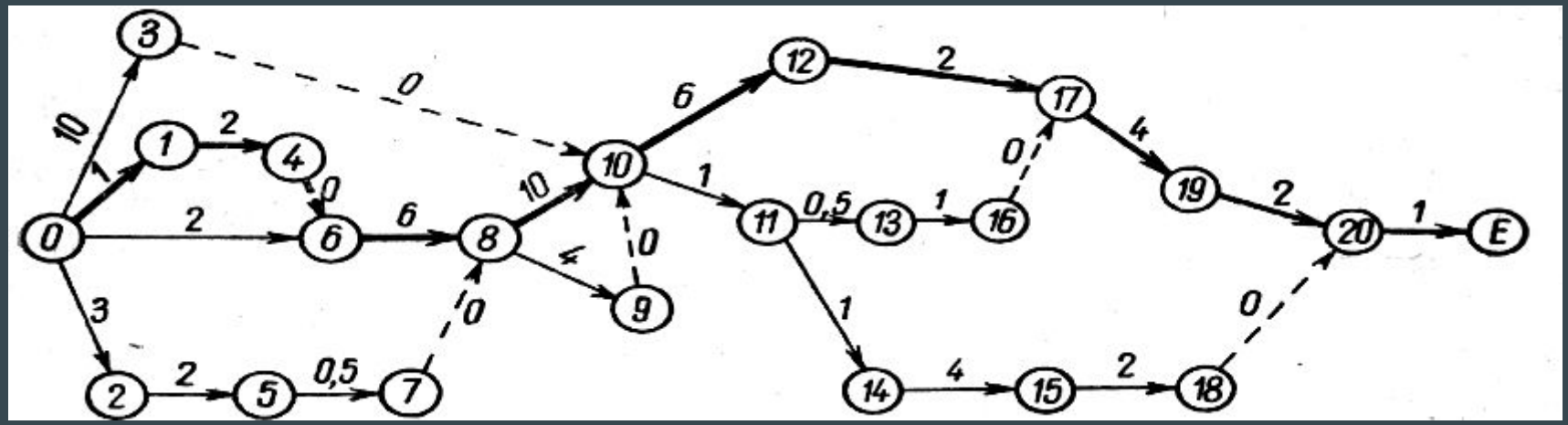
One of the leaders in the practical introduction of Scientific Management. His "bonus system" for paying workingmen is widely known. His book, "Work, Ways and Profit," is a lucid explanation of the new ideas

ORGANIZATION OF ACTIVITIES

- Gant Diagram



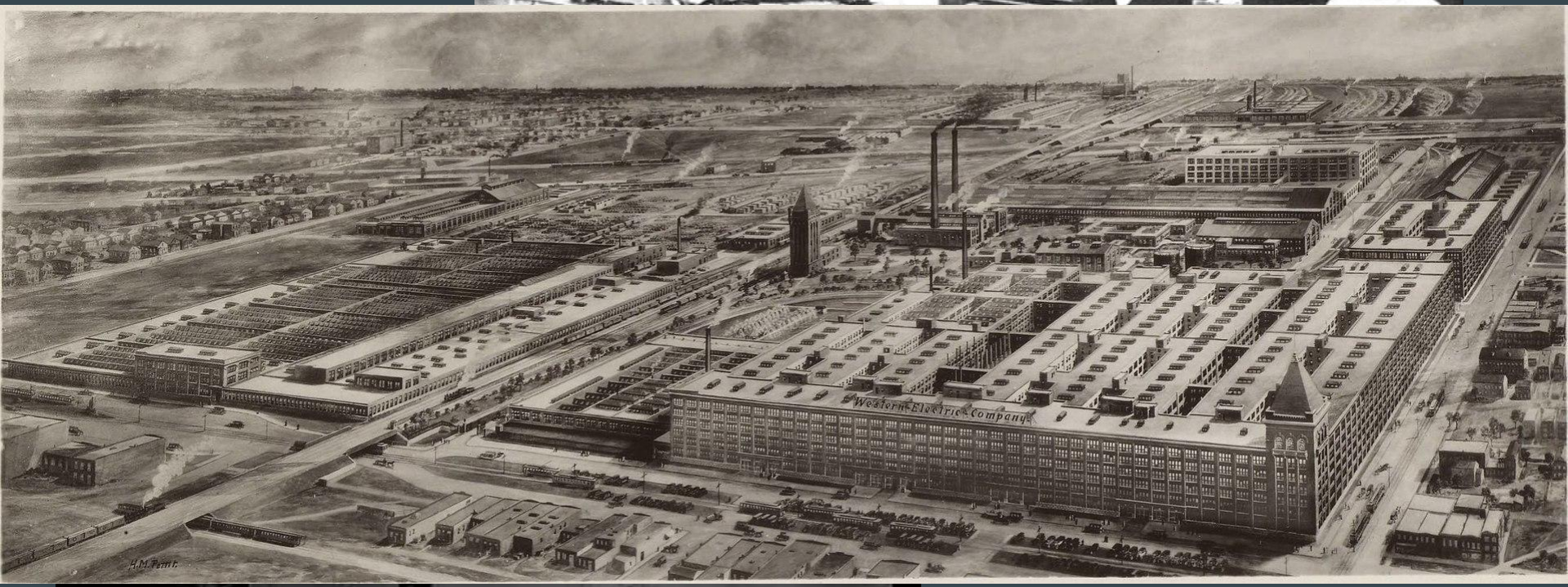
- Network diagram



SCHOOL OF SCIENTIFIC MANAGEMENT

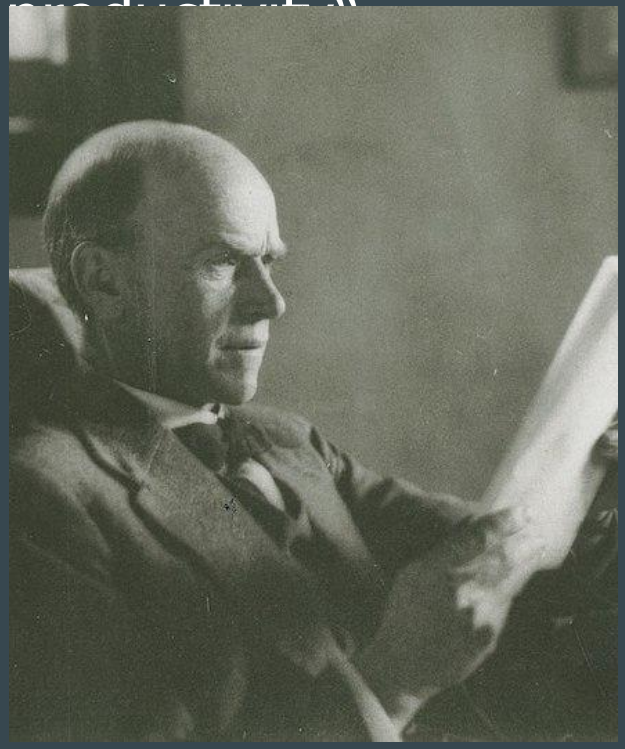
- Scientific Analysis
  - Execution
  - Fatigue
  - Tools
- The search for single best way
- Educating
- Anti-soldering & Anti-unions
- Financial incentives
- Managerial Consultancy
- Management as a Scientific Discipline
- Vast improvement in productivity
- Mass production
- Taylorized World

HAWTHORNE STUDIES



THE SCHOOL OF HUMAN RELATIONS

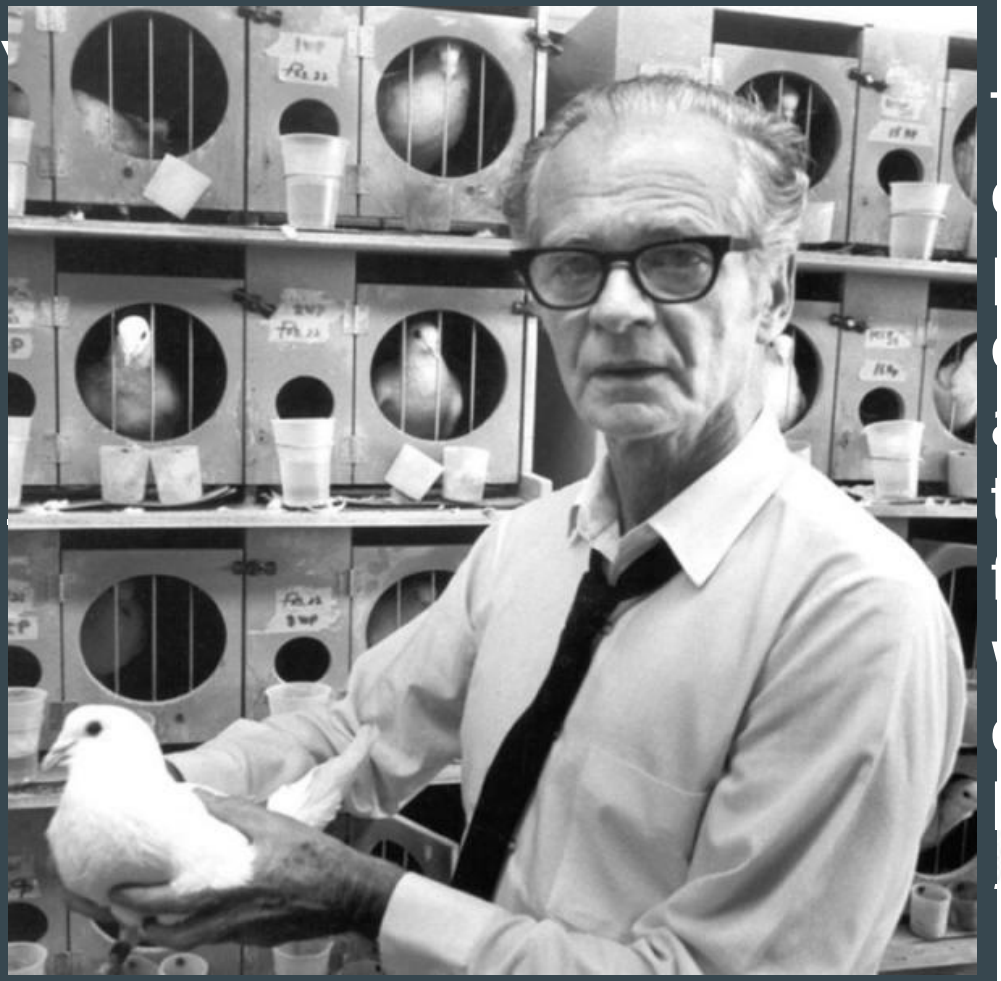
- Elton Mayo (1880 -1949)
  - Hawthorne Studies (1924-1932)
  - Role of the Human Factor in Management.
  - "Human factors, especially social interaction and group behavior, have an impact on individual
- The industrial psychologist

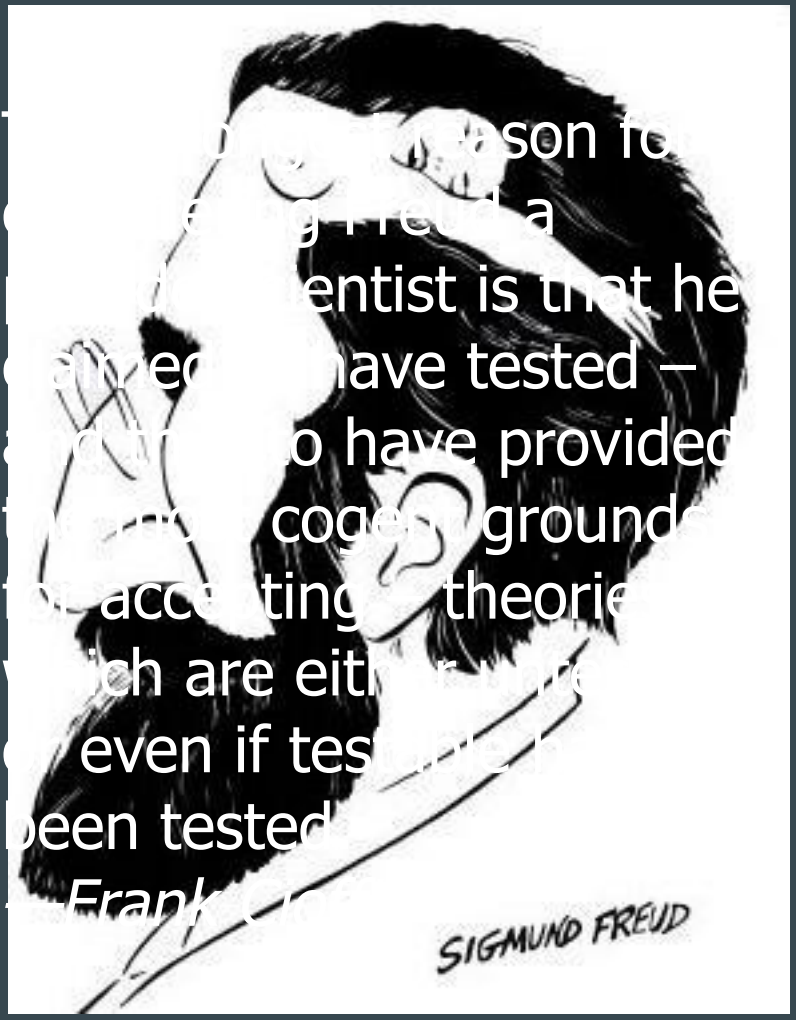


THE SCHOOL OF HUMAN RELATIONS

- Mary Parker Follett
  - "Management is ensuring the completion of the work with the help of others"
  - Management as "the art of getting things done through people"
- Visionary with many contributions
  - Human centric management
  - Advances in organizational theory
  - Theory of leadership

PSYCHO ANALYSIS VS. EXPERIMENTAL PSYCHOLOGY





BEHAVIORISM

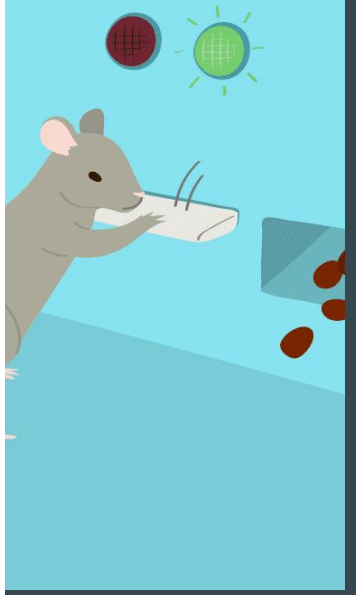
- B. F. Skinner
  - Harvard (since 1947)
  - Mental state is unobservable, behavior is
  - behavior is a consequence of environmental histories of reinforcement
  - *Behavior of Organisms (1938)*
  - *Science and Human Behavior (1953)*
  - *Schedules of Reinforcement (1957)*
- Main contributions
  - Operant conditioning (contrary to classical)
  - Control of operant conditioning
  - Explain complex behavior
  - Positive reinforcement
  - Education implications

Classical Conditioning

Associate an involuntary response and a stimulus

Operant Conditioning

Associate a voluntary behavior and a consequence



Dawn Drake, Ph.D., 3/3/14

Operant Conditioning

- Identify a behavior that you want to influence in the subject
- Most effective: If attempting to weaken, also identify a replacement (preferred) behavior and reinforce it when it occurs
- Determine what the *subject* values (likes) and dislikes (wants to avoid/stop)
- The subject must associate the consequence with the behavior

Weaken? ← **BEHAVIOR** → **Strengthen?**

PUNISH

- Something that is not happening now and the subject does ***not*** want to experience
- Something the subject does like/value and ***wants to keep***

REINFORCE

- Something the subject is experiencing (or expects to experience) and ***wants to stop or avoid***
- Something the subject does like/value and ***wants to have or keep***

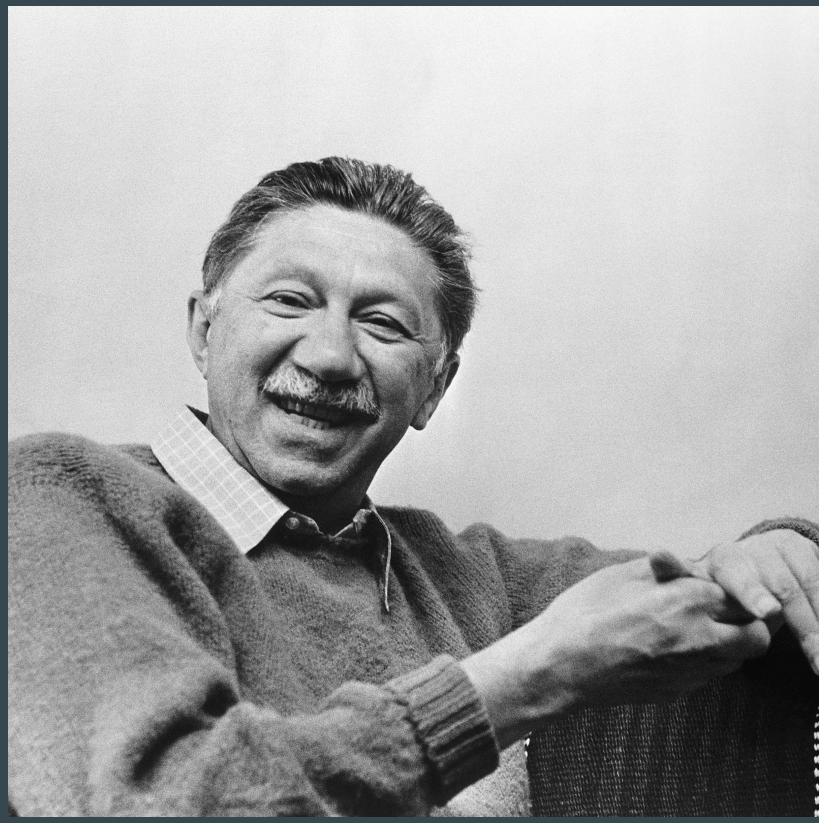
Consequences

ADD it	SUBTRACT it	SUBTRACT it	ADD it
Positive	**Negative**	**Negative**	**Positive**
Punishment	**Punishment**	**Reinforcement**	**Reinforcement**

BEHAVIOR SCHOOL ON MANAGEMENT

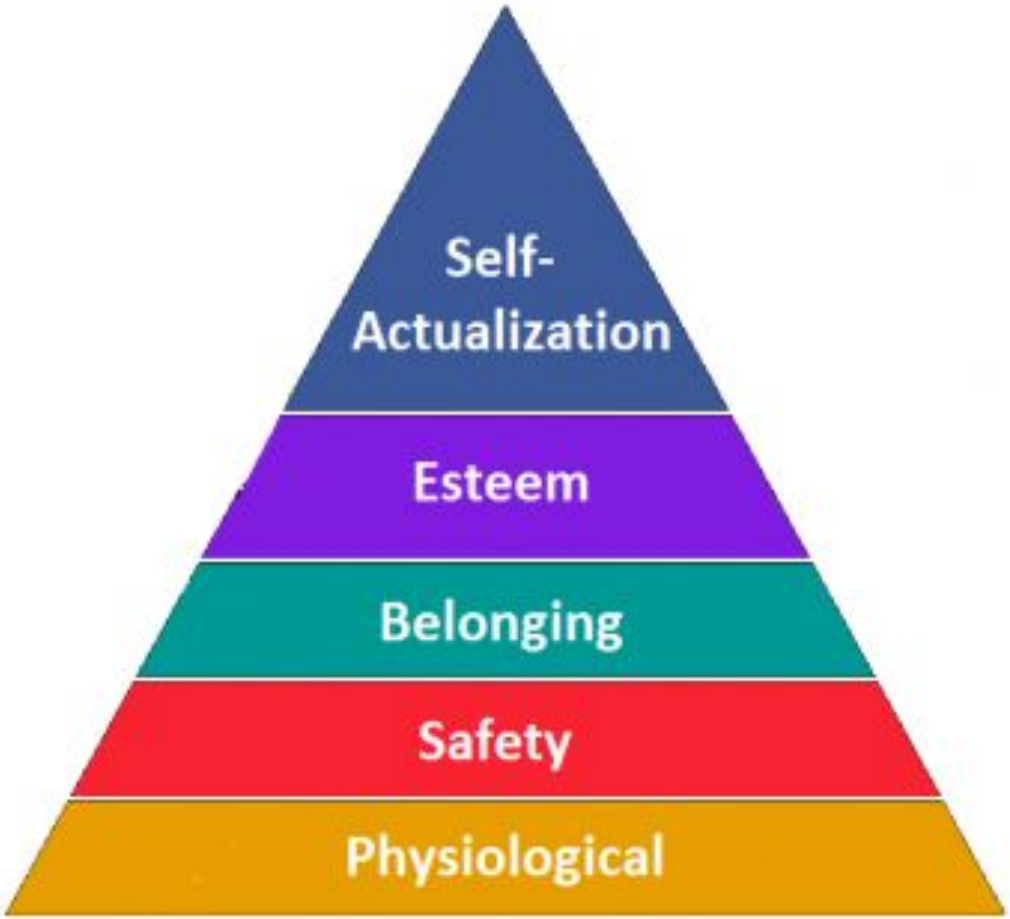
- The different aspects of social interaction, motivation, nature of authority, organizational structure, communication in the organization, leadership and the quality of the working life - are studied.
- Behavioral school is a step forward compared to the school of human relations.
- Basic thesis: A manager who applies behavioral science will always increase the efficiency of the work for both the individual worker and the organization as a whole.

BEHAVIOR SCHOOL
Contextual motivational theories



- Abraham Maslow (1907 -1970)
  - "A theory of human motivation" (1970)
  - Motivation and hierarchy of needs
  - The basis of human actions is not economic forces but different needs
  - Criticism
- Herzberg: Motivating and hygienic factors

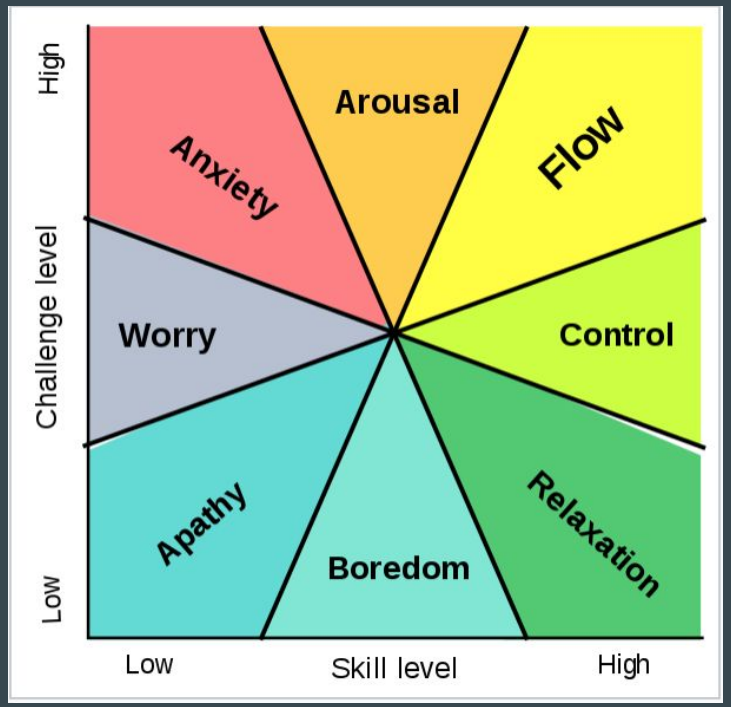
Maslow's pyramid



Challenges to the job creative approach
Public recognition Promotion
social interaction, group stability stimulating cooperation
Safe working conditions security at work
Salary Space

BEHAVIOR SCHOOL
Contextual motivational theories

- McLean
  - Motivation through success
- Self-determination theory
  - Intrinsic & Extrinsic motivation
- Mihaly Csikszentmihalyi
  - Flow

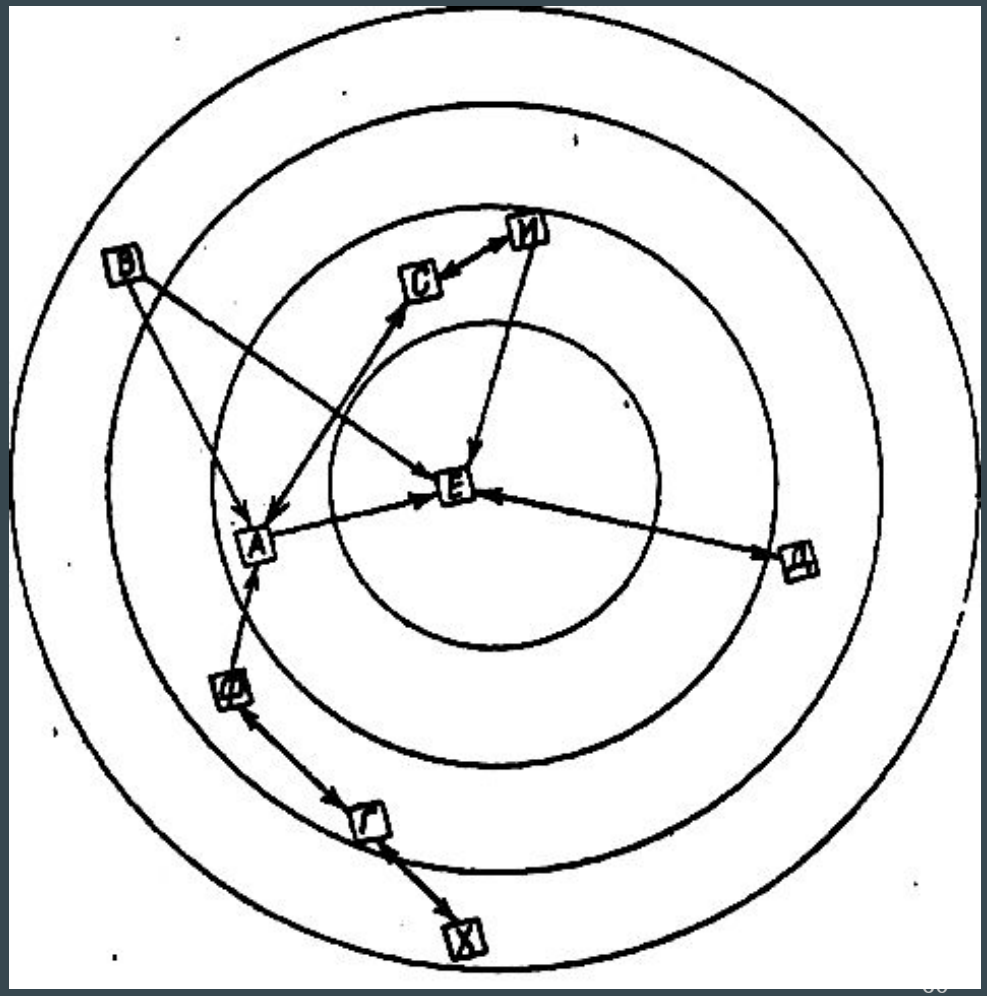


BEHAVIOR SCHOOL
Processual motivational theories

- Douglas McGregor (1906 -1964)
  - Theory X & Theory Y
  - The man in the organization
  - "The human side of enterprise" (1960)
- Moreno: Sociogram
- Group dynamics

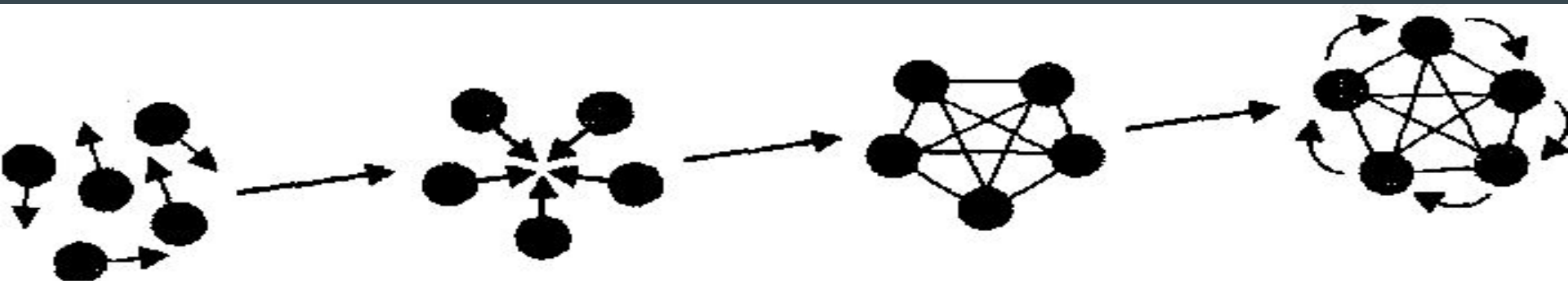
Sociogram

- Analyzes the situation for one person occupies in the group.
- Examines the structure of the group.
- Shows the role of its individual members.

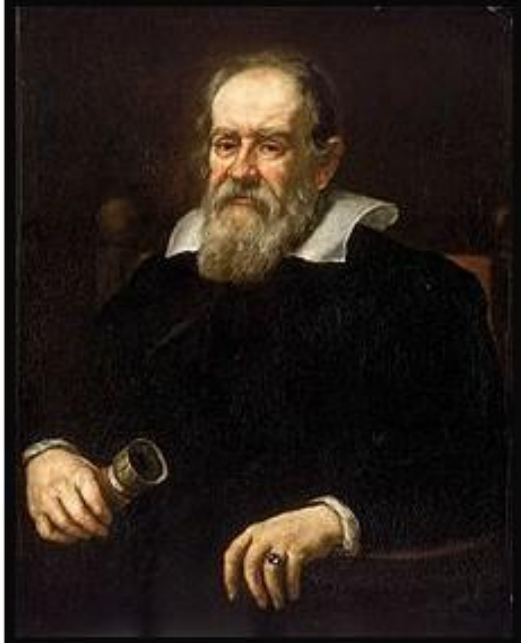


Groups in the organization

- A set of two or more individuals interacting with each other, so each of them has some influence on others and all at once are under the influence of others.
- Formal and informal groups.
- Stages of group development.



Quantitative approach in management

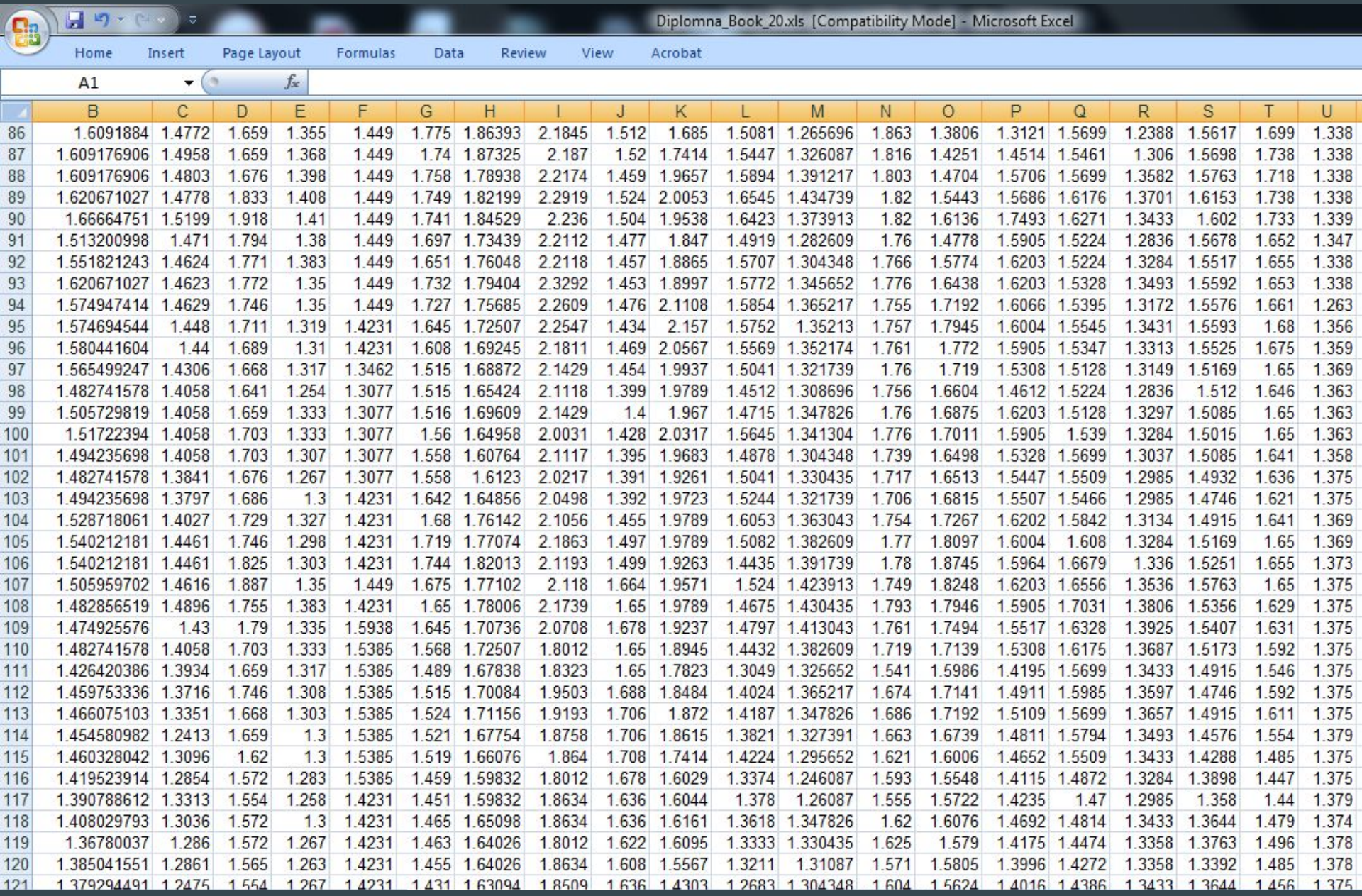


Measure what is measurable, and make measurable what is not so.

(Galileo Galilei)

izquotes.com

THE FAVOURITE THING TO READ
Statistical tables…



	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
86	1.6091884	1.4772	1.659	1.355	1.449	1.775	1.86393	2.1845	1.512	1.685	1.5081	1.265696	1.863	1.3806	1.3121	1.5699	1.2388	1.5617	1.699	1.338
87	1.609176906	1.4958	1.659	1.368	1.449	1.74	1.87325	2.187	1.52	1.7414	1.5447	1.326087	1.816	1.4251	1.4514	1.5461	1.306	1.5698	1.738	1.338
88	1.609176906	1.4803	1.676	1.398	1.449	1.758	1.78938	2.2174	1.459	1.9657	1.5894	1.391217	1.803	1.4704	1.5706	1.5699	1.3582	1.5763	1.718	1.338
89	1.620671027	1.4778	1.833	1.408	1.449	1.749	1.82199	2.2919	1.524	2.0053	1.6545	1.434739	1.82	1.5443	1.5686	1.6176	1.3701	1.6153	1.738	1.338
90	1.66664751	1.5199	1.918	1.41	1.449	1.741	1.84529	2.236	1.504	1.9538	1.6423	1.373913	1.82	1.6136	1.7493	1.6271	1.3433	1.602	1.733	1.339
91	1.513200998	1.471	1.794	1.38	1.449	1.697	1.73439	2.2112	1.477	1.847	1.4919	1.282609	1.76	1.4778	1.5905	1.5224	1.2836	1.5678	1.652	1.347
92	1.551821243	1.4624	1.771	1.383	1.449	1.651	1.76048	2.2118	1.457	1.8865	1.5707	1.304348	1.766	1.5774	1.6203	1.5224	1.3284	1.5517	1.655	1.338
93	1.620671027	1.4623	1.772	1.35	1.449	1.732	1.79404	2.3292	1.453	1.8997	1.5772	1.345652	1.776	1.6438	1.6203	1.5328	1.3493	1.5592	1.653	1.338
94	1.574947414	1.4629	1.746	1.35	1.449	1.727	1.75685	2.2609	1.476	2.1108	1.5854	1.365217	1.755	1.7192	1.6066	1.5395	1.3172	1.5576	1.661	1.263
95	1.574694544	1.448	1.711	1.319	1.4231	1.645	1.72507	2.2547	1.434	2.157	1.5752	1.35213	1.757	1.7945	1.6004	1.5545	1.3431	1.5593	1.68	1.356
96	1.580441604	1.44	1.689	1.31	1.4231	1.608	1.69245	2.1811	1.469	2.0567	1.5569	1.352174	1.761	1.772	1.5905	1.5347	1.3313	1.5525	1.675	1.359
97	1.565499247	1.4306	1.668	1.317	1.3462	1.515	1.68872	2.1429	1.454	1.9937	1.5041	1.321739	1.76	1.719	1.5308	1.5128	1.3149	1.5169	1.65	1.369
98	1.482741578	1.4058	1.641	1.254	1.3077	1.515	1.65424	2.1118	1.399	1.9789	1.4512	1.308696	1.756	1.6604	1.4612	1.5224	1.2836	1.512	1.646	1.363
99	1.505729819	1.4058	1.659	1.333	1.3077	1.516	1.69609	2.1429	1.4	1.967	1.4715	1.347826	1.76	1.6875	1.6203	1.5128	1.3297	1.5085	1.65	1.363
100	1.51722394	1.4058	1.703	1.333	1.3077	1.56	1.64958	2.0031	1.428	2.0317	1.5645	1.341304	1.776	1.7011	1.5905	1.539	1.3284	1.5015	1.65	1.363
101	1.494235698	1.4058	1.703	1.307	1.3077	1.558	1.60764	2.1117	1.395	1.9683	1.4878	1.304348	1.739	1.6498	1.5328	1.5699	1.3037	1.5085	1.641	1.358
102	1.482741578	1.3841	1.676	1.267	1.3077	1.558	1.6123	2.0217	1.391	1.9261	1.5041	1.330435	1.717	1.6513	1.5447	1.5509	1.2985	1.4932	1.636	1.375
103	1.494235698	1.3797	1.686	1.3	1.4231	1.642	1.64856	2.0498	1.392	1.9723	1.5244	1.321739	1.706	1.6815	1.5507	1.5466	1.2985	1.4746	1.621	1.375
104	1.528718061	1.4027	1.729	1.327	1.4231	1.68	1.76142	2.1056	1.455	1.9789	1.6053	1.363043	1.754	1.7267	1.6202	1.5842	1.3134	1.4915	1.641	1.369
105	1.540212181	1.4461	1.746	1.298	1.4231	1.719	1.77074	2.1863	1.497	1.9789	1.5082	1.382609	1.77	1.8097	1.6004	1.608	1.3284	1.5169	1.65	1.369
106	1.540212181	1.4461	1.825	1.303	1.4231	1.744	1.82013	2.1193	1.499	1.9263	1.4435	1.391739	1.78	1.8745	1.5964	1.6679	1.336	1.5251	1.655	1.373
107	1.505959702	1.4616	1.887	1.35	1.449	1.675	1.77102	2.118	1.664	1.9571	1.524	1.423913	1.749	1.8248	1.6203	1.6556	1.3536	1.5763	1.65	1.375
108	1.482856519	1.4896	1.755	1.383	1.4231	1.65	1.78006	2.1739	1.65	1.9789	1.4675	1.430435	1.793	1.7946	1.5905	1.7031	1.3806	1.5356	1.629	1.375
109	1.474925576	1.43	1.79	1.335	1.5938	1.645	1.70736	2.0708	1.678	1.9237	1.4797	1.413043	1.761	1.7494	1.5517	1.6328	1.3925	1.5407	1.631	1.375
110	1.482741578	1.4058	1.703	1.333	1.5385	1.568	1.72507	1.8012	1.65	1.8945	1.4432	1.382609	1.719	1.7139	1.5308	1.6175	1.3687	1.5173	1.592	1.375
111	1.426420386	1.3934	1.659	1.317	1.5385	1.489	1.67838	1.8323	1.65	1.7823	1.3049	1.325652	1.541	1.5986	1.4195	1.5699	1.3433	1.4915	1.546	1.375
112	1.459753336	1.3716	1.746	1.308	1.5385	1.515	1.70084	1.9503	1.688	1.8484	1.4024	1.365217	1.674	1.7141	1.4911	1.5985	1.3597	1.4746	1.592	1.375
113	1.466075103	1.3351	1.668	1.303	1.5385	1.524	1.71156	1.9193	1.706	1.872	1.4187	1.347826	1.686	1.7192	1.5109	1.5699	1.3657	1.4915	1.611	1.375
114	1.454580982	1.2413	1.659	1.3	1.5385	1.521	1.67754	1.8758	1.706	1.8615	1.3821	1.327391	1.663	1.6739	1.4811	1.5794	1.3493	1.4576	1.554	1.379
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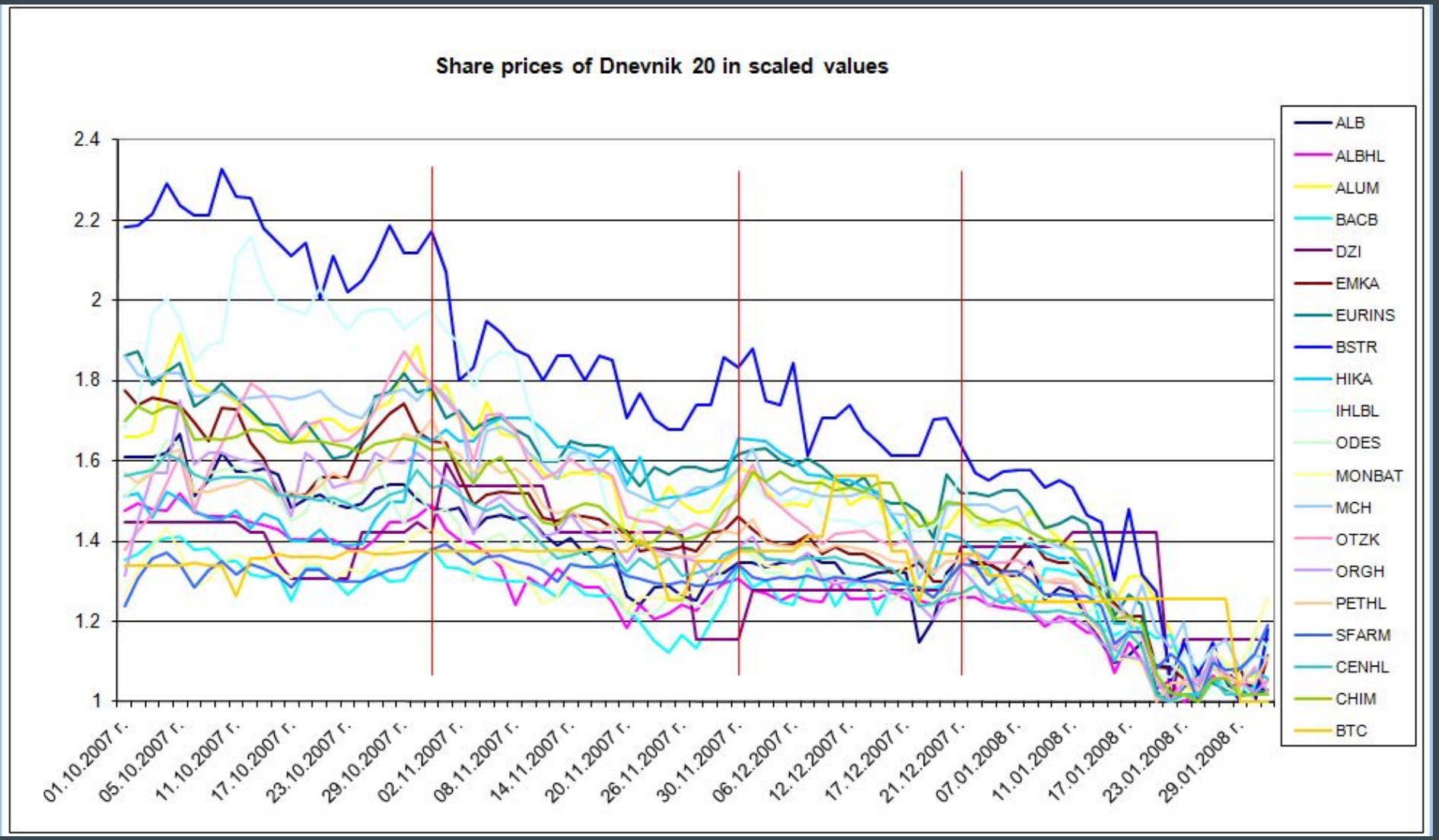
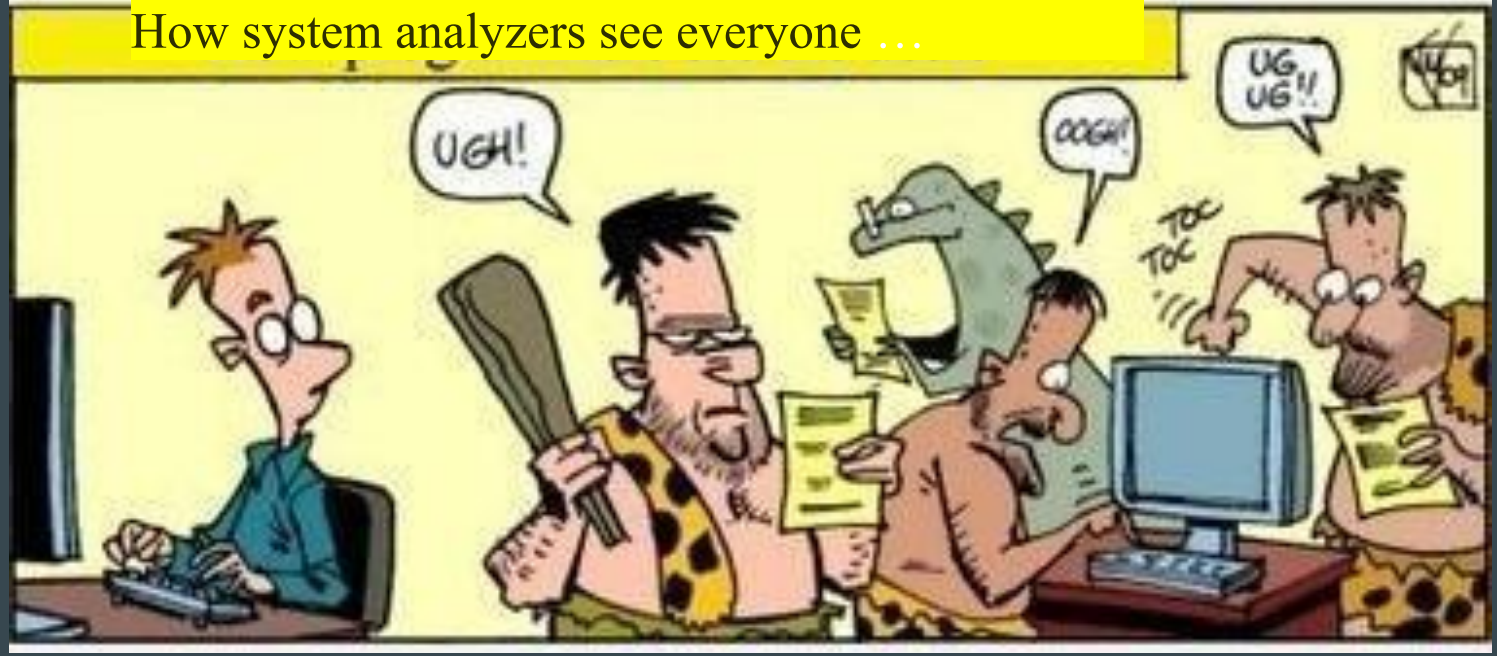
118	1.408029793	1.3036	1.572	1.3	1.4231	1.465	1.65098	1.8634	1.636	1.6161	1.3618	1.347826	1.62	1.6076	1.4692	1.4814	1.3433	1.3644	1.479	1.374
119	1.36780037	1.286	1.572	1.267	1.4231	1.463	1.64026	1.8012	1.622	1.6095	1.3333	1.330435	1.625	1.579	1.4175	1.4474	1.3358	1.3763	1.496	1.378
120	1.385041551	1.2861	1.565	1.263	1.4231	1.455	1.64026	1.8634	1.608	1.5567	1.3211	1.31087	1.571	1.5805	1.3996	1.4272	1.3358	1.3392	1.485	1.378
121	1.379294491	1.2475	1.554	1.267	1.4231	1.431	1.63094	1.8509	1.636	1.4303	1.2683	1.304348	1.604	1.5624	1.4016	1.4386	1.3433	1.3644	1.456	1.375

THE FAVOURITE THING TO READ
How the data looks…



How everyone sees system analyzers…

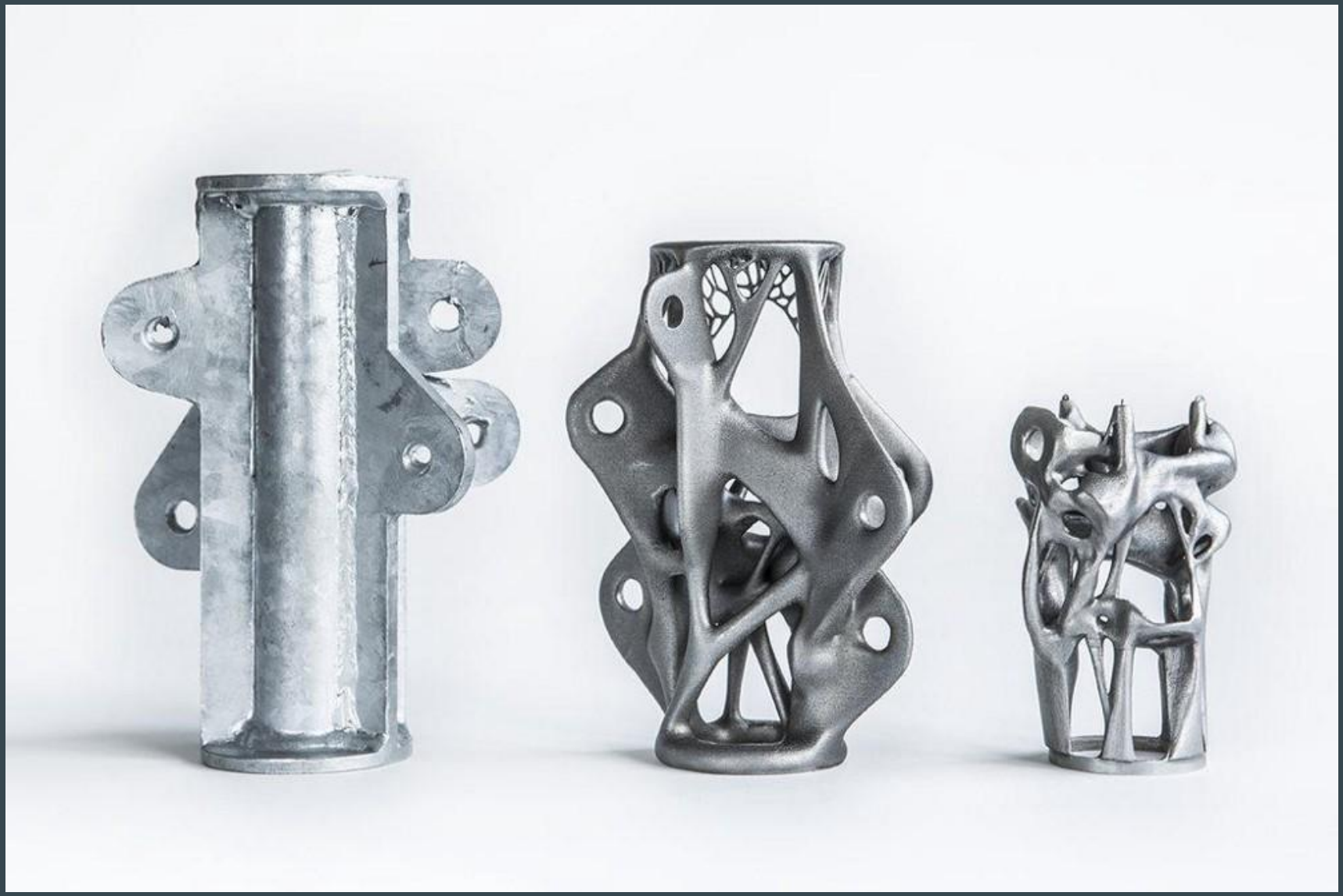
How system analyzers see everyone …



QUANTITATIVE APPROACH IN MANAGEMENT

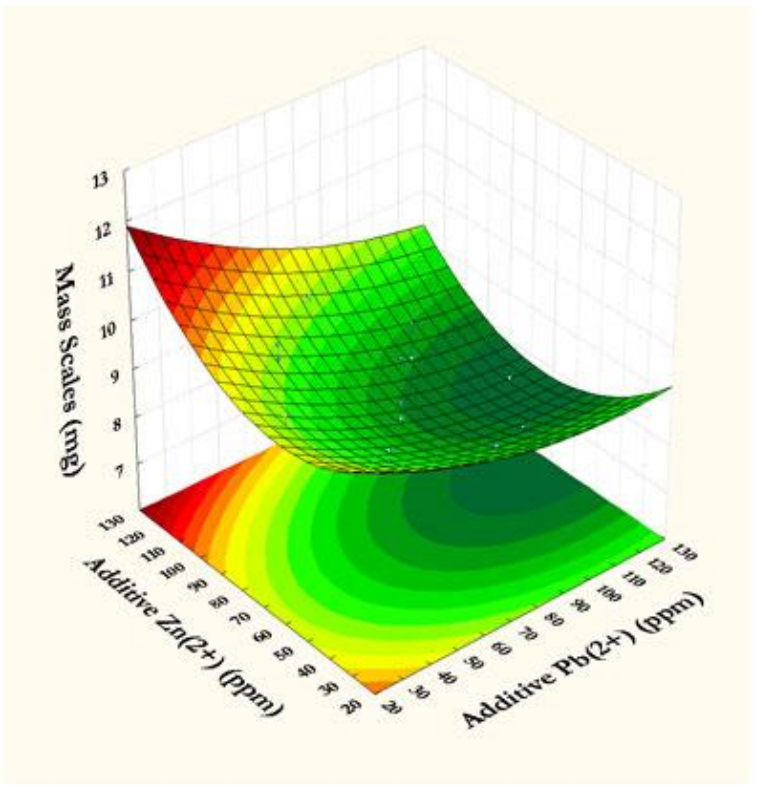
- In the early 1950s. mathematics, statistics, engineering studies have made a significant contribution to management theory because of:
  - large scales
  - the need to reach significant goals
  - in conditions of increasingly limited resources
  - appearance and development of the computers

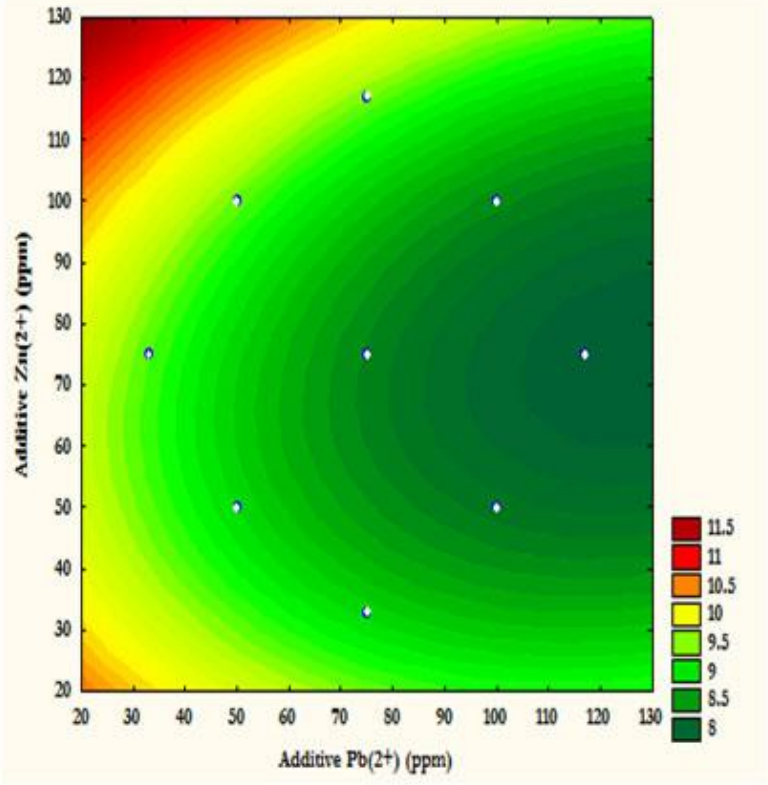
- Develop and improve quantitative methods to help decision-makers in complex situations.
- Replacement of verbal reasoning and descriptions with analysis of models, symbols and quantitative meanings.
- Computerization, forecasting and modeling in management



Optimization

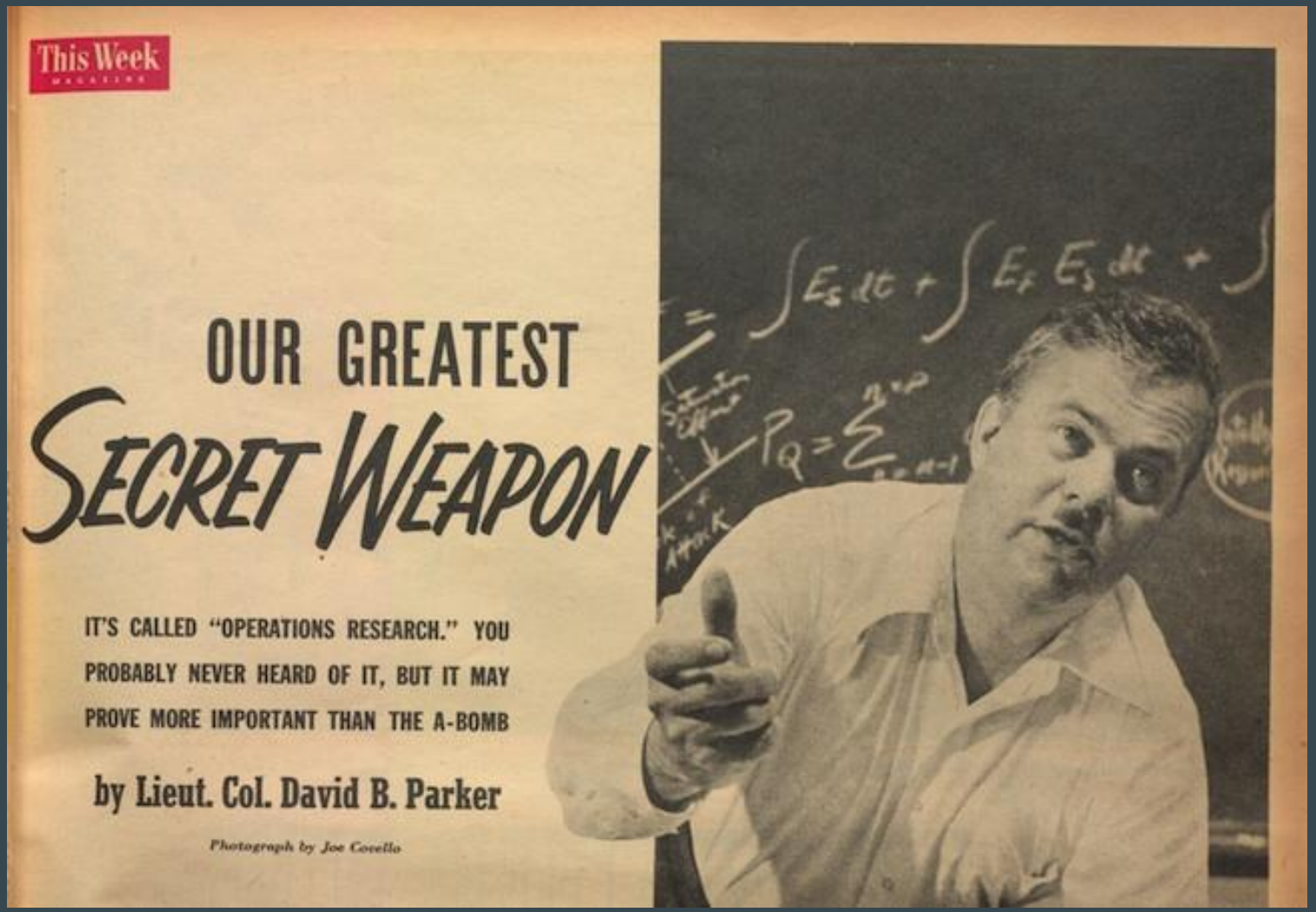
Leonid Kantorovich **George Dantzig**





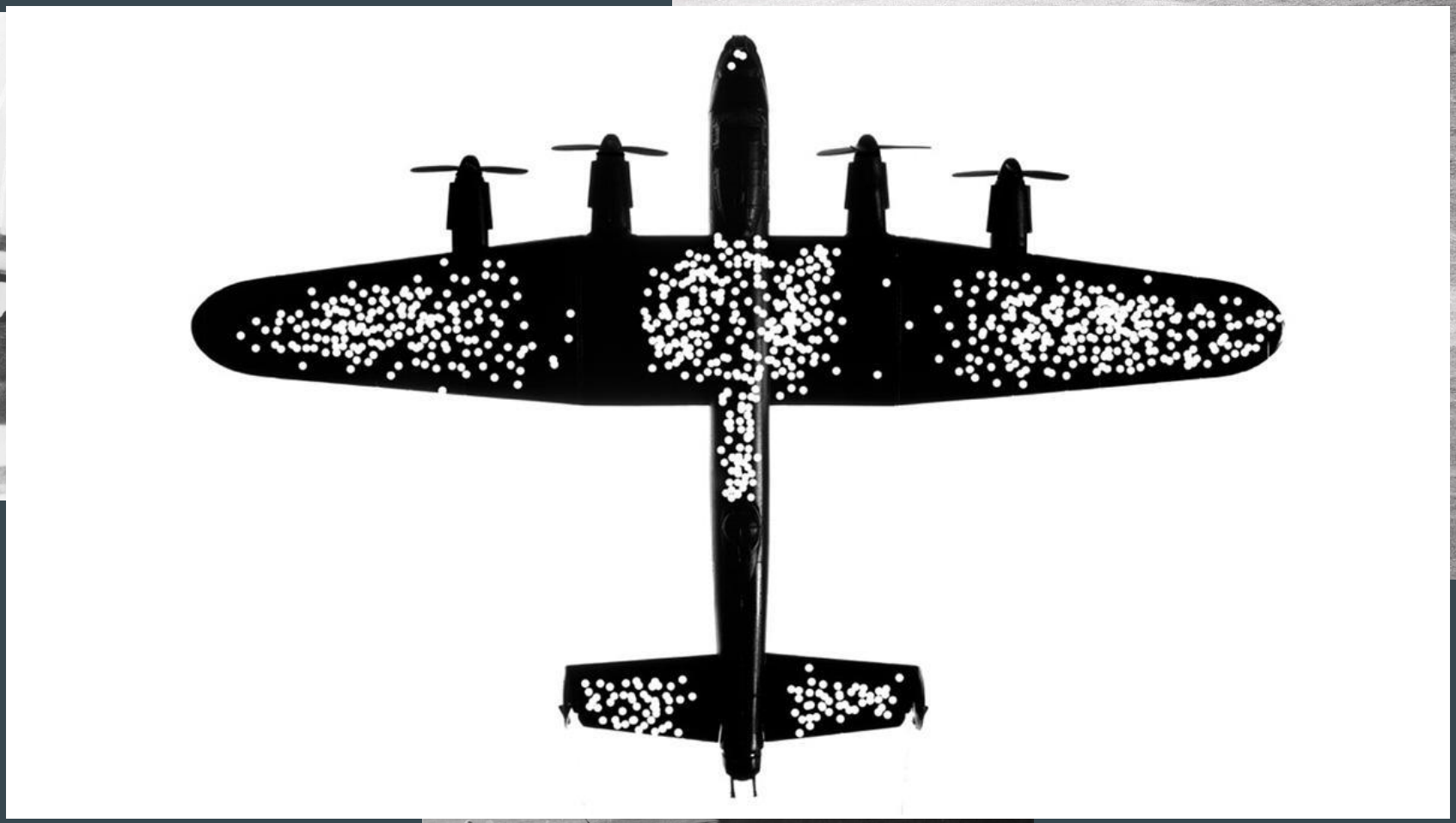
Nobel Prize 1975

Operation research

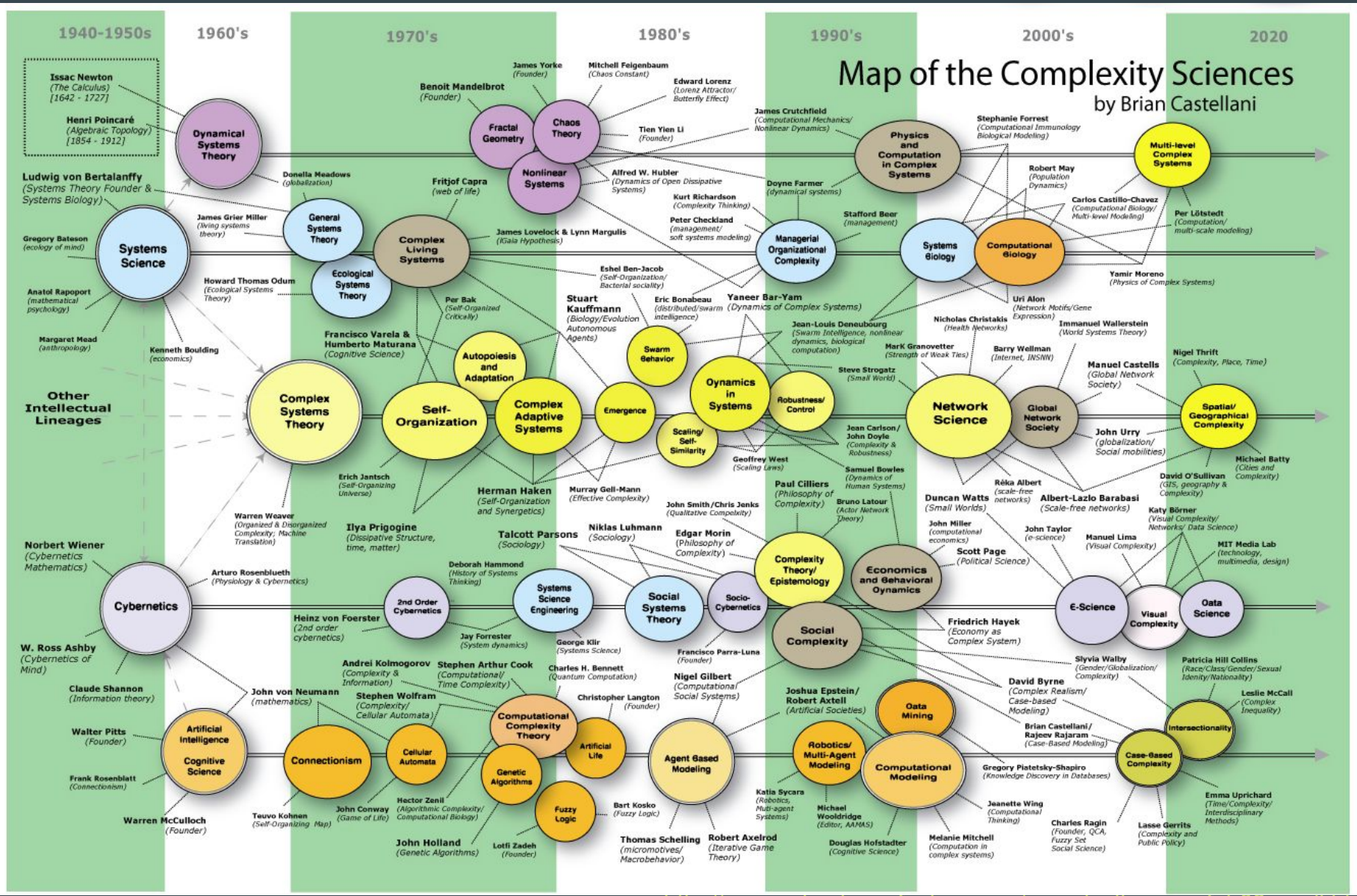


Operation research

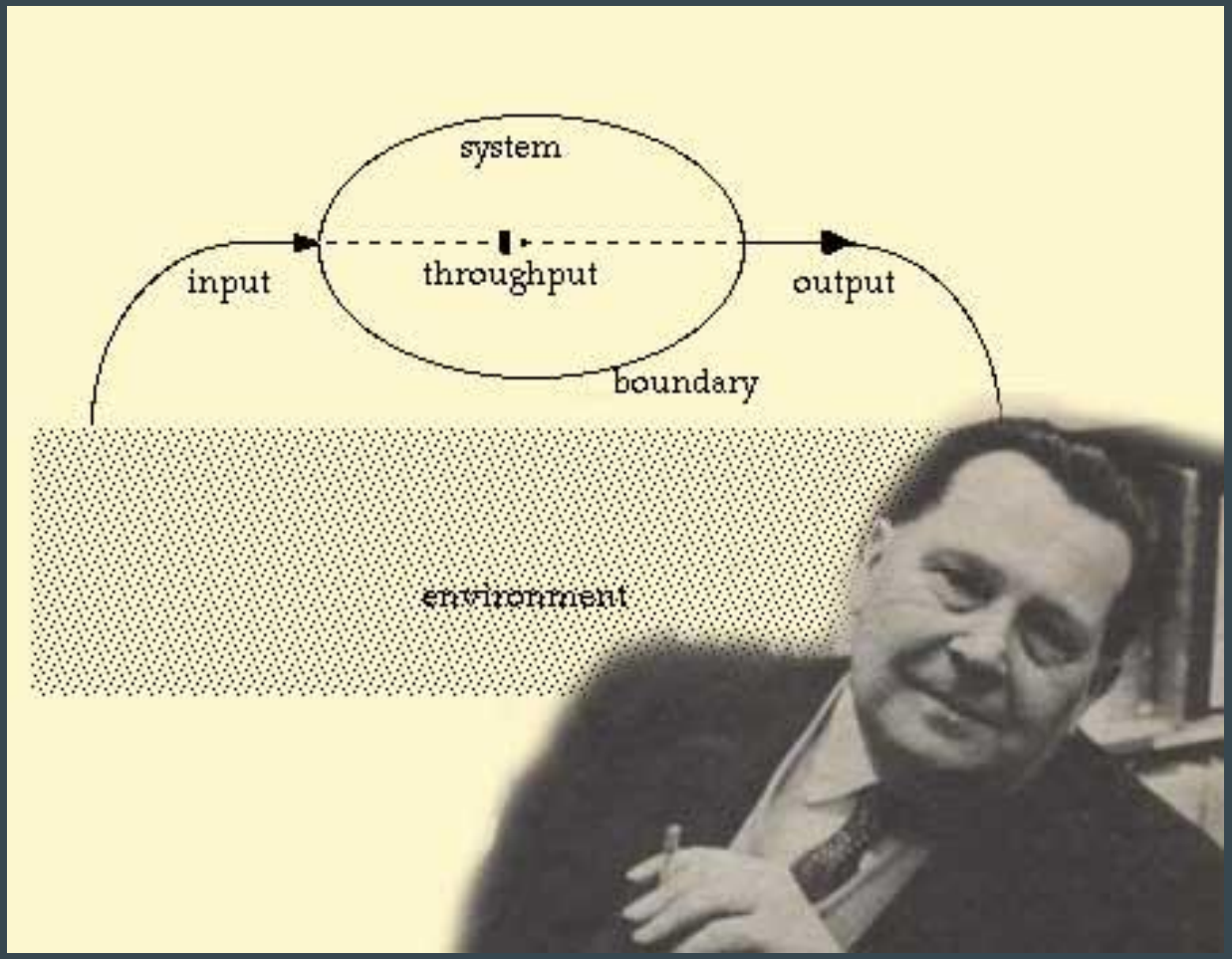
- Operations research - application of the methods for scientific research, to the production problems in the organization.

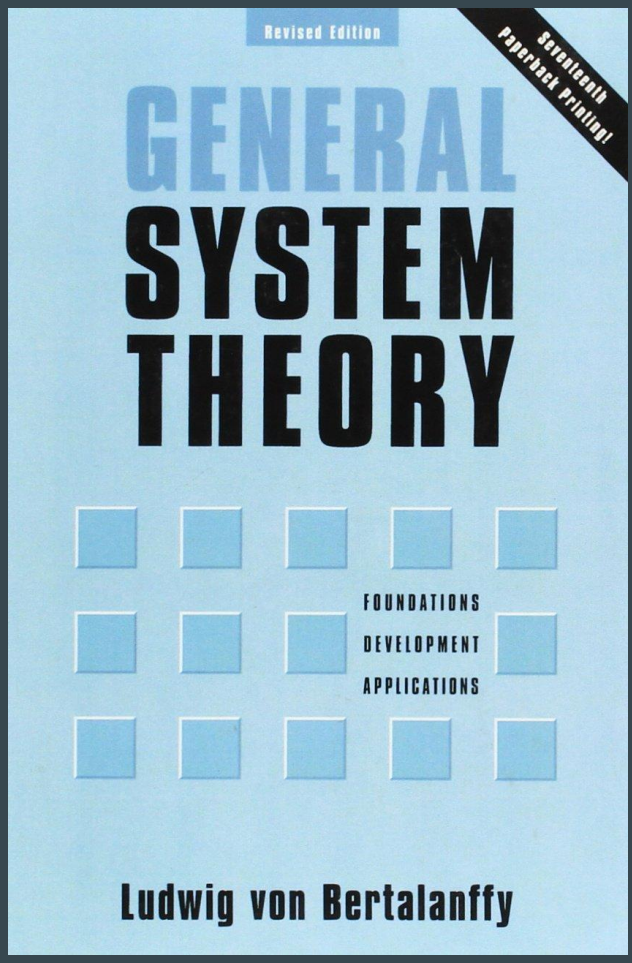


Universal language / close cousins



http://www.art-sciencefactory.com/complexity-map_feb09_april.html

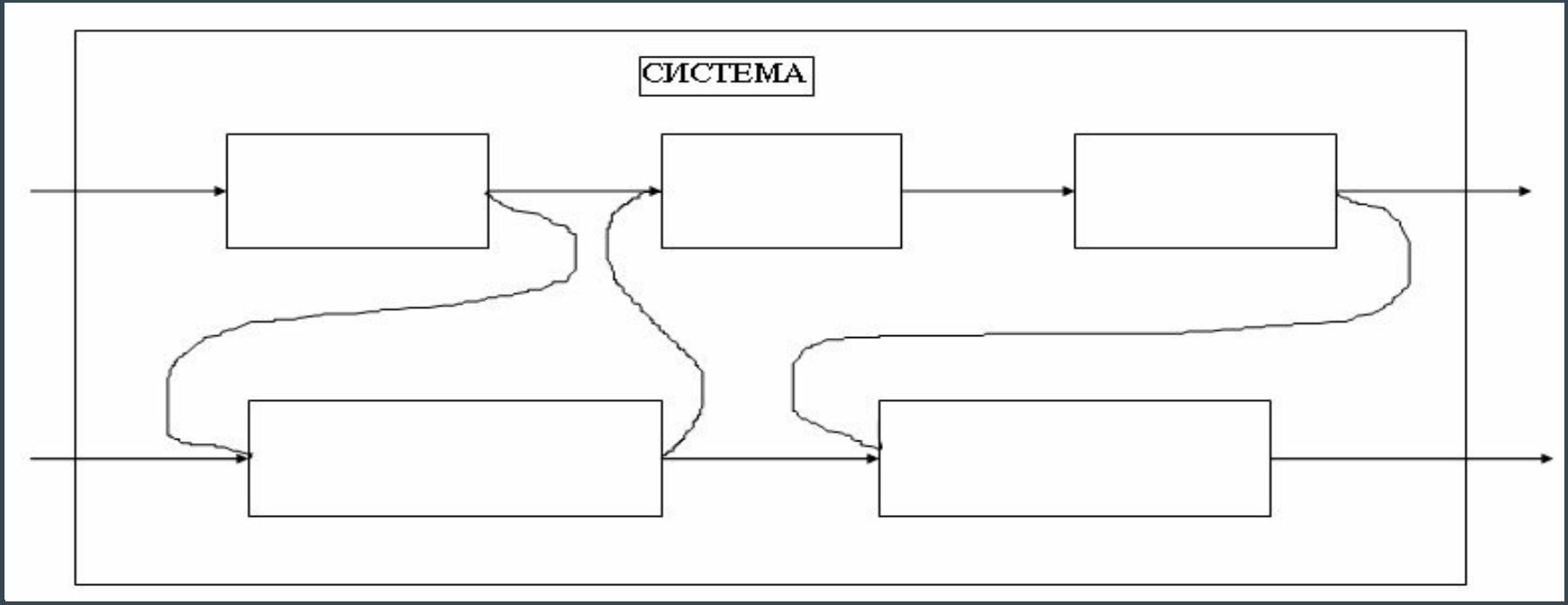

system
input
throughput
output
boundary
environment


Revised Edition
Seventeenth Paperback Printing!
GENERAL
SYSTEM
THEORY
FOUNDATIONS
DEVELOPMENT
APPLICATIONS
Ludwig von Bertalanffy

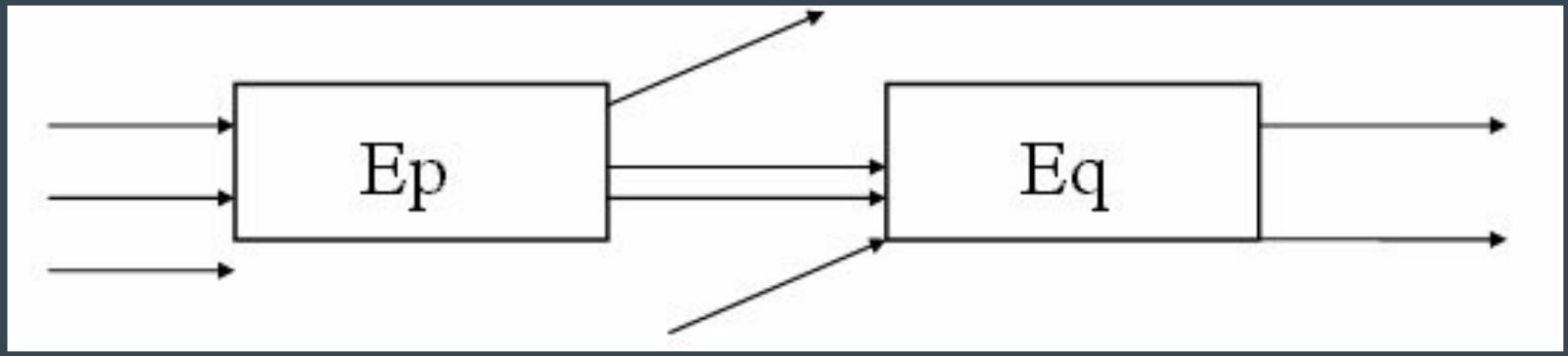
System theory

- **Ordered set of interconnected elements forming some whole unity**

- Internal structure of a system.

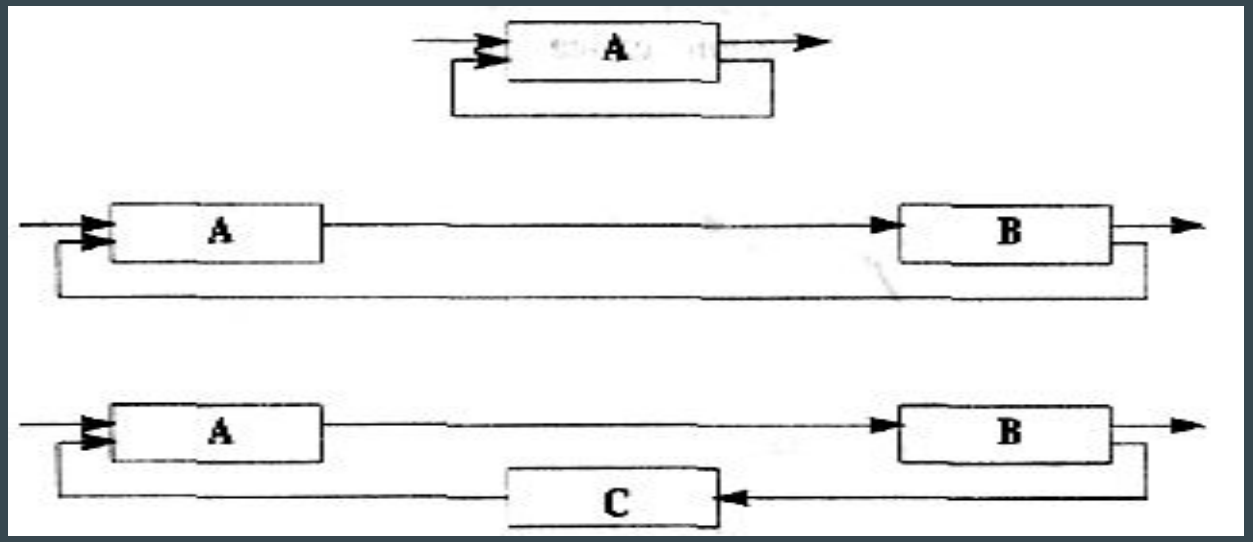


Connections between elements



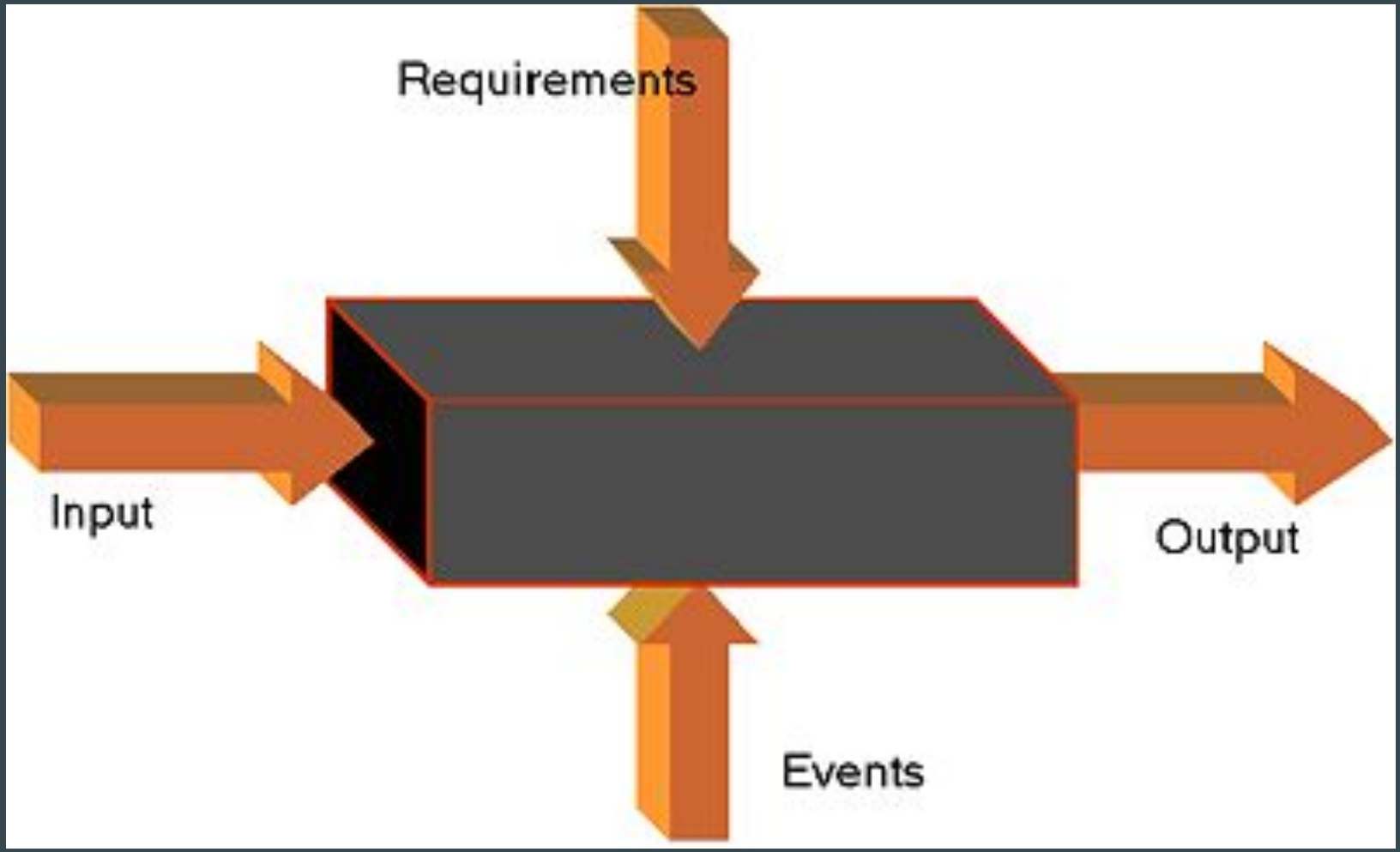
System theory

- Feedback & Feedforward connection.
- Principle of feedback



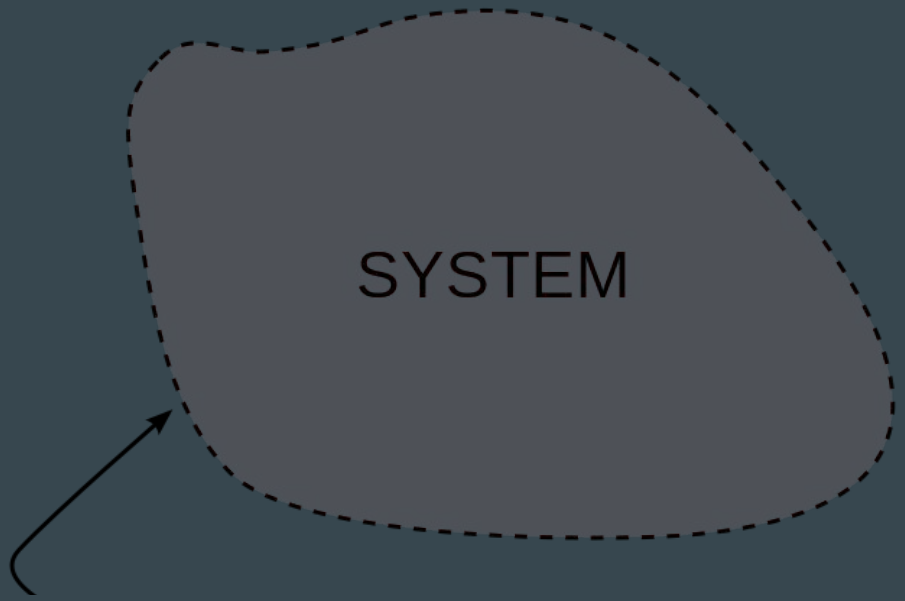
- http://ncase.me/loopy/v1.1/

Black box method



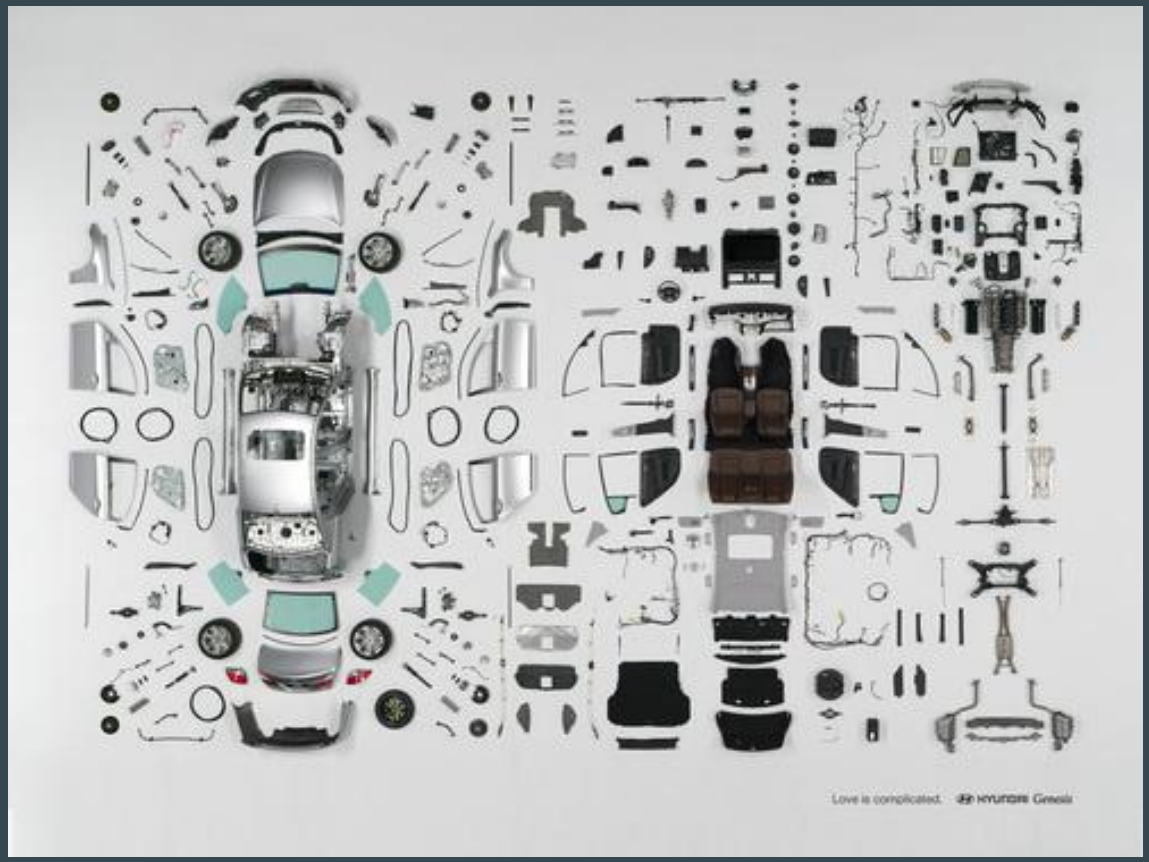
Features of a system

- Unity = the system is observed as a whole unity, it is evaluated as it too.



Features of a system

- Dissectability = Every system may be observed as a consisting of multiple subsystems (components/elements)

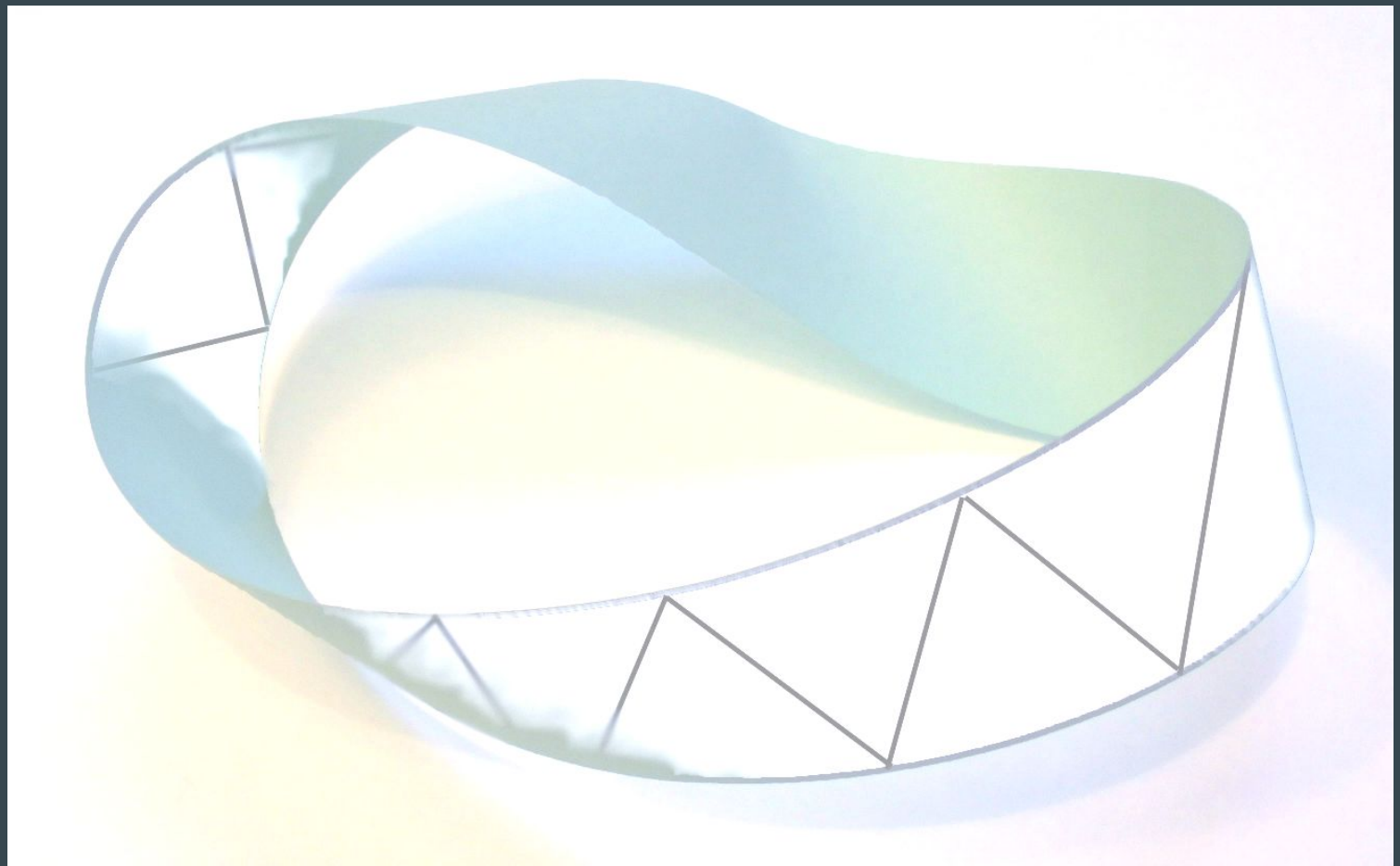


Features of a system

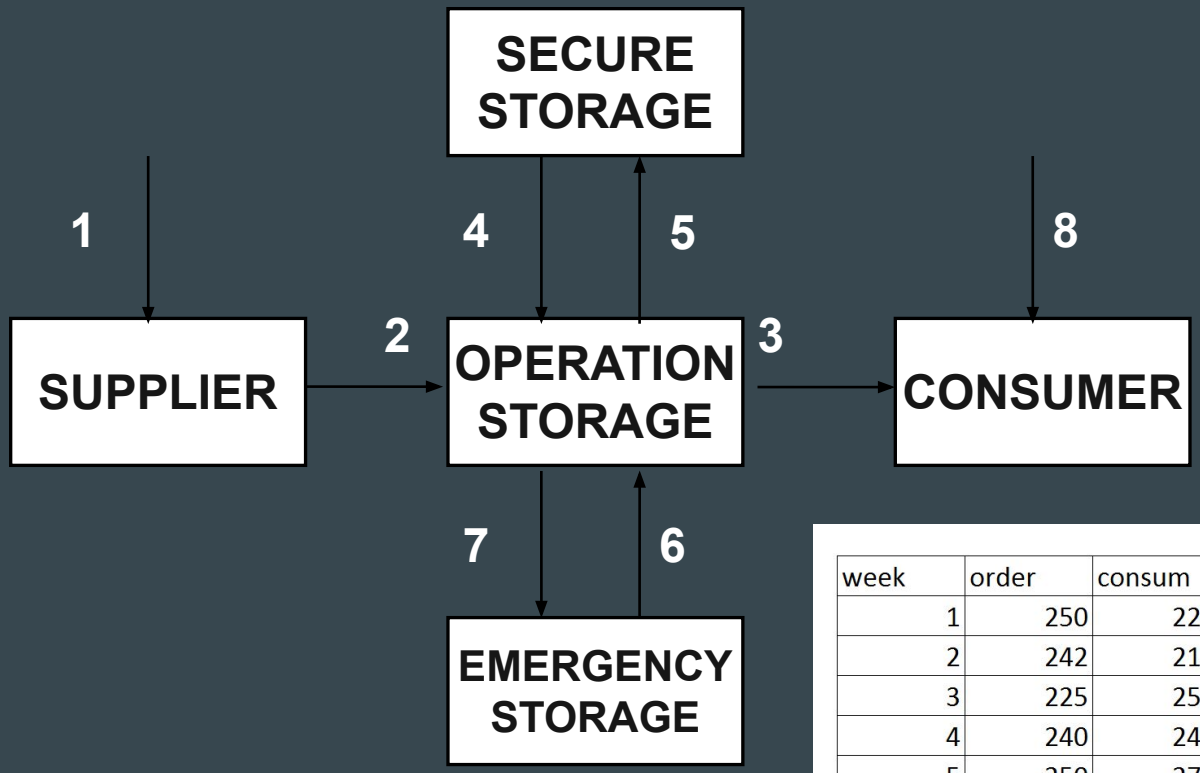
- Interconnectability = Linear/non-linear connections between/among the components of the system are defining the complex behavior of the system.

Features of a system

- Emergence = The system as a whole has different characteristics than the components (i.e. the effect of diversification).



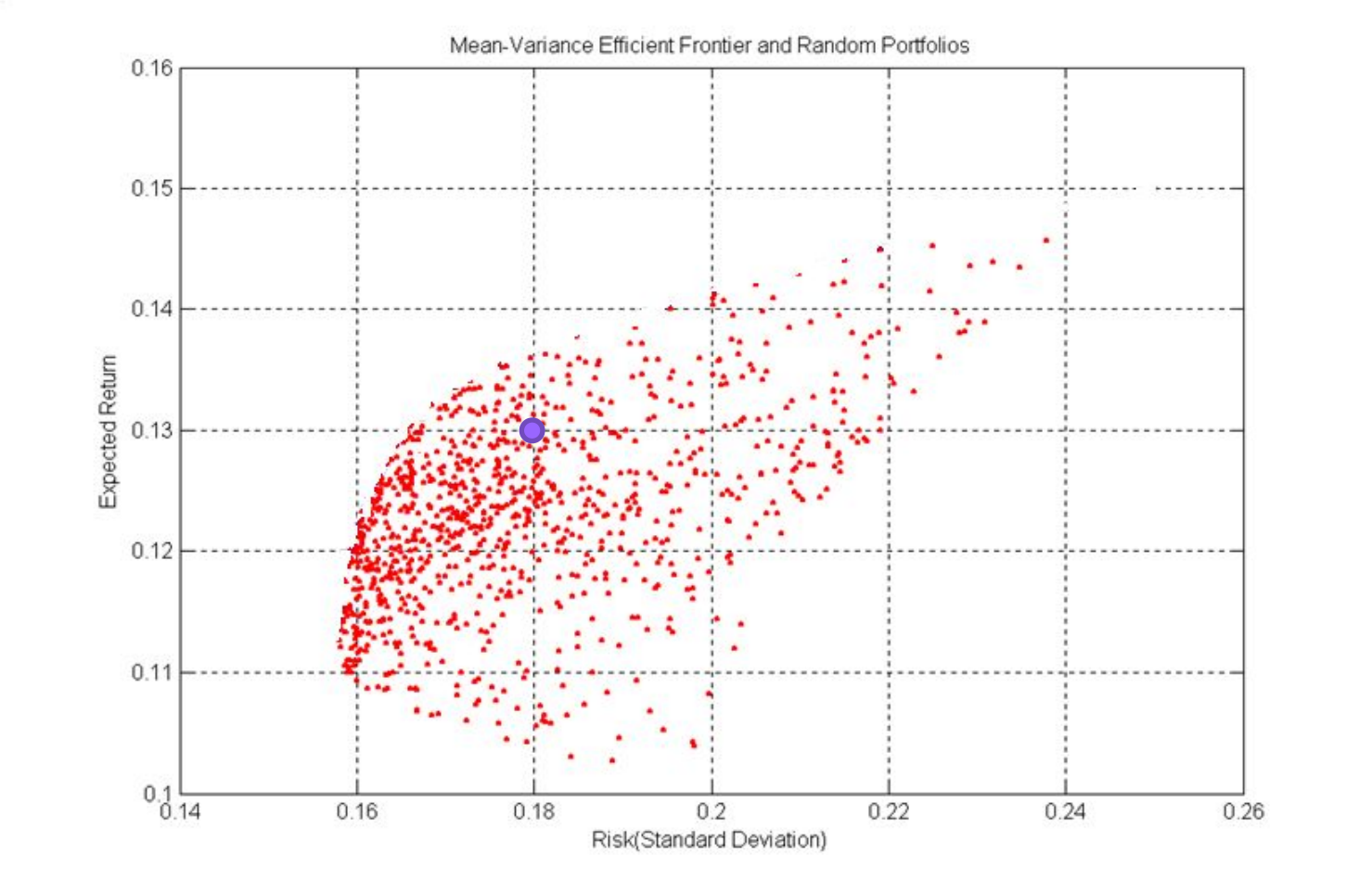
Stock Control Game



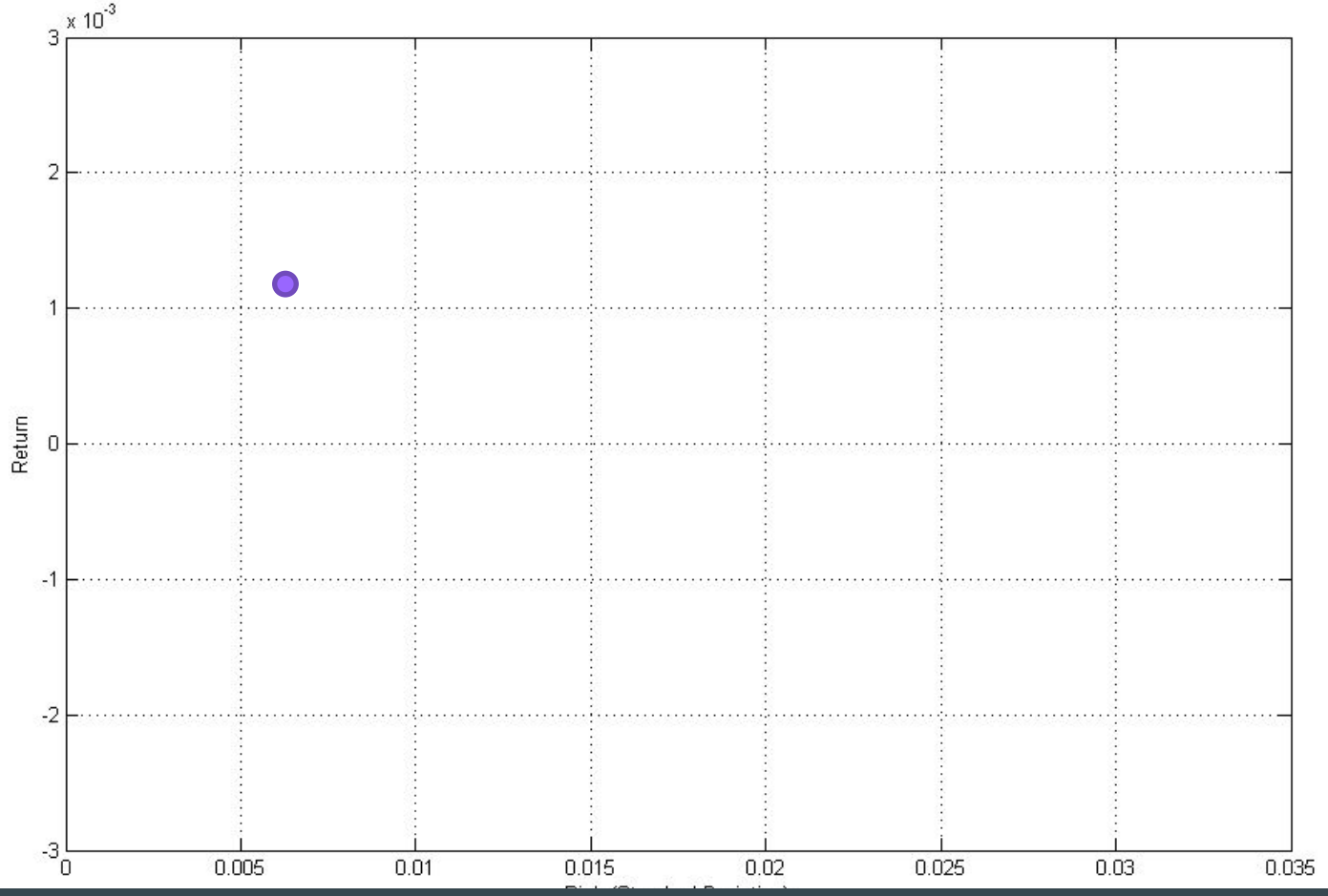
week	order	consum	balance	transport	storage	fine	total
1	250	228	22	900	44	0	944
2	242	213	51	900	102	0	1002
3	225	252	24	900	48	0	948
4	240	247	17	900	34	0	934
5	250	274	-7	900	0	300	1200
6	290	274	9	900	18	0	918
7	320	243	86	900	172	0	1072
8	262	303	45	900	90	0	990
9	260	260	45	900	90	0	990
10	303	318	30	900	60	0	960
							9958

State space of the system

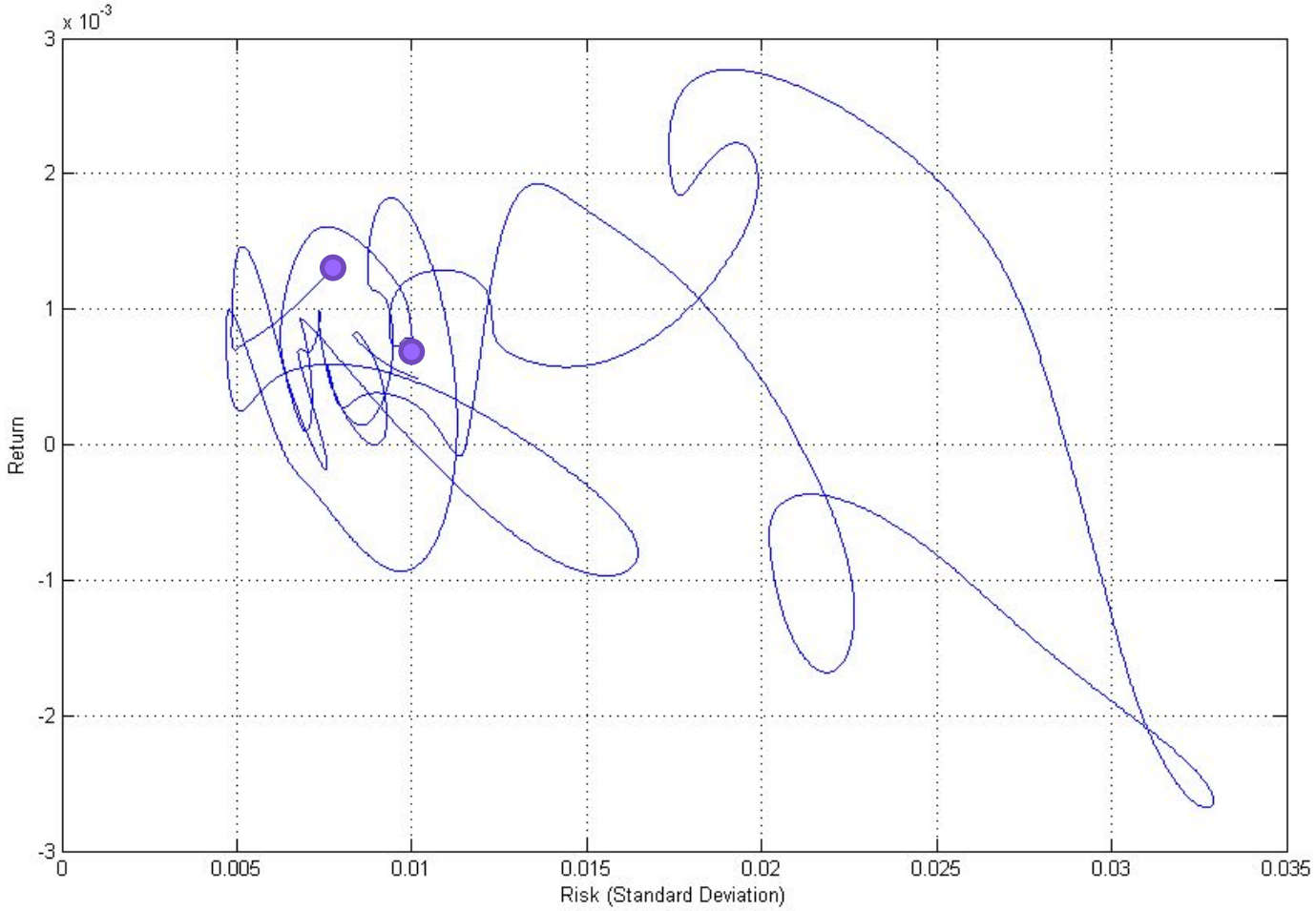
State of the system– in a state space defined by the significant variables (i.e. risk and return)



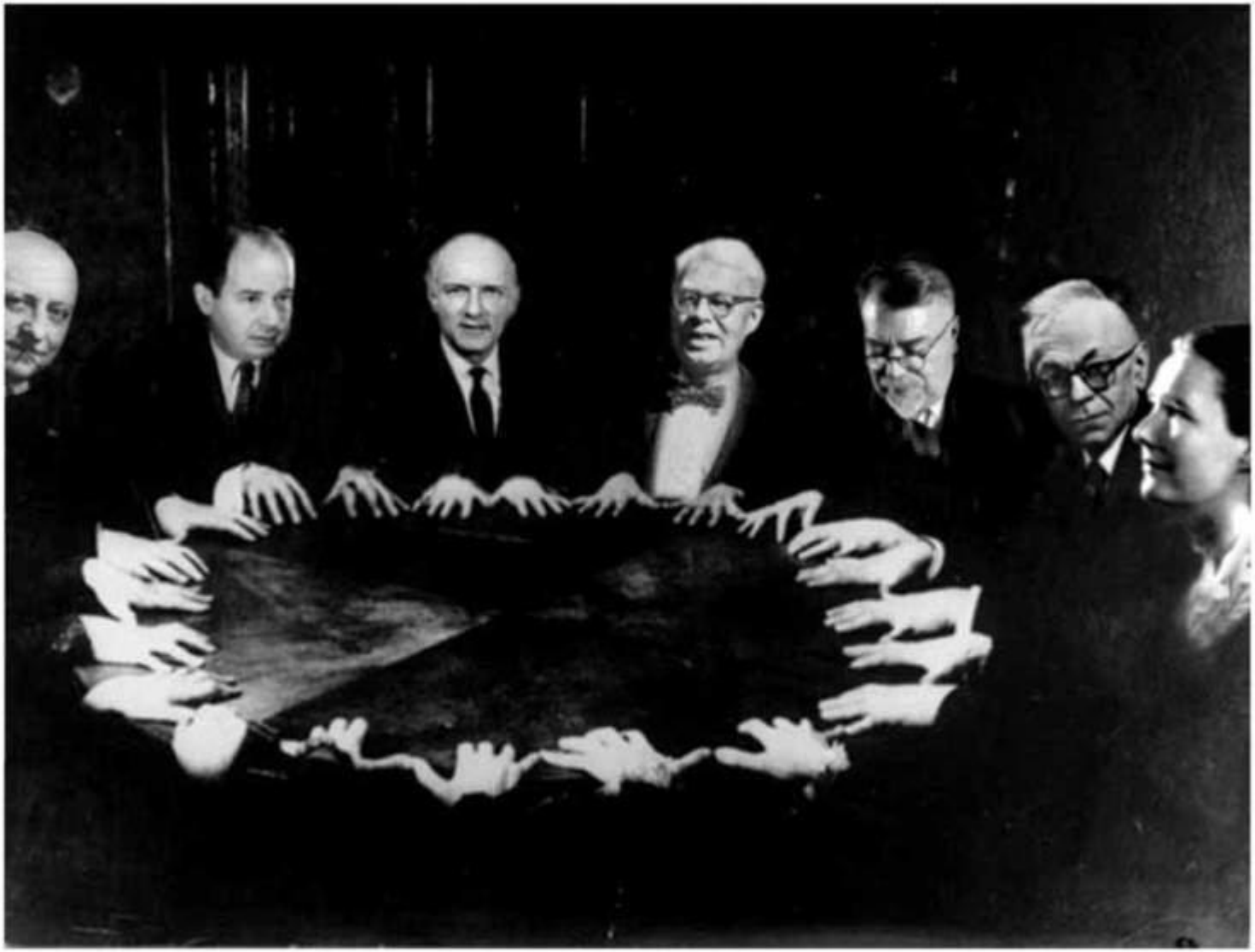
State of the system



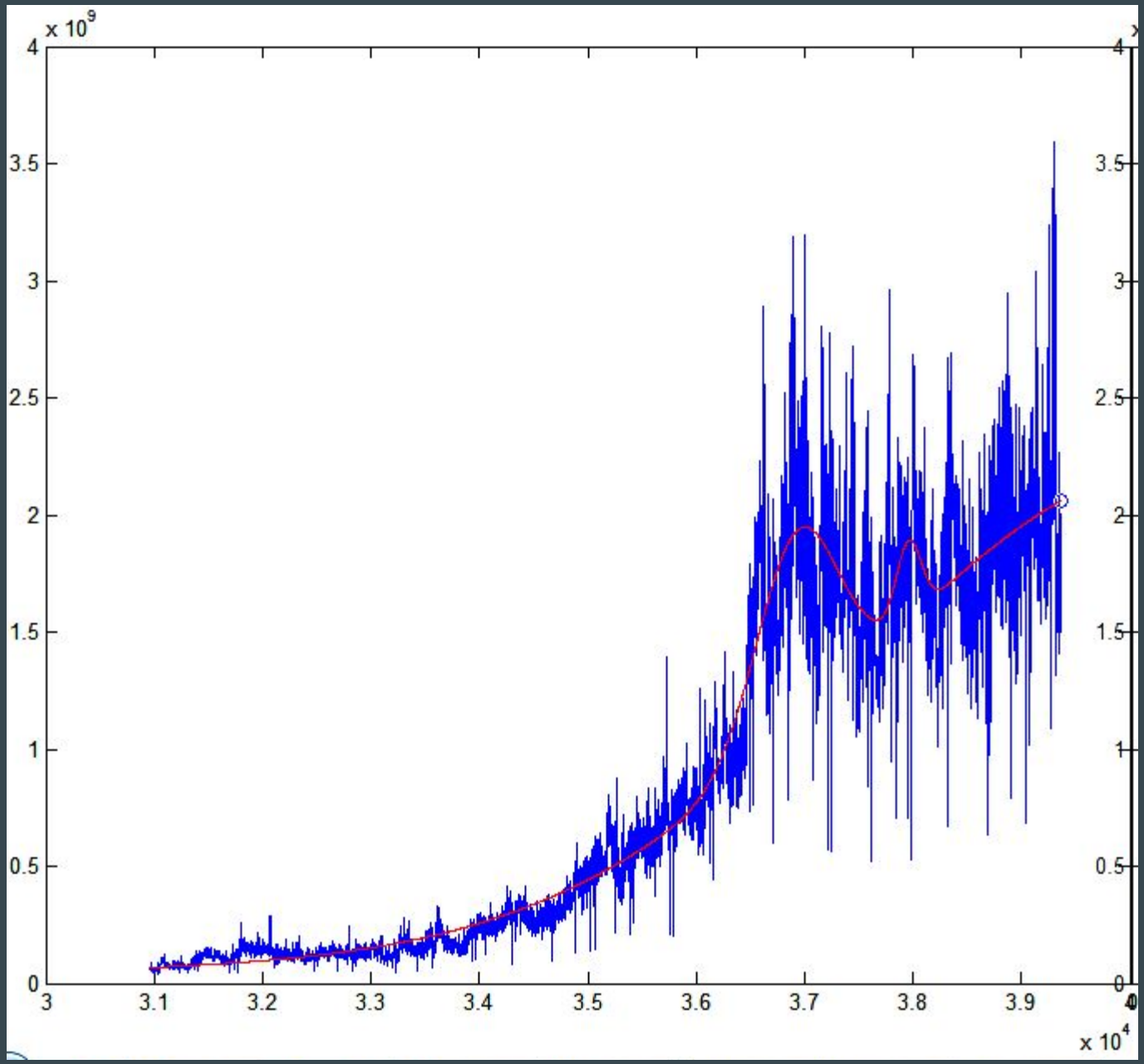
Behavior of the system



► **MATLAB demo**



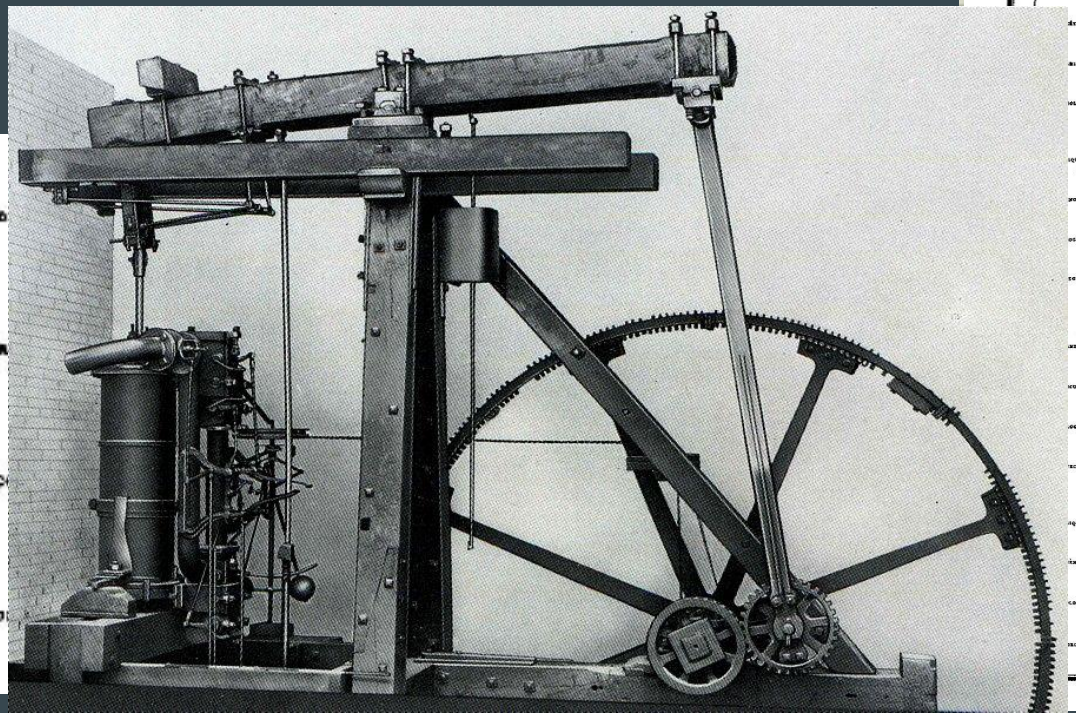
Cybernetic Séance - New York City, 1947
From Left to Right : Ralph W. Gerard (Neurophysiologist), John von Neumann (Mathematician), Heinz von Foerster (Electrical Engineer), Lawrence K. Frank (Social Scientist), Norbert Wiener (Mathematician), Heinrich Klüver (Psychologist), Molly Harrower (Psychologist). Front (missing from view): Rafael Lorente De No (Neurophysiologist), Margaret Mead (Anthropologist), Kurt Lewin (Psychologist), Warren S. McCulloch (Neuropsychiatrist), Paul F. Lazarsfeld (Sociologist), Arturo Rosenblueth (Physiologist), Gregory Bateson (Anthropologist). Observers (missing from view): Frank Fremont-Smith (Medical Director of the Macy Foundation), Julian Bigelow (Computer Engineer), Walter Pitts (Mathematician), George Evelyn Hutchinson (Ecologist), Leonard J. Savage (Mathematician), Henry Brosin (Psychiatrist), Theodore Schneirla (Comparative Psychologist), Hans Lukas Teuber (Psychologist), Gerhardt von Bonin (Neuroanatomist), Lawrence S. Kubie (Psychiatrist), Filmer S. C. Northrop (Philosopher), Alex Bavelas (Social Psychologist) and Donald Marquis (Psychologist).

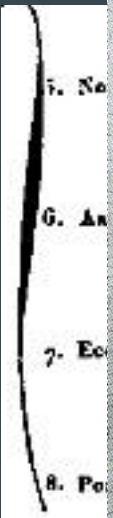


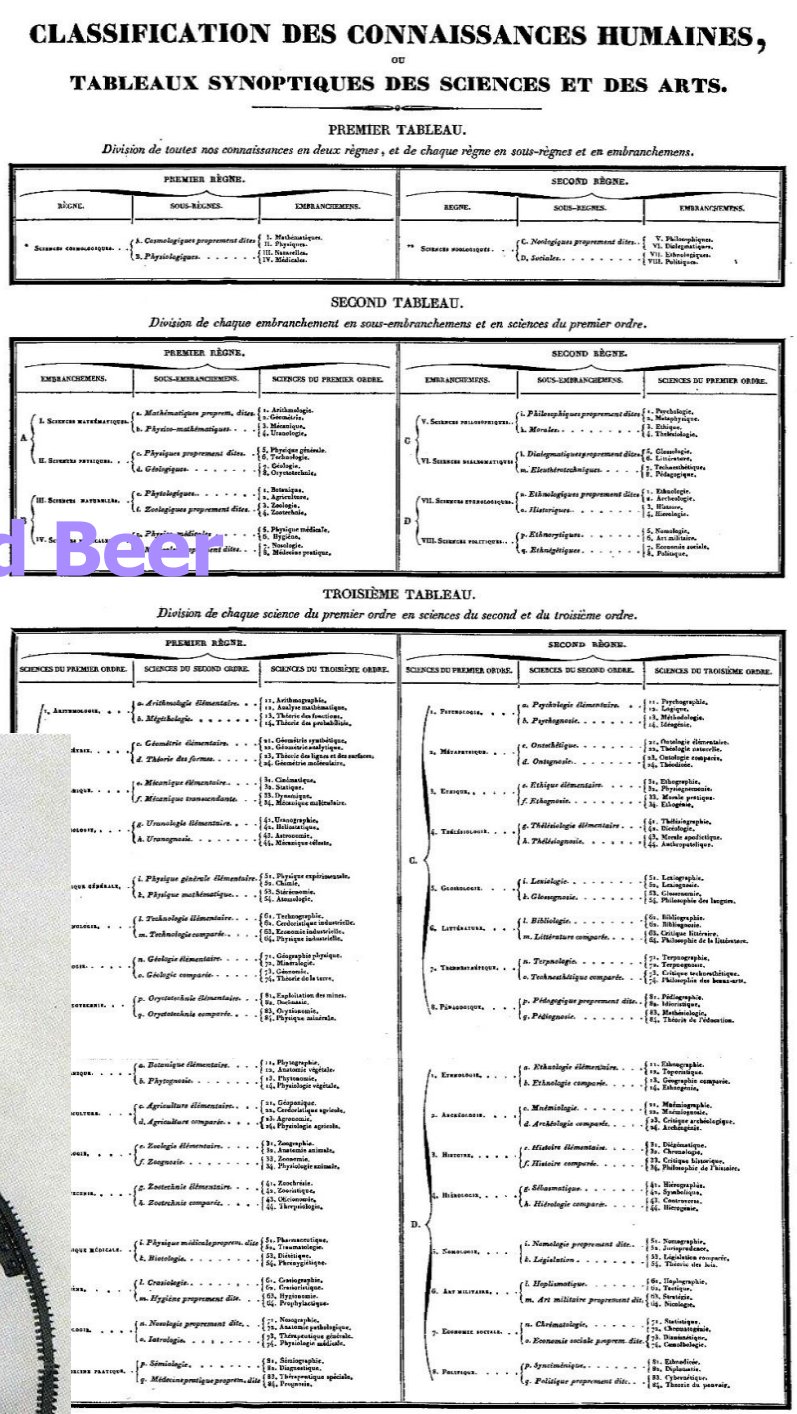
? Cardio
? Gearbox
? Nasdaq

What is cybernetics?

- “κυβερνώ” (Aristotle)
- “cybernetique” (Ampere)
- “governor” (Watt) Stafford Beer
- “cybernetics” (Wiener)







CLASSIFICATION DES CONNAISSANCES HUMAINES,

OU

TABLEAUX SYNOPTIQUES DES SCIENCES ET DES ARTS.

PREMIER TABLEAU.

Division de toutes nos connaissances en deux règnes, et de chaque règne en sous-règnes et en embranchemens.

PREMIER RÈGNE.			SECOND RÈGNE.		
RÈGNE.	SOUS-RÈGNES.	EMBRANCHEMENS.	RÈGNE.	SOUS-RÈGNES.	EMBRANCHEMENS.
* Sciences cosmologiques.	A. *Cosmologiques proprement dites*	I. Mathématiques. II. Physiques.	** Sciences noologiques.	C. *Noologiques proprement dites.*	V. Philosophiques. VI. Dialogmatiques.
	B. *Physiologiques.*	III. Naturelles. IV. Médicales.		D. *Sociales.*	VII. Libreologiques. VIII. Politiques.

SECOND TABLEAU.

Division de chaque embranchement en sous-embranchemens et en sciences du premier ordre.

PREMIER RÈGNE.			SECOND RÈGNE.		
EMBRANCHEMENS.	SOUS-EMBRANCHEMENS.	SCIENCES DU PREMIER ORDRE.	EMBRANCHEMENS.	SOUS-EMBRANCHEMENS.	SCIENCES DU PREMIER ORDRE.
I. Sciences mathématiques.	a. *Mathématiques propres, dites.*	1. Arithmologie. 2. Géométrie.	V. Sciences philosophiques.	i. *Philosophiques proprement dites*	1. Psychologie. 2. Métaphysique.
	b. *Physico-mathématiques.*	3. Mécanique. 4. Uranologie.		k. *Morales.*	3. Ethique. 4. Théologie.
II. Sciences physiques.	c. *Physiques proprement dites.*	5. Physique générale. 6. Technologie.	VI. Sciences dialogmatiques.	l. *Dialogmatiques proprement dites.*	5. Glossologie. 6. Littérature.
	d. *Géologiques.*	7. Géologie. 8. Oryctotechnie.		m. *Eleuthérotechniques.*	7. Technembétique. 8. Pédagogique.
III. Sciences naturelles.	e. *Phytologiques.*	1. Botanique. 2. Agriculture. 3. Zoologie. 4. Zootechnie.	VII. Sciences ethnologiques.	n. *Ethnologiques proprement dites*	1. Ethnologie. 2. Archéologie. 3. Histoire. 4. Hiérologie.
	f. *Zoologiques proprement dites.*			o. *Historiques.*	
IV. Sciences médicales.	g. *Physico-médicales.*	5. Physique médicale. 6. Hygiène. 7. Nosologie. 8. Médecine pratique.	VIII. Sciences politiques.	p. *Ethnarchiques.*	5. Nomologie. 6. Art militaire. 7. Economie sociale. 8. Politique.
	h. *Médico-pratiques proprement dites.*			q. *Ethnalgiques.*	

TROISIÈME TABLEAU.

Division de chaque science du premier ordre en sciences du second et du troisième ordre.

PREMIER RÈGNE.			SECOND RÈGNE.		
SCIENCES DU PREMIER ORDRE.	SCIENCES DU SECOND ORDRE.	SCIENCES DU TROISIÈME ORDRE.	SCIENCES DU PREMIER ORDRE.	SCIENCES DU SECOND ORDRE.	SCIENCES DU TROISIÈME ORDRE.
1. Arithmologie.	a. *Arithmologie élémentaire.*	11. Arithmographie. 12. Analyse mathématique. 13. Théorie des fonctions. 14. Théorie des probabilités.	1. Psychologie.	a. *Psychologie élémentaire.*	11. Psychographie. 12. Logique. 13. Méthodologie. 14. Idéologie.
	b. *Mégethologie.*			b. *Psychogenesie.*	
2. Géométrie.	c. *Géométrie élémentaire.*	21. Géométrie synthétique. 22. Géométrie analytique. 23. Théorie des lignes et des surfaces. 24. Géométrie infinitésimale.	2. Métaphysique.	c. *Ontothéologie.*	21. Ontologie élémentaire. 22. Théologie naturelle. 23. Ontologie comparée. 24. Théodicée.
	d. *Théorie des formes.*			d. *Ontogenesie.*	
3. Mécanique.	e. *Mécanique élémentaire.*	31. Cinématique. 32. Statique. 33. Dynamique. 34. Mécanique multiforme.	3. Ethique.	e. *Ethique élémentaire.*	31. Ethographie. 32. Physiognomonie. 33. Morale poétique. 34. Ethogénie.
	f. *Mécanique transcendante.*			f. *Ethogenesie.*	
4. Uranologie.	g. *Uranologie élémentaire.*	41. Uranographie. 42. Héliostatique. 43. Astrocosmie. 44. Mécanique céleste.	4. Théologie.	g. *Théologie élémentaire.*	41. Théologographie. 42. Théologie. 43. Morale apodictique. 44. Anthropotéique.
	h. *Uranogenesie.*			h. *Théogenesie.*	
5. Physique générale.	i. *Physique générale élémentaire.*	51. Physique expérimentale. 52. Chimie. 53. Stéréonomie. 54. Atmologie.	5. Glossologie.	i. *Lexiologie.*	51. Lexiographie. 52. Lexiogenesie. 53. Glossonomie. 54. Philosophie des langues.
	k. *Physique mathématique.*			k. *Glossognosie.*	
6. Technologie.	l. *Technologie élémentaire.*	61. Technographie. 62. Technologie industrielle. 63. Economie industrielle. 64. Physique industrielle.	6. Littérature.	l. *Bibliologie.*	61. Bibliographie. 62. Bibliognosie. 63. Critique littéraire. 64. Philosophie de la littérature.
	m. *Technologie comparée.*			m. *Littérature comparée.*	
7. Géologie.	n. *Géologie élémentaire.*	71. Géographie physique. 72. Minéralogie. 73. Géocosmie. 74. Théorie de la terre.	7. Thermathétique.	n. *Torpologie.*	71. Torpographie. 72. Torpognosie. 73. Critique technocratique. 74. Philosophie des beaux-arts.
	o. *Géologie comparée.*			o. *Technathétique comparée.*	
8. Oryctotechnie.	p. *Oryctotechnie élémentaire.*	81. Exploitation des mines. 82. Docimasie. 83. Oryctonomie. 84. Physique minérale.	8. Pédagogique.	p. *Pédagogique proprement dite.*	81. Pédagogie. 82. Mésologie. 83. Méthodologie. 84. Théorie de l'éducation.
	q. *Oryctotechnie comparée.*			q. *Pédagogenesie.*	
1. Botanique.	a. *Botanique élémentaire.*	11. Phytographie. 12. Anatomie végétale. 13. Phytonomie. 14. Physiologie végétale.	1. Ethnologie.	a. *Ethnologie élémentaire.*	11. Ethnographie. 12. Toponymie. 13. Géographie comparée. 14. Ethnogénie.
	b. *Phytogenesie.*			b. *Ethnologie comparée.*	
2. Agriculture.	c. *Agriculture élémentaire.*	21. Géoponique. 22. Cerdonistique agricole. 23. Agronomie. 24. Physiologie agricole.	2. Archéologie.	c. *Mnémologie.*	21. Mnémographie. 22. Mnémognosie. 23. Critique archéologique. 24. Archéogénie.
	d. *Agriculture comparée.*			d. *Archéologie comparée.*	
3. Zoologie.	e. *Zoologie élémentaire.*	31. Zoographie. 32. Anatomie animale. 33. Zoonomie. 34. Physiologie animale.	3. Histoire.	e. *Histoire élémentaire.*	31. Diégématique. 32. Chronologie. 33. Critique historique. 34. Philosophie de l'histoire.
	f. *Zoogenesie.*			f. *Histoire comparée.*	
4. Zootechnie.	g. *Zootechnie élémentaire.*	41. Zoochrisie. 42. Zoocratique. 43. Œcionomie. 44. Théopsiologie.	4. Hiérologie.	g. *Sélasmatique.*	41. Hiérographie. 42. Symbolique. 43. Controverse. 44. Hiérogénie.
	h. *Zootechnie comparée.*			h. *Hiérologie comparée.*	
1. Physique médicale proprem. dite.	i. *Physique médicale proprem. dite*	51. Pharmaceutique. 52. Traumatologie. 53. Diététique. 54. Phrenygiétique.	5. Nomologie.	i. *Nomologie proprement dite.*	51. Nomographie. 52. Jurisprudence. 53. Législation comparée. 54. Théorie des lois.
	k. *Biotologie.*			k. *Législation.*	
2. Cranéologie.	l. *Cranéologie.*	61. Cranéographie. 62. Cranéotomie. 63. Hygiotomie. 64. Prophylactique.	6. Art militaire.	l. *Hoplomatique.*	61. Hoplographie. 62. Tactique. 63. Stratégie. 64. Nicologie.
	m. *Hygiène proprement dite.*			m. *Art militaire proprement dit.*	
3. Nosologie.	n. *Nosologie proprement dite.*	71. Nosographie. 72. Anatomie pathologique. 73. Théopsiologie générale. 74. Physiologie médicale.	7. Economie sociale.	n. *Chrématologie.*	71. Statistique. 72. Chrématographie. 73. Diasomatologie. 74. Gamathologie.
	o. *Iatrologie.*			o. *Economie sociale proprem. dite.*	
4. Médecine pratique.	p. *Séméiologie.*	81. Séméiographie. 82. Diagnostique. 83. Théopsiologie spéciale. 84. Prognostic.	8. Politique.	p. *Synchrématique.*	81. Ethnodicée. 82. Diplomatie. 83. Cybernétique. 84. Théorie du pouvoir.
	q. *Médecine pratique proprem. dite.*			q. *Politique proprement dite.*	

Cybernetique

Cybernétique. Les relations de peuple à peuple, étudiées dans les deux sciences précédentes, ne sont que la moindre partie des objets sur lesquels doit veiller un bon gouvernement ; le maintien de l'ordre public, l'exécution des lois, la juste répartition des impôts, le choix des hommes qu'il doit employer, et tout ce qui peut contribuer à l'amélioration de l'état social, réclament à chaque instant son attention. Sans cesse il a à choisir entre diverses mesures celle qui est la plus propre à atteindre le but ; et ce n'est que par l'étude approfondie et comparée des divers éléments que lui fournit, pour ce choix, la connaissance de tout ce qui est relatif à la nation qu'il régit, à son caractère, ses moeurs, ses opinions, son histoire, sa religion, ses moyens d'existence et de prospérité, son organisation et ses lois, qu'il peut se faire des règles générales de conduite, qui le guident dans chaque cas particulier. Ce n'est donc qu'après toutes les sciences qui s'occupent de ces divers objets qu'on doit placer celle dont il est ici question et que je nomme Cybernétique, du mot κυβερνώ, qui, pris d'abord, dans une acception restreinte, pour l'art de gouverner un vaisseau, reçut de l'usage, chez les Grecs même, la signification, tout autrement étendue, de l'art de gouverner en général.

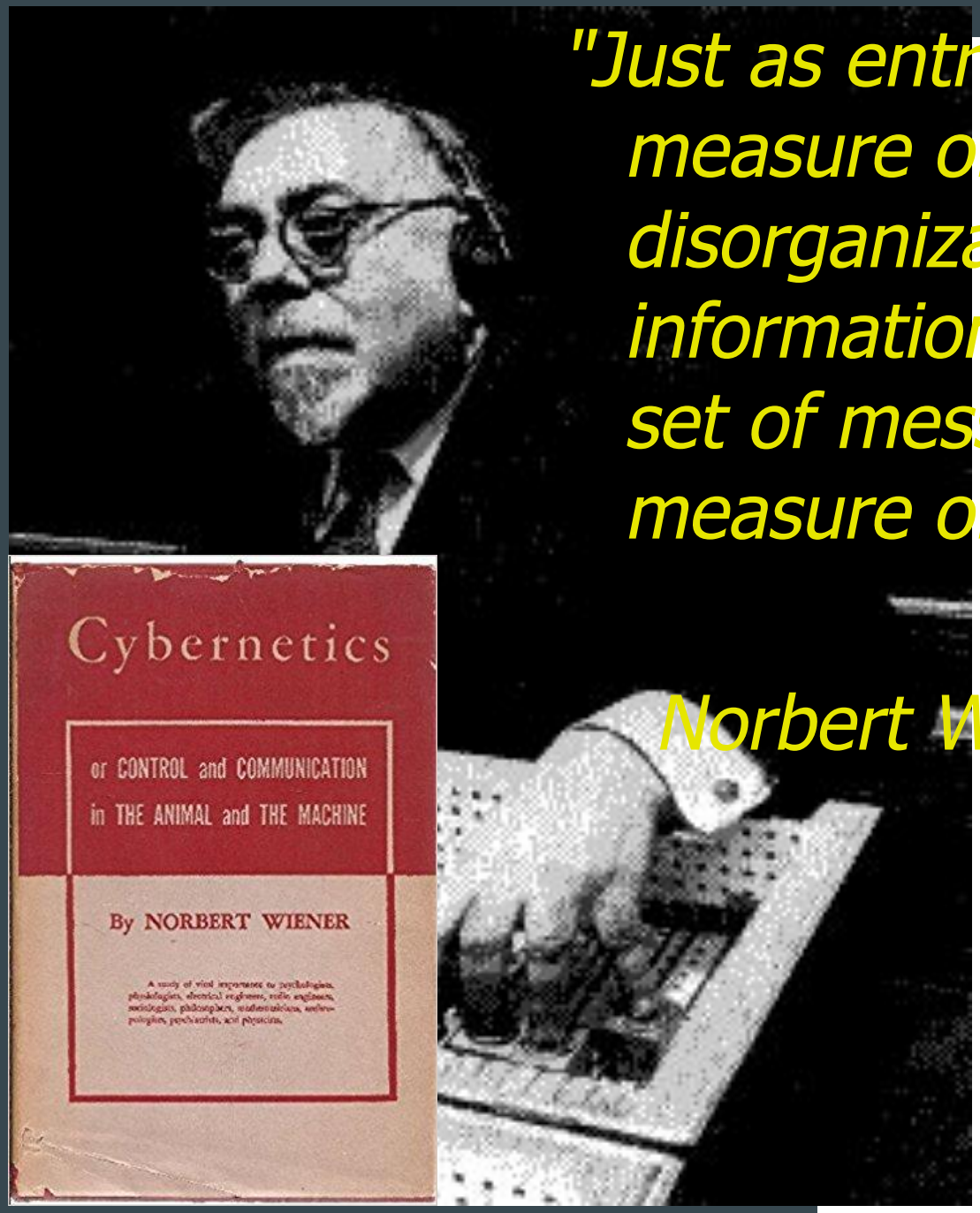
...

On reconnaît avec la même facilité ceux du point de vue troponomique dans la cybernétique, qui est, à l'égard du gouvernement des nations, ce qu'est la stratégie relativement à la conduite d'une armée.

Cybernetics. The relations between people and people, studied in the two preceding sciences, are only the least part of the objects over which good government must watch; the maintenance of public order, the execution of laws, the fair distribution of taxes, the choice of the men it must employ, and everything that can contribute to the improvement of the social state, require at every moment His attention. He constantly has to choose between various measures the one that is best suited to achieving the goal; and it is only through the in-depth and comparative study of the various elements that provides him, for this choice, with the knowledge of everything relating to the nation that he governs, to its character, its morals, its opinions, its history, its religion, its means of existence and prosperity, its organization and its laws, that it can make general rules of conduct, which guide it in each particular case. It is therefore only after all the sciences which deal with these various objects that we must place that which is in question here and which I call Cybernetics, from the word κυβερνώ, which, taken firstly, in a sense restricted, for the art of governing a vessel, received from usage, among the Greeks themselves, the meaning, quite differently extended, of the art of governing in general.

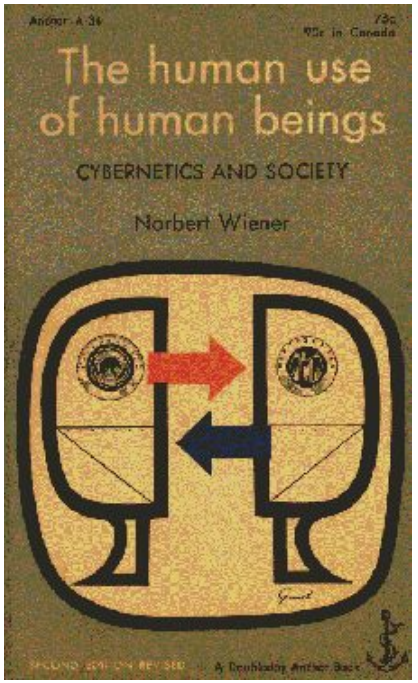
...

We recognize with the same ease those from the troponomic point of view in cybernetics, which is, with regard to the government of nations, what strategy is relative to the conduct of an army.



"Just as entropy is a measure of disorganization, the information carried by a set of messages is a measure of organization"

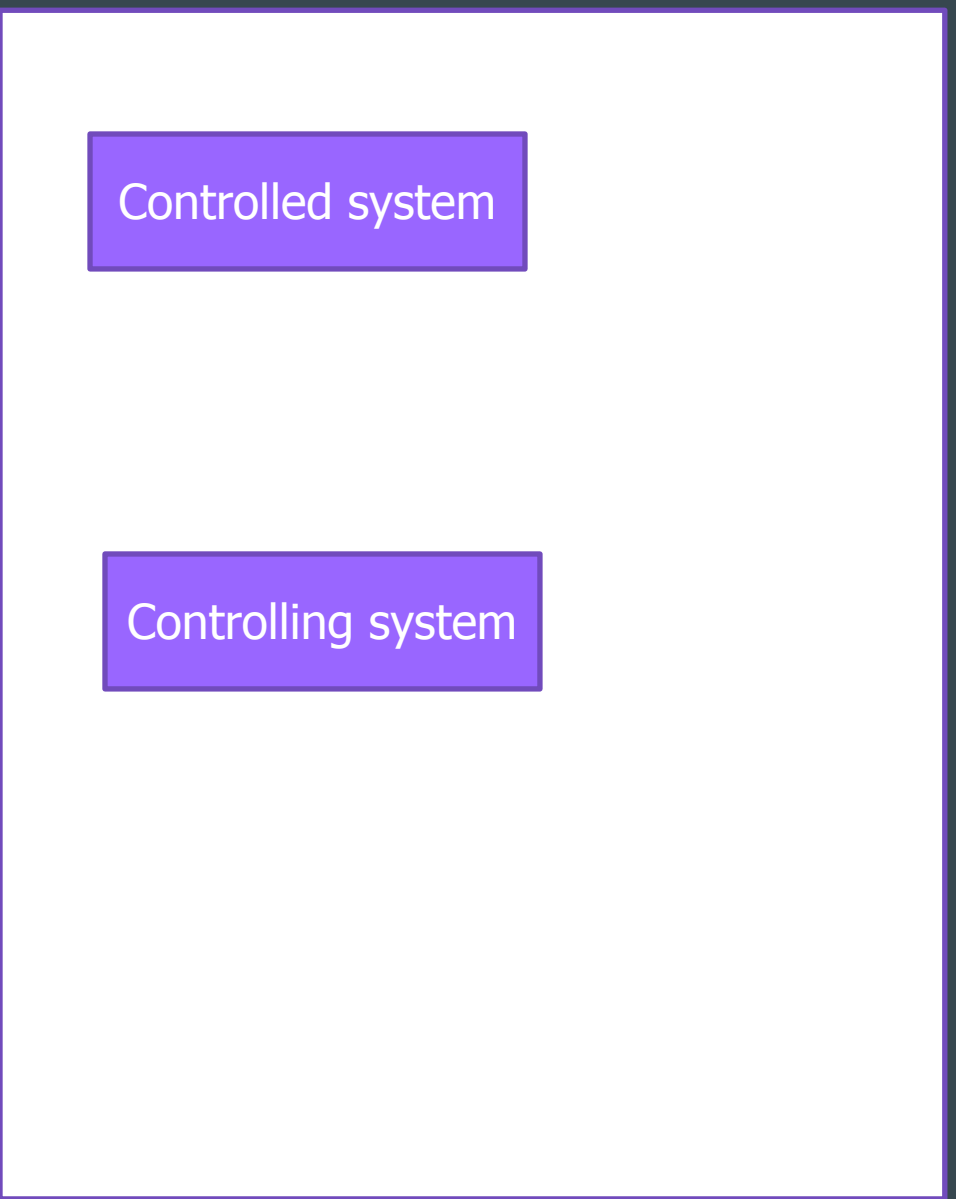
Norbert Wiener



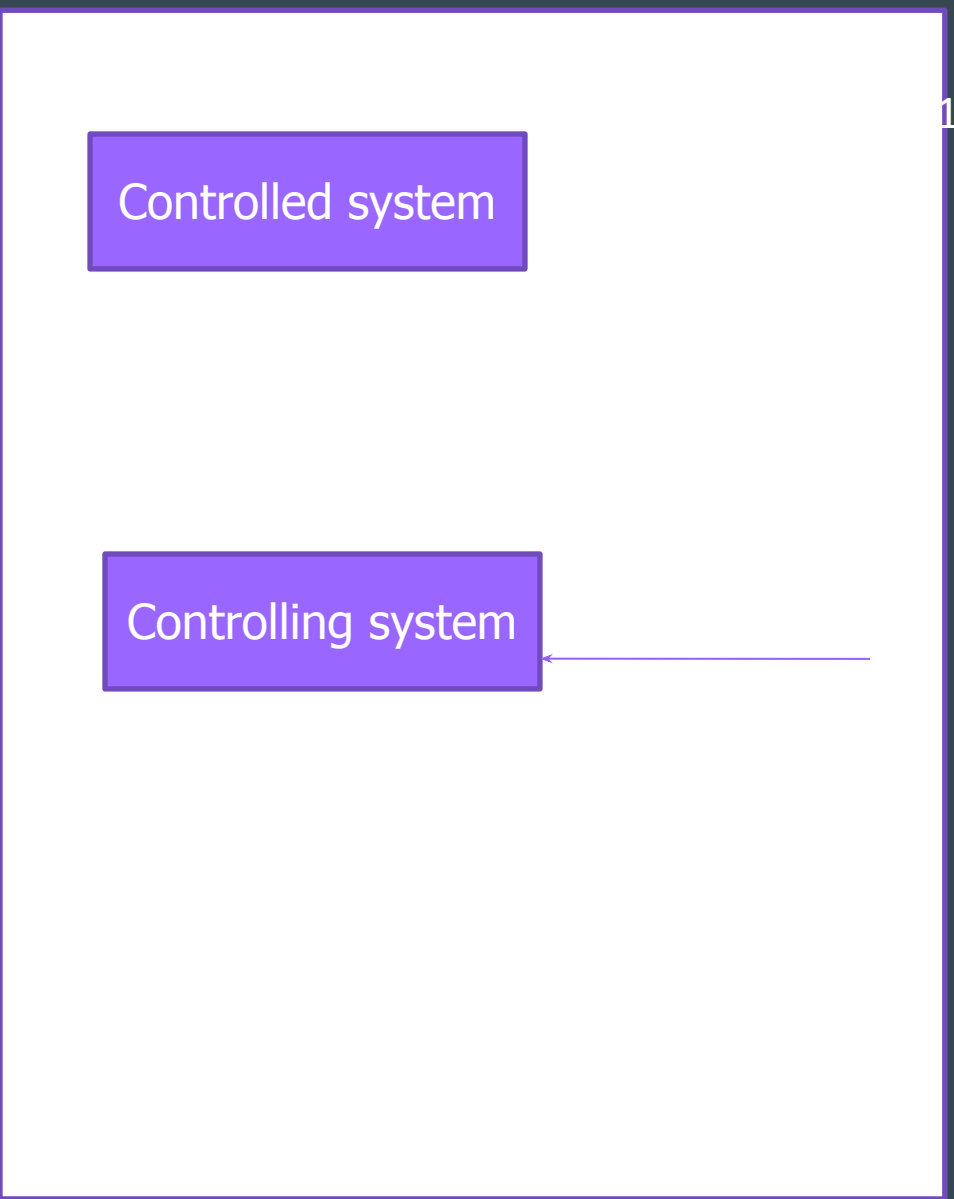
Control System

- Management is a goal-oriented informational transformation process.
- Controlling system is an information transformer.
- Hierarchy = the management system may be composed of subsystems of lower levels.
- Law of control – the pre-defined strategy for management.
- Observation frequency – characteristic inherent to the strategy, reflects how often the management reviews the strategy.

Control system

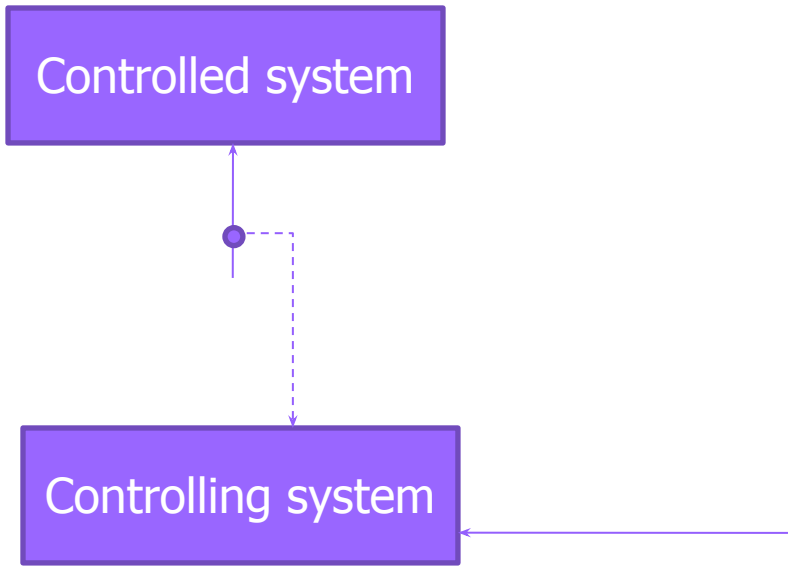


Control system



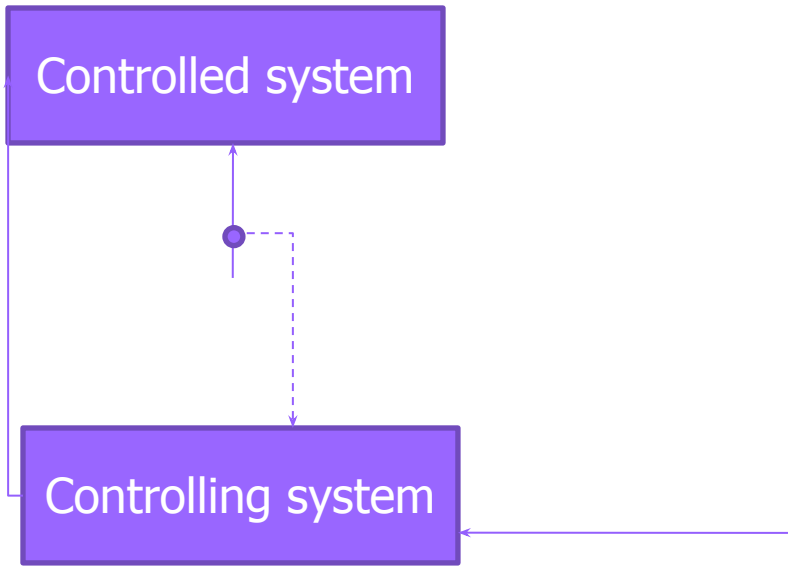
1. Goals

Control system



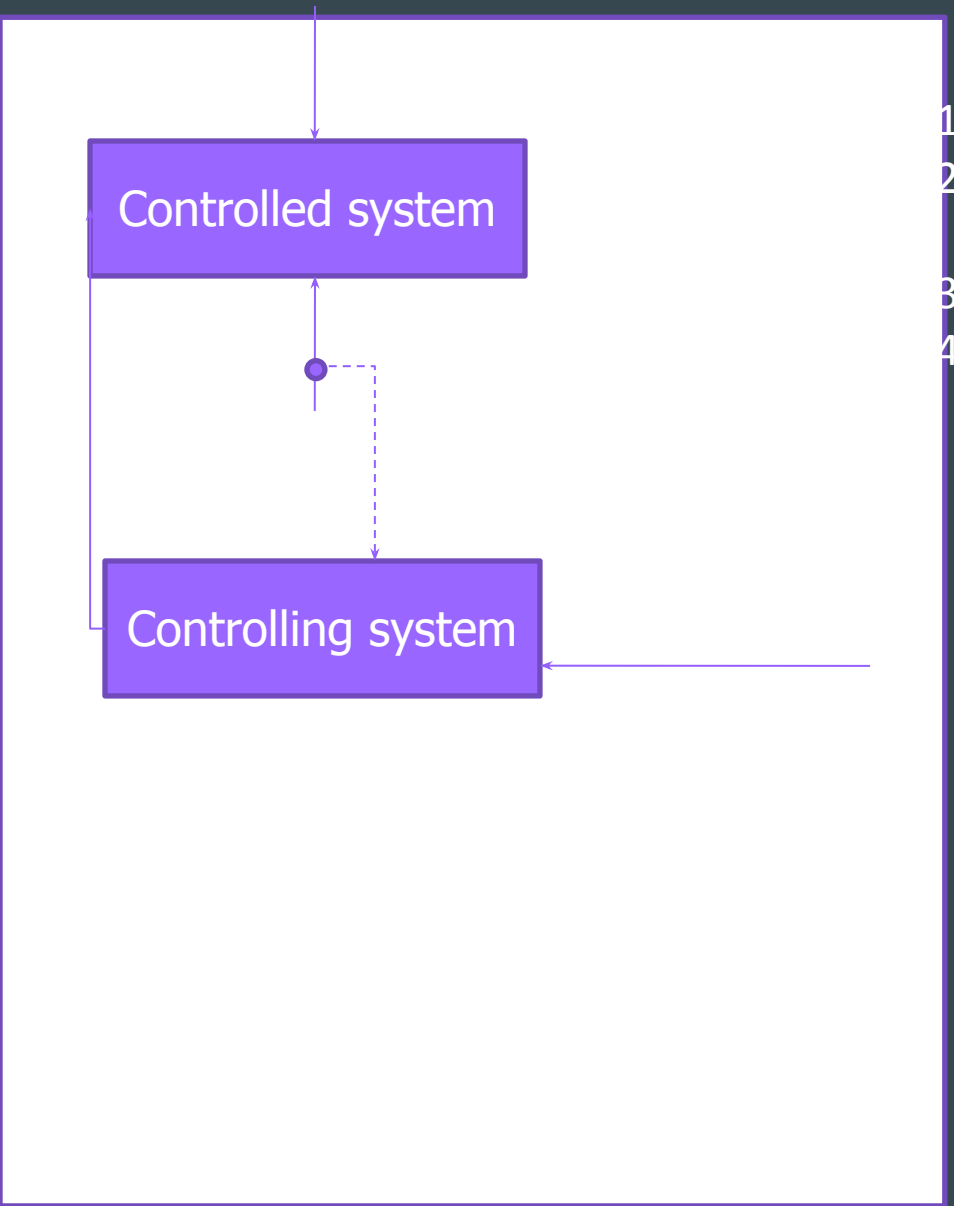
1. Goals
2. Observed influences from the environment (market factors)

Control system



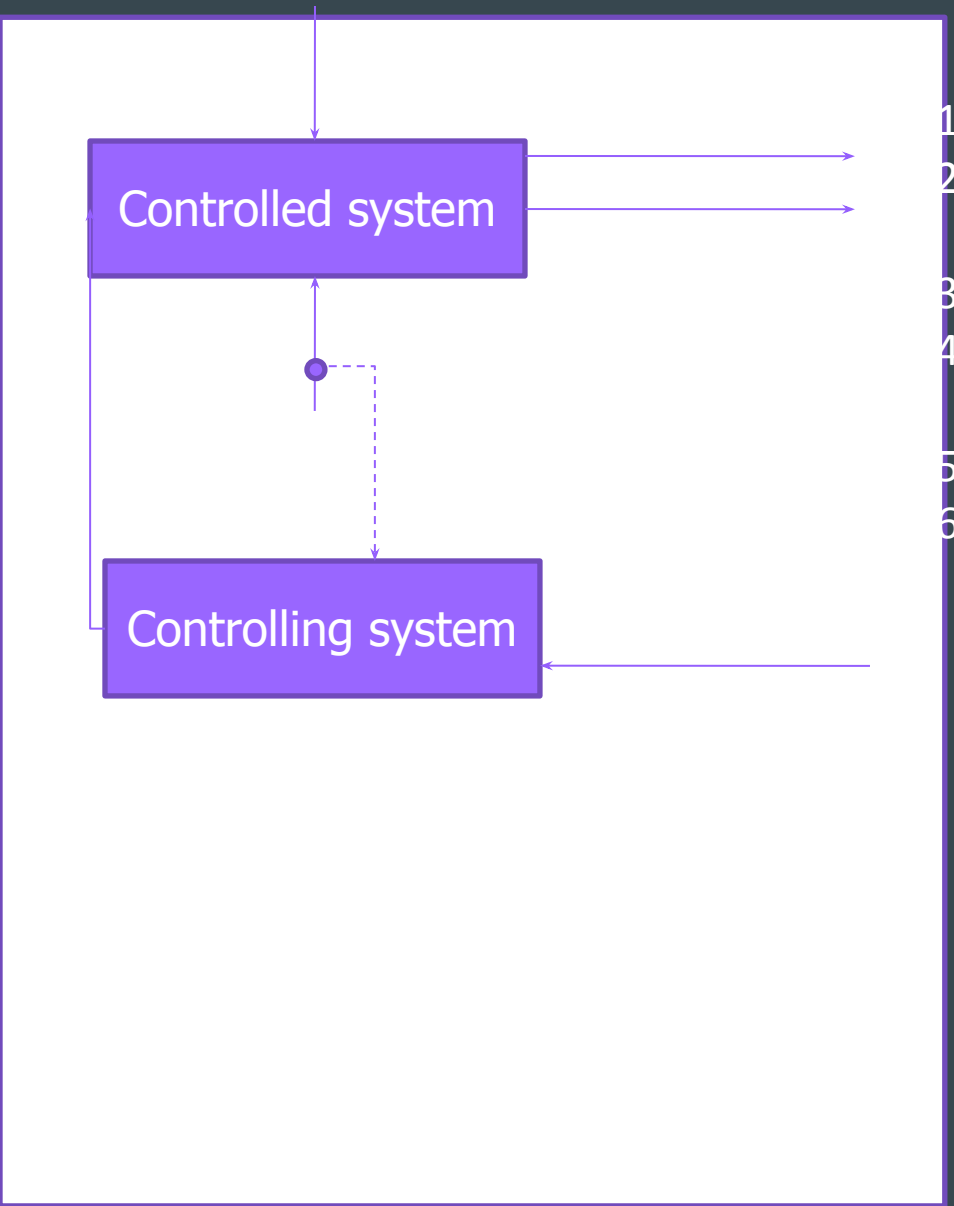
1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences

Control system



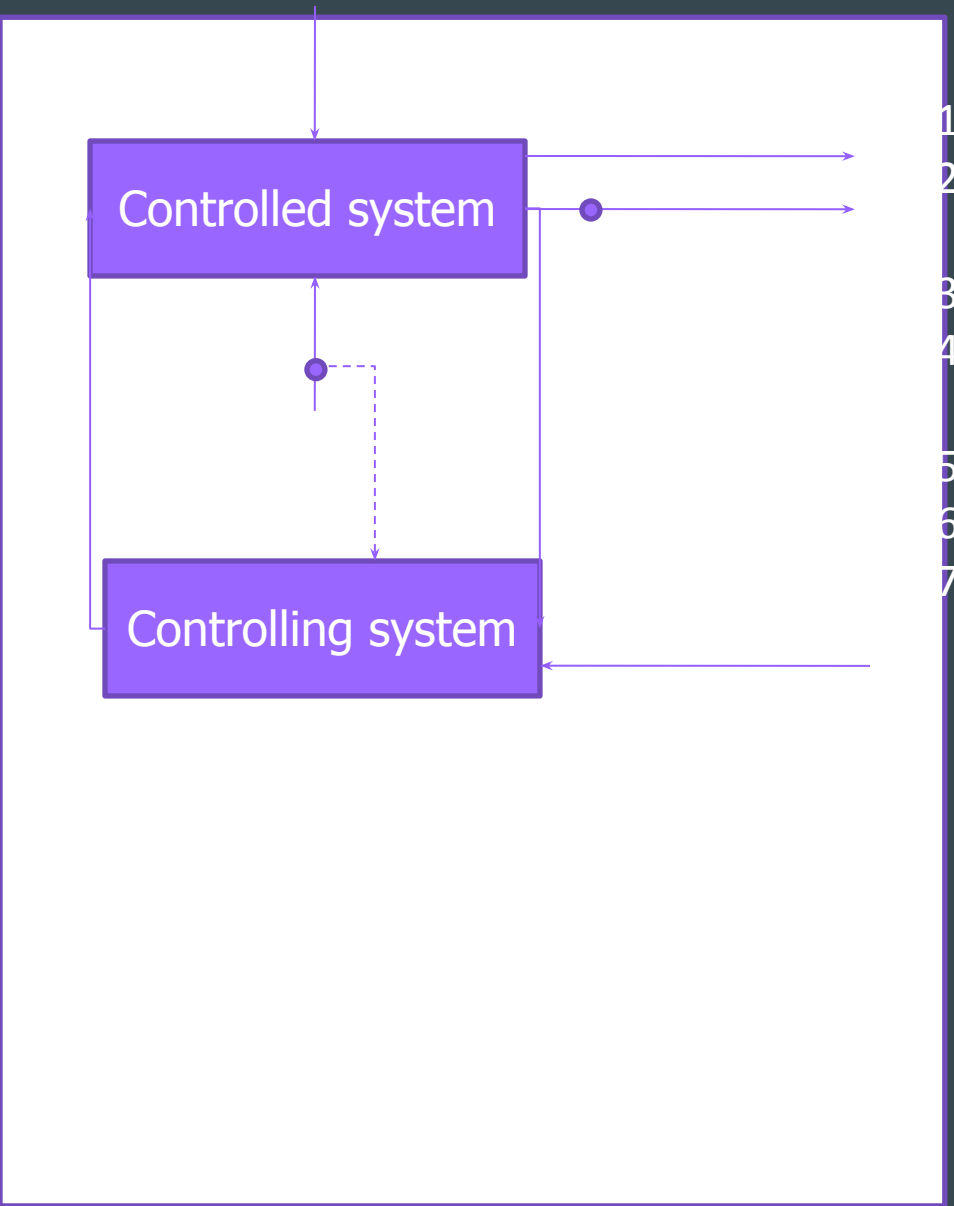
1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences
4. Unobserved influences from the environment

Control system



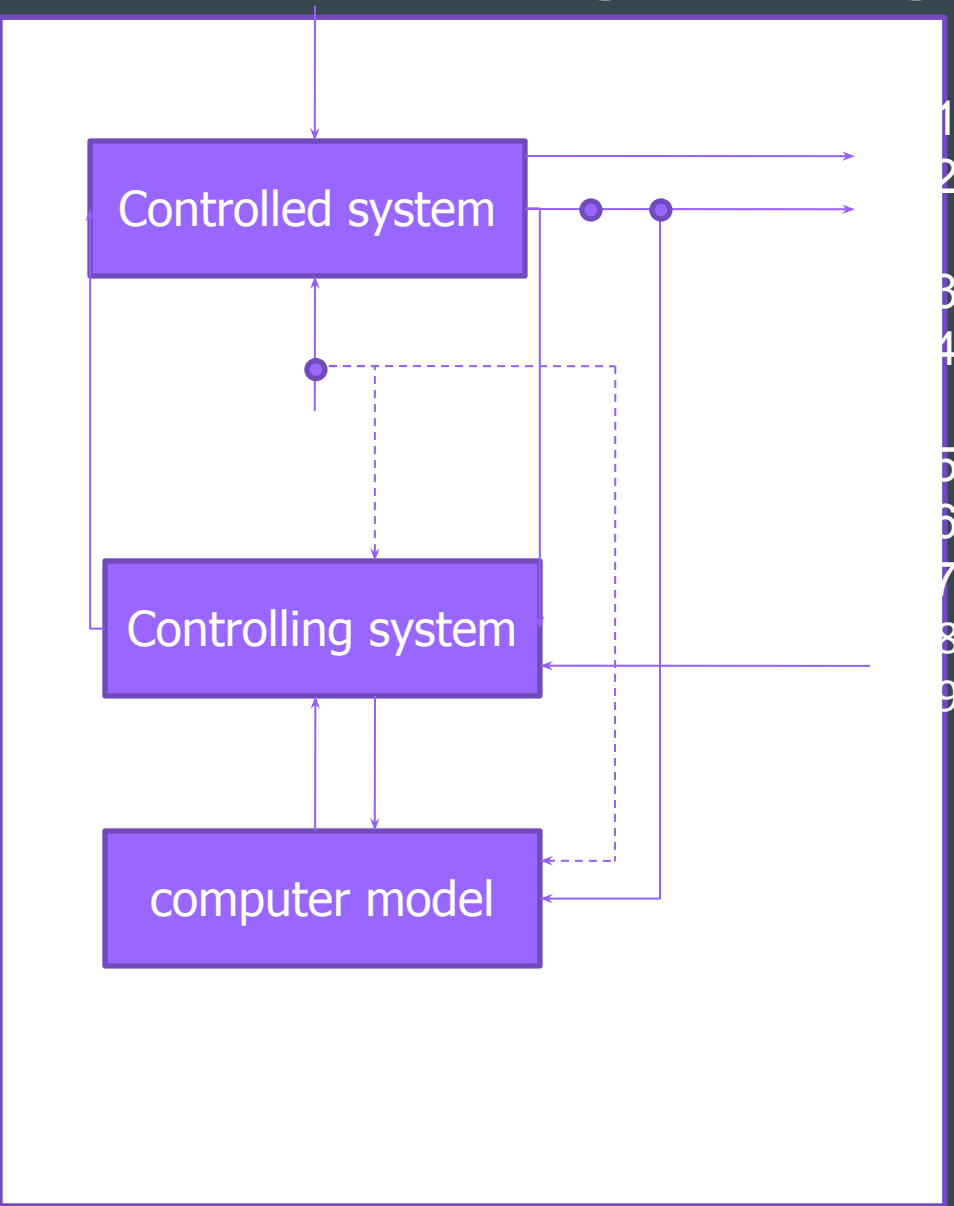
1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences
4. Unobserved influences from the environment
5. Insignificant variables (?)
6. Significant variables

Control system



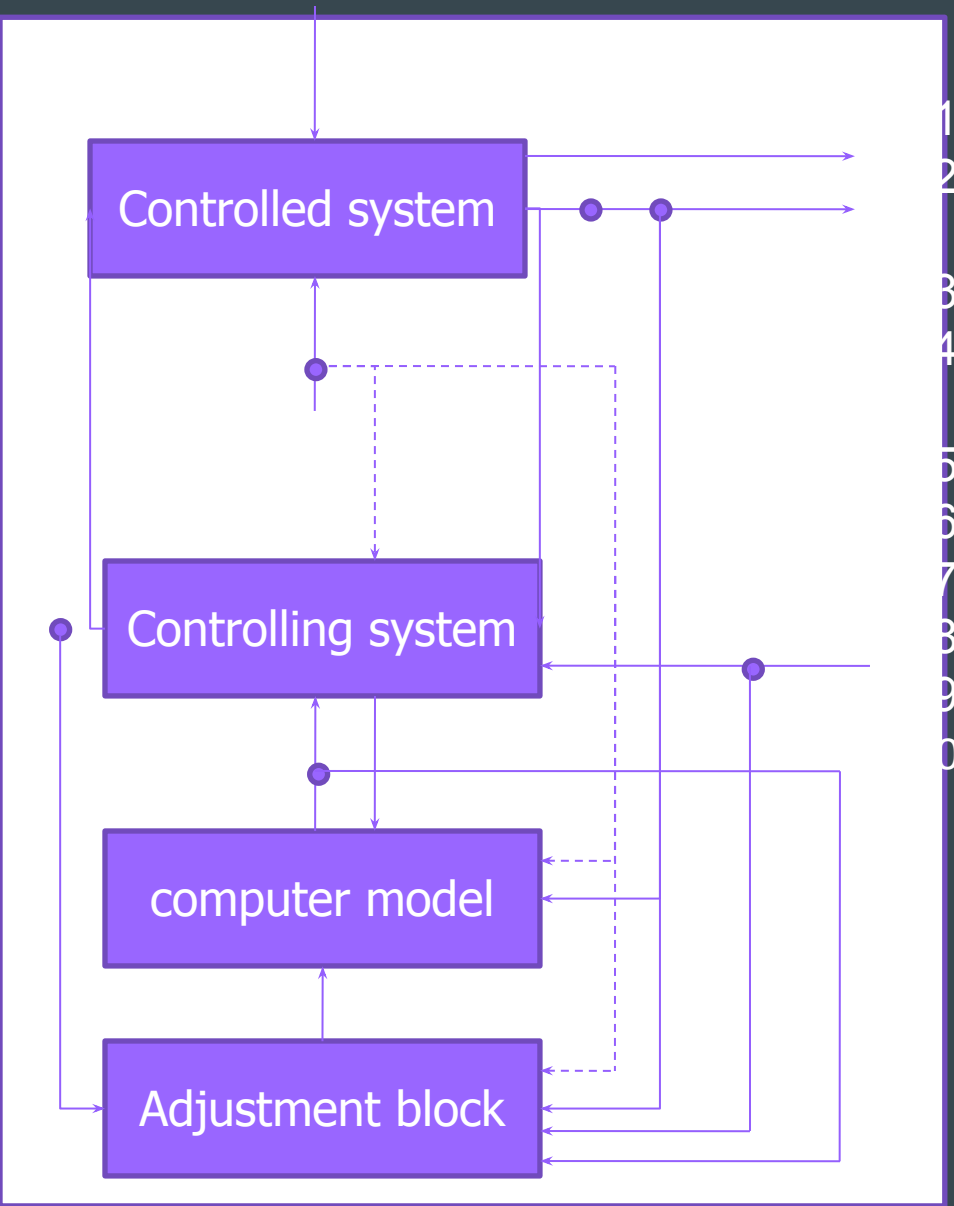
1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences
4. Unobserved influences from the environment
5. Insignificant variables (?)
6. Significant variables
7. Feedback

Controlling using computer model



1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences
4. Unobserved influences from the environment
5. Insignificant variables (?)
6. Significant variables
7. Feedback
8. Task for the computer model
9. Proposed controlled influences

Computer model with adjustment



1. Goals
2. Observed influences from the environment (market factors)
3. Controlling influences
4. Unobserved influences from the environment
5. Insignificant variables (?)
6. Significant variables
7. Feedback
8. Task for the computer model
9. Proposed controlled influences
10. Adjusting the internal structure and/or the values of the variables of the computer model

Phases in the process of Controlled system management

A. Goals = Criteria for evaluating Controlled system performance (i.e Profit)
B. Receiving, Collecting, Systemizing information on the behavior of the Controlled system.
C. Receiving, Collecting, Systemizing information on the behavior of the market (environment).
D. Forecasting/estimating expected values.
E. Defining and evaluating possible "states" – combinations of primitive Controlled systems.
F. Use of computer model („etalon" i.e. Simulation Model).
G. Making decision and selecting a Controlled system desired state (optimality; multi-criteria; rationality; necessary addition principle).
H. Controlling influence = realization of the decision (sub optimality, discretization, dissectability of an issue; whole number optimization; time of reaction; real limitations; market friction).
I. Self-learning and Self-organization in process of Controlled system management
J. Automation of the process of Controlled system management.

(Each phase is represented by a subsystem in the controlling system – Controlling system).

The Map of Control Theory

pontryagin's maximum principle

Max(H)

model reference adaptive

extremum-seeking

$\hat{u} +$

hamilton-jacobi-bellman equation

value → act

iterative learning control

Again!

lqr vs.

optimal

predictive

linear mpc

model predictive control

robust mpc

backstepping

fuzzy control

gain scheduling

nonlinear

feedback linearization

dynamic inversion

G^{-1} G

intelligent

bang-bang

reinforcement learning

explore vs exploit

genetic algorithms

sliding mode

multi-agent

graph theoretic control

leader-follower

swarm

gang of six

root locus

active disturbance rejection control

robust

Hinf

mu synthesis

adaptive

loop shaping

pid

$K_p e(t)$

$K_i \int e(t)\,dt$

$K_d \frac{de(t)}{dt}$

full state feedback

K

lead-lag

linear

control methods

continuous

discrete

time

frequency

D2C

C2D

feedback

feedforward

laplace

performance

system analysis

stability

nonminimum phase

controllability observability

$C_m = [B, AB, A^2B]$

$O_m = [C, CA, CA^2]^T$

margins

SAFETY

nyquist

passivity

phase plane

pole-zero plot

lyapunov stability

bode plots

nichols chart

constraints

RRT

A*

optimal

holonomic nonholonomic redundant

observer

step

sine

impulse

planning

mapping

filtering

kalman filter

calibration

$y_p = [\,] y + b$

moving horizon estimation

tracking

state estimation

sigma-point

sensor fusion

IMU

GPS

camera

particle

modeling & simulation

linear state space

$\dot{x} = Ax + Bu$

$y = Cx + Du$

nonlinear state space

$\frac{dx}{dt} = f(x,u)$

$y = g(x,u)$

simulation

hybrid system

transfer functions

$G(s) = \frac{\omega^2}{s^2 + 2\zeta\omega s + \omega^2}$

block diagrams

system id

Hello my name is $G(s) = \frac{s}{s+1}$

minimum realizations

first principles

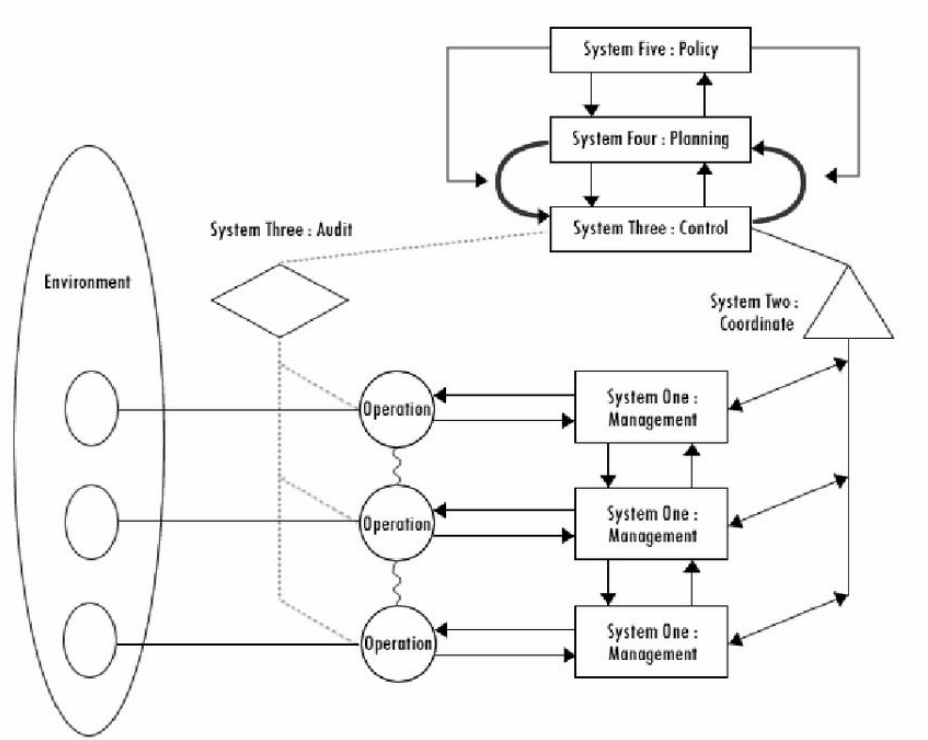
linearization

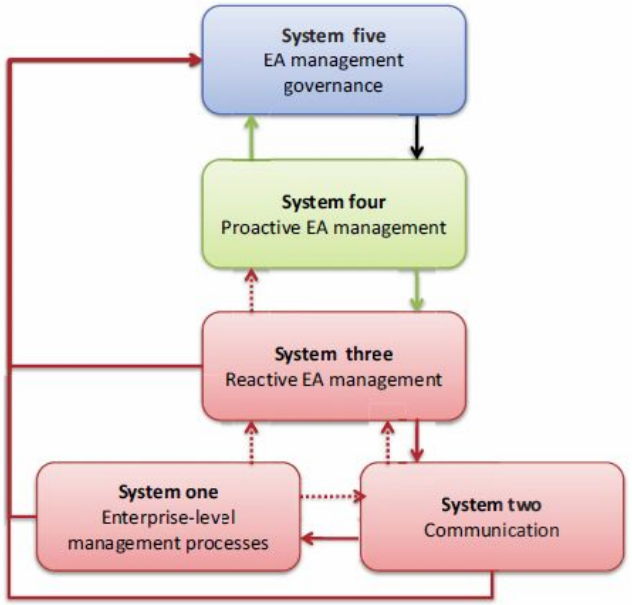
brian douglas © aug 2020

Engineering Media

Viable organization

- Stafford Beer, 1975





What is a model?

?

What is a model?

Purposefully created artificial system, which:

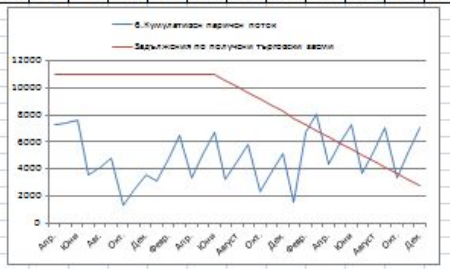
1. Reflects the most significant features of the real system:
   - Describes the most significant (for the purpose of the research) components and connections of the real system;
   - Has behavior close enough (for the purpose of the research) to the behavior of the real system.
2. Provides gathering of new information about the real system:
   - By following the behavior in future and past time period in convinient time scale;
   - By replacing to some extend (for the purpose of the research) the real system
   - By experiments with the model instead of the real system ("what… if…?").

Analytical or Simulation model

$$E=mc^2$$

Albert Einstein, 1905.

		2012									2013					
			II			III			IV			I			II	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Апр.	Май	Юни	Юли	Авг.	Септ.	Окт.	Ноем.	Дек.	Ян-ри	Февр.	Март	Апр.	Май	Юни
Печалба преди лихви и данъци	лв.	710	-15	-15	630	-1	1	1248	-19	-19	3565	4	4	665	14	17
Изменение в оборотния капитал	лв.	-4920.7	314.85	330.08	-4481	713.4	773.8	-4626	1258	1330	-3862	1782	1821	-3535	1805	1842
Платени данъци	лв.	0	0	0	0	0	0	0	0	0	0	0	0	-128.2	0	0
Паричен поток от оперативна дейност	0	-4211	300	315	-3852	713	775	-3379	1239	1311	-297	1786	1825	-2999	1820	1859
Постъпления/Плащания от лихви	лв.	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5	-137.5
Постъпления/Плащания от главници	лв.	11000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Паричен поток от финансова дейност	лв.	6652	162	178	-3989	575	637	-3516	1102	1174	-434	1648	1688	-3136	1682	1722
Увеличение на капитал	лв.	600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Паричен поток след отчитане движението на капитала	лв.	7252	162	178	-3989	575	637	-3516	1102	1174	-434	1648	1688	-3136	1682	1722
5.Паричен поток в началото на отчетния период	лв.	0	7252	7414	7592	3603	4178	4815	1299	2401	3574	3140	4788	6476	3340	5022
6.Кумулативен паричен поток	0	7252	7414	7592	3603	4178	4815	1299	2401	3574	3140	4788	6476	3340	5022	6743
7.Кумулативен ПП от оперативна дейност	0	-4211	-3911	-3595	-7447	-6734	-5960	-9338	-8099	-6788	-7085	-5299	-3474	-6473	-4653	-2794
Нетна настояща стойност NPV																
Дисконтирани парични потоци по месеци		7165	159	172	-3801	541	593	-3231	1000	1053	-385	1443	1460	-2680	1420	1436
Година	лв.	2012	2013	2014												
Дисконтирани парични потоци по години	-11600	3650	3487	5300												
Дисконтирана стойност на КМА към момента на отчитане				7434												
Нетна настояща стойност NPV	8271															
Процент на дисконтиране D	14.59%															
Вътрешна норма на възвращаемост	39.5%	2012	2013	2014												
Парични потоци по години	-11600	3574	4278	18564												
Средна претеглена цена на капитала																
Източник	Размер	Дял	Цена	Тегло												
Собствен капитал	600	5%	7%	0.36%												
Дългосрочни задължения	11000	95%	15%	14.2%												
Общо	11600	100%		14.59%												



Generalization of principles and relationships

Particular results (values) to support decision making

Features of computer simulations in business:

- *Inductive reasoning*
- *Empirism*
- *Systematic approach*
- *Heuristics*
- *Complexity*
- *Discrete time*
- *Interdisciplinary nature*
- *Self-organization*

Stages of building computer simulation

1. Concept;
2. Study the real system;
3. Detailed description of the blocks in the model;
4. Software realization;
5. Adjusting the parameters and tuning the model;
6. Evaluation of adequacy;
7. Experimentation.

THE EVOLUTION OF FORECASTING

Improvements in forecast are most dramatic when there is a fundamental change in the approach to forecasting
(from No Forecasting to Naive, from Statistical to Demand Planning, and from Demand Planning to Demand Modeling)

The combination of Demand Modeling and Machine Learning will decrease errors and lost sales by **33%**

No Forecasting	Naive Forecasting	Statistical Forecasting	Demand Planning	Demand Modeling	Machine Learning
ERROR ↓					
				15%	10%
				85%	90%
	Assumes last year's or last month's demand value will occur again this month	Fits a forecast curve through historical demand quantities	Statistically predicts monthly or weekly demand patterns	Leverages more granular and downstream data to get a cleaner demand signal and reduce volatility and bullwhip effect	Takes advantage of extended and even big data to further increase accuracy
		Incorporates seasonality, trend data, and moving averages	30%	Includes techniques that are usually associated with short-term demand sensing to dramatically increase long-term accuracy	Relies on powerful models to consider demand drivers such as promotional details, new product introductions, social media, etc.
		Is often done in Excel	70%		
	60%	50%	Hierarchy and causal effects are incorporated into the forecast		
	40%	50%	Becomes a nightmare to manage in Excel		
Purely reactive					






ACCURACY ↑

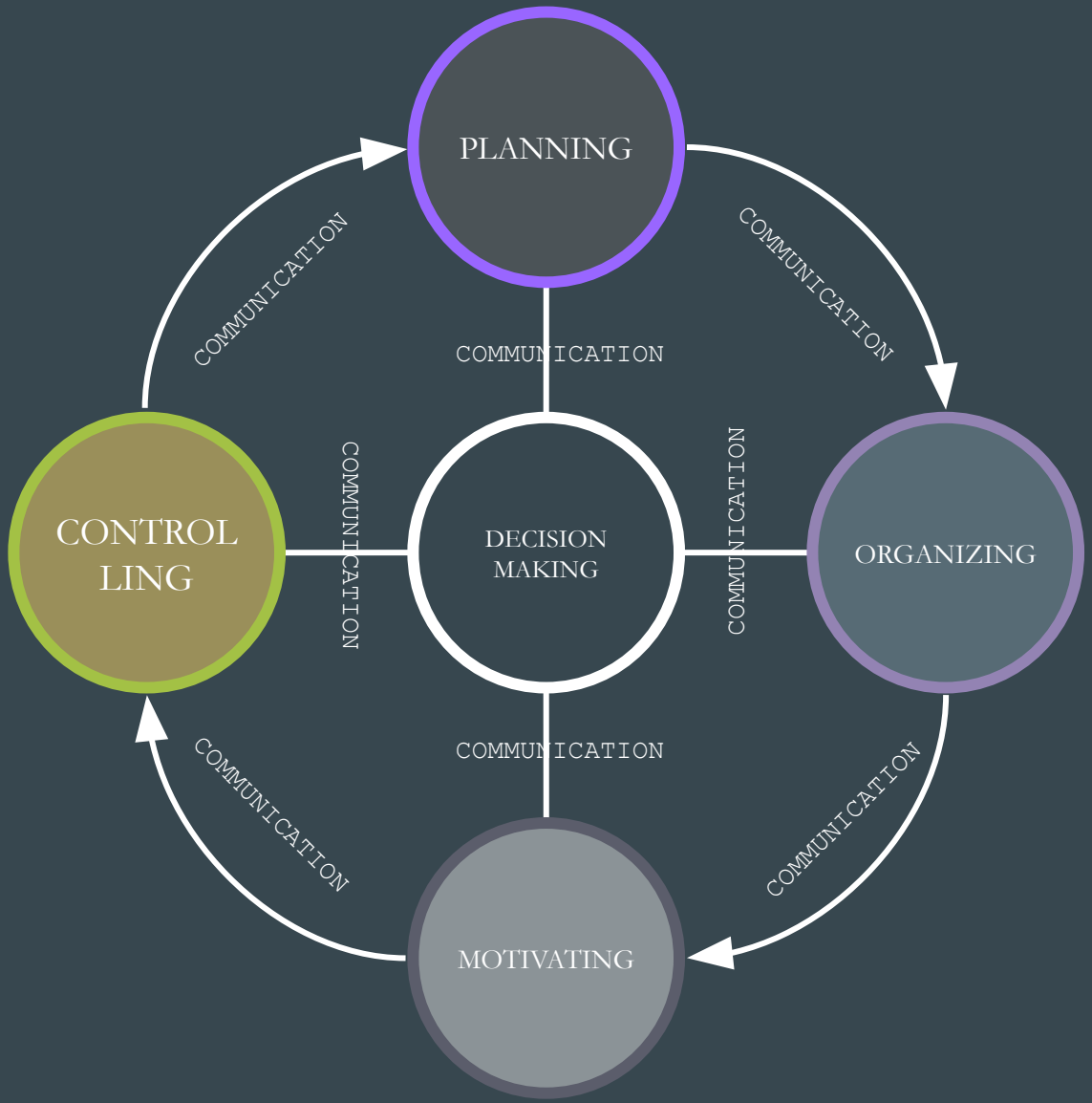
Some sources of wisdom…

- http://www.youtube.com/user/JAVIERLIVAS - Javier Livas
- **http://www.youtube.com/watch?v=jS0zj_dYeBE - Igor Nikolic**
- http://www.youtube.com/watch?v=VSCjWT_nI_Q - General Systems theory
- http://www.youtube.com/watch?v=JwqArbHinCg – Control system
- http://www.gwu.edu/~asc/asc-cyber.html - What is Cybernetics
- http://pespmc1.vub.ac.be/ASC/CYBSYSTH.html - Cybernetics and Systems Theory
- http://pespmc1.vub.ac.be/ASC/Default.html - Principia CyberneticaWeb
- http://pespmc1.vub.ac.be/books/IntroCyb.pdf - R. Ashby, Introduction to Cybernetics
- http://www.art-sciencefactory.com/complexity-map_feb09_april.html - Interactive map of complexity sciences

PROCESS MANAGEMENT APPROACH

- Key management functions:
  - planning
  - organizing
  - motivating
  - controlling
- Business Process Reengineering
- the process approach views functions as interconnected and mutually dependant.
- Binding processes
  - Communicating
  - Decision making

PROCESS MANAGEMENT APPROACH

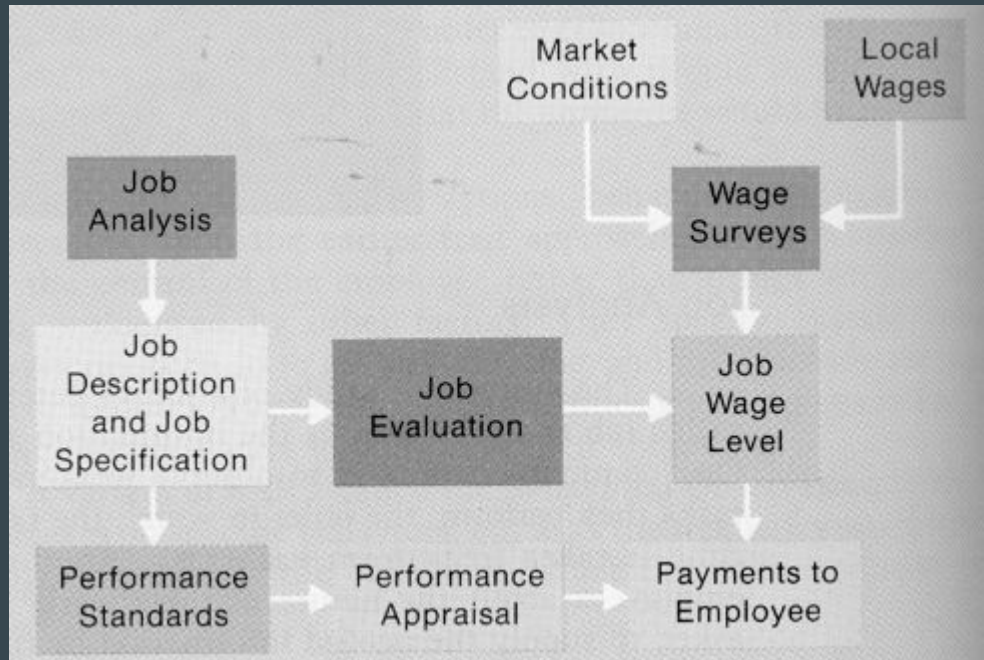


Planning Function

Developing a definition the parameters for achieving the goals of the organization in the future

Organizing Function

- Identify relationships among people, tasks and activities so that all resources of the organization are integrated and coordinated, fulfilling its goals.
- Competencies of the manager:
  - Separation into detached units
  - Specialization
  - The span of control
  - Hierarchy
  - Delegation
  - Centralization
  - Matching
  - Groups
  - Formalization



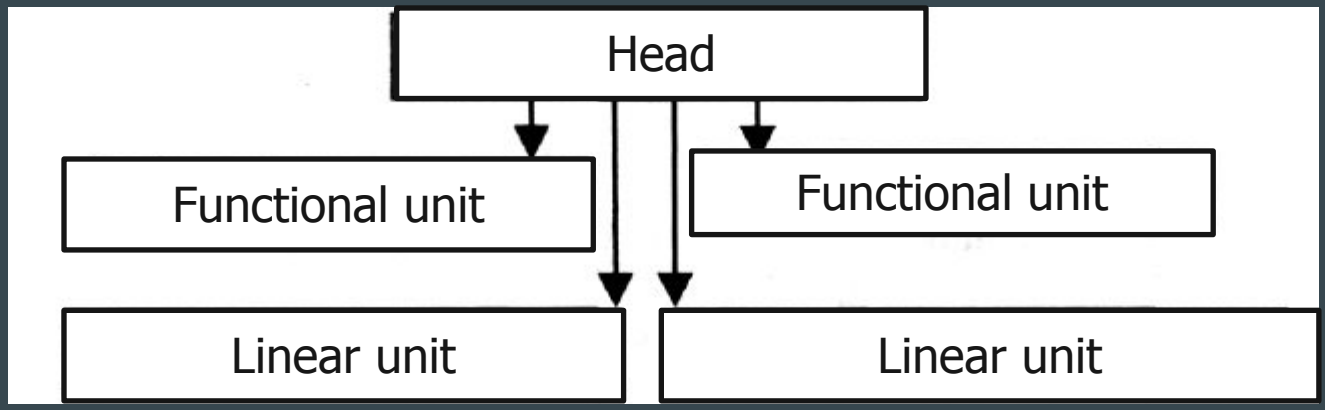
Organizational structures

- Formal connections between separate management units interacting with each other and purposefully implementing the management activities of the organization.
- Requirements:
  - Min units
  - Adaptability
  - Quality communications
  - Efficiency

Organizational structures

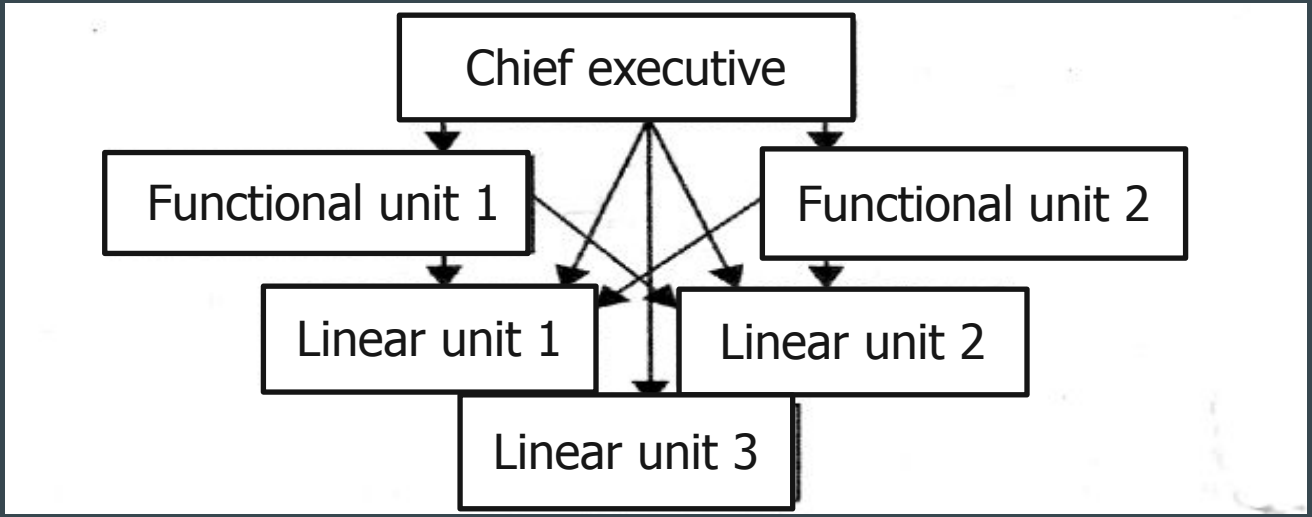
- Linear

- Functional

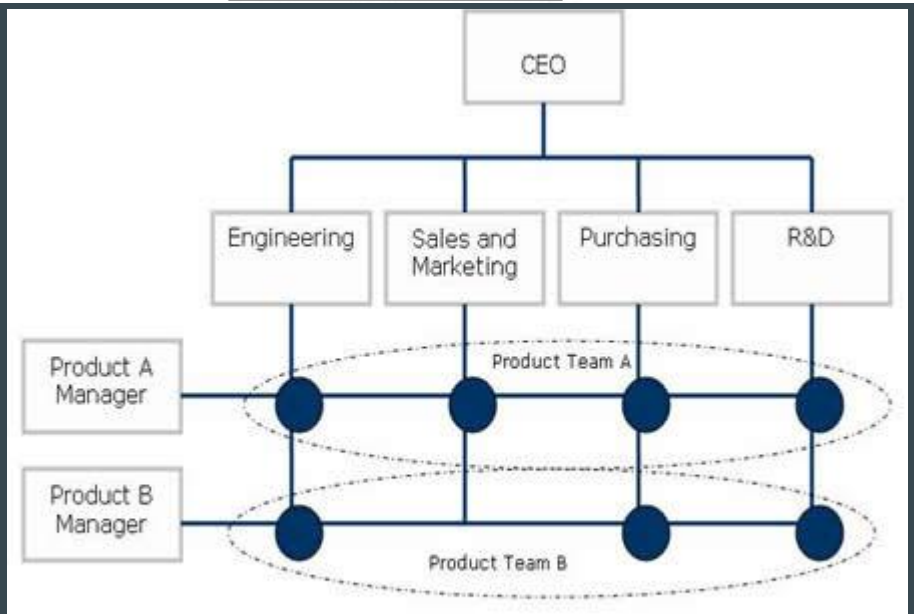


ORGANIZATIONAL STRUCTURES

- Linear-functional



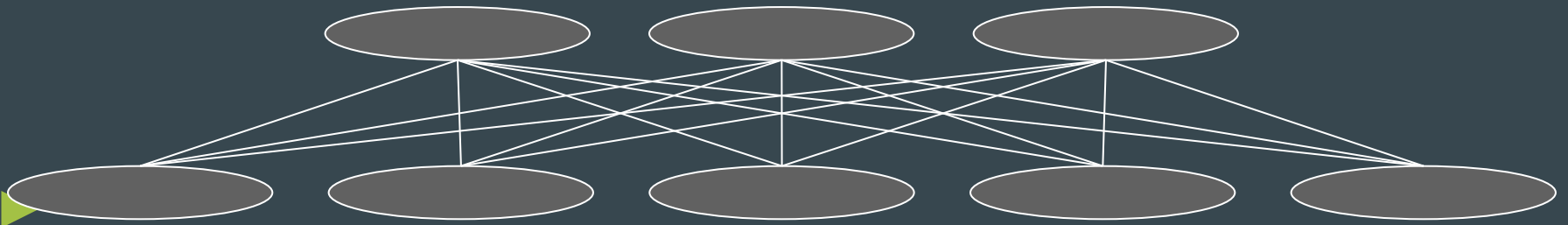
- Matrix (design)



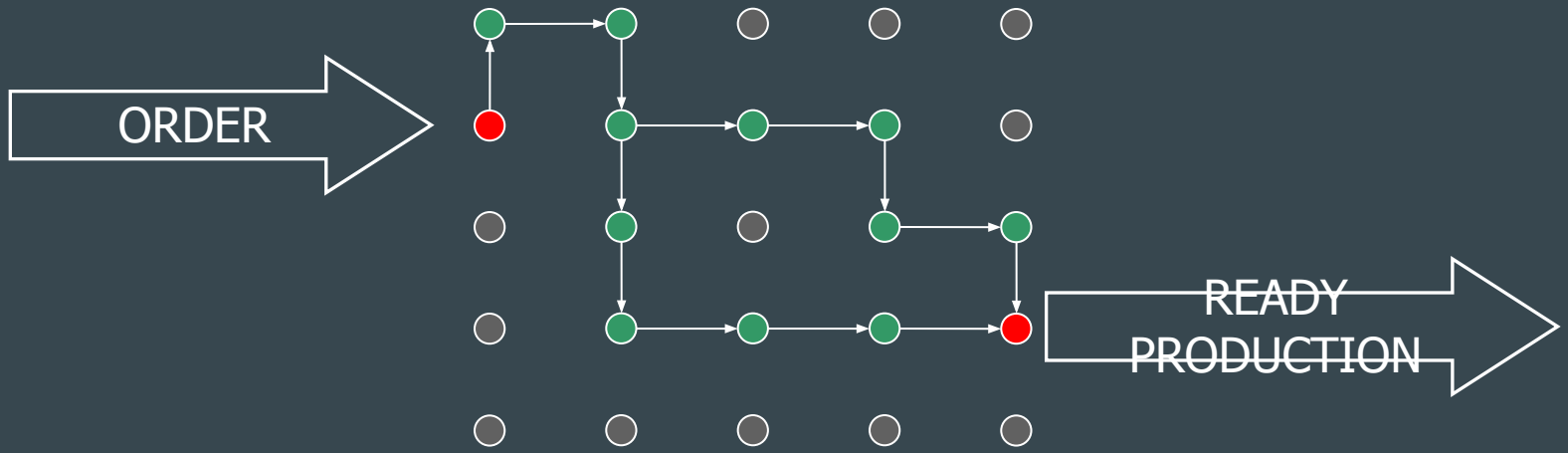
STRUCTURAL TRANSFORMATIONS

MODERN ORGANIZATIONAL STRUCTURES

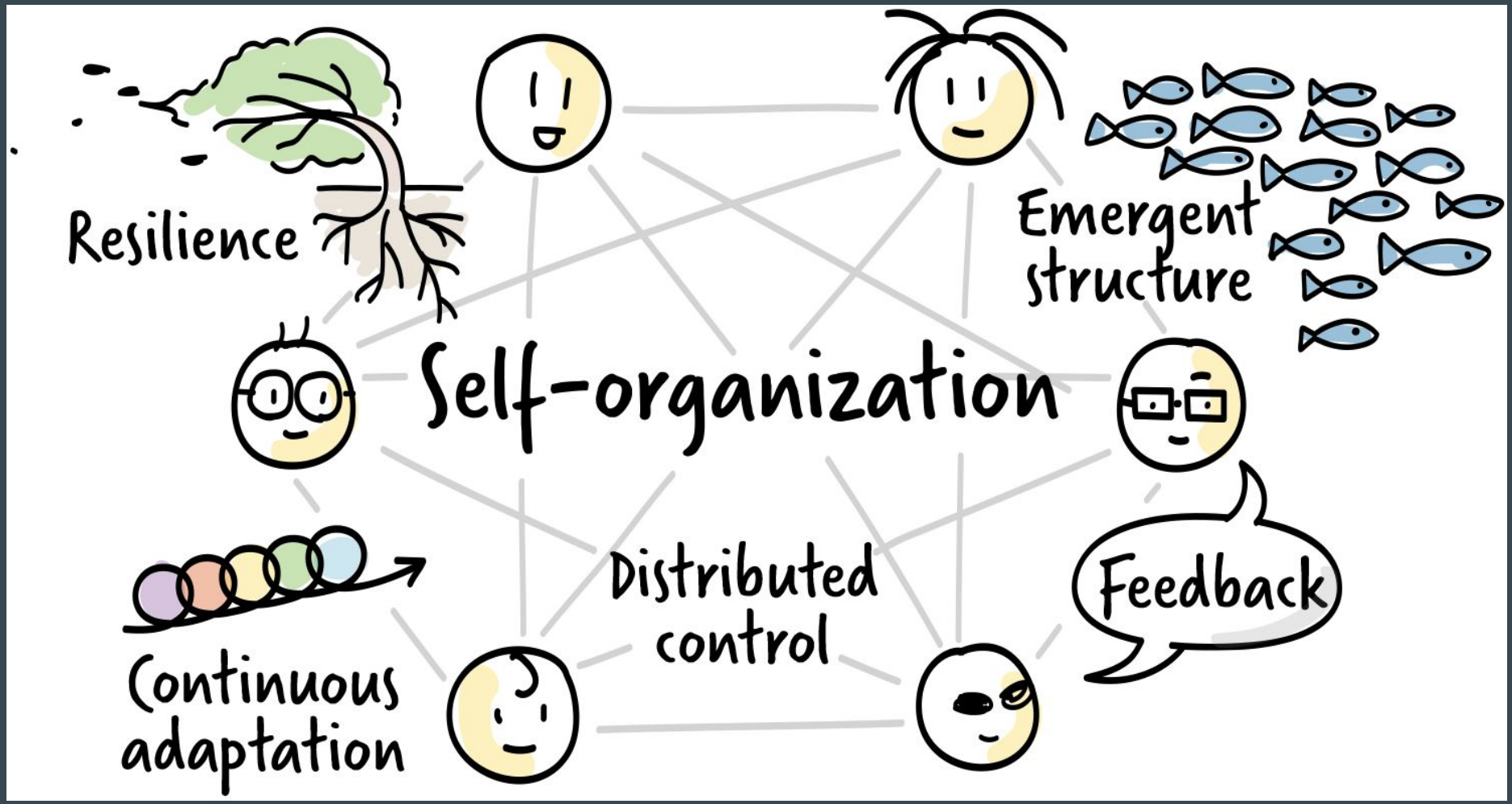
- Flat / Lean



- Virtual Organization (Holon)



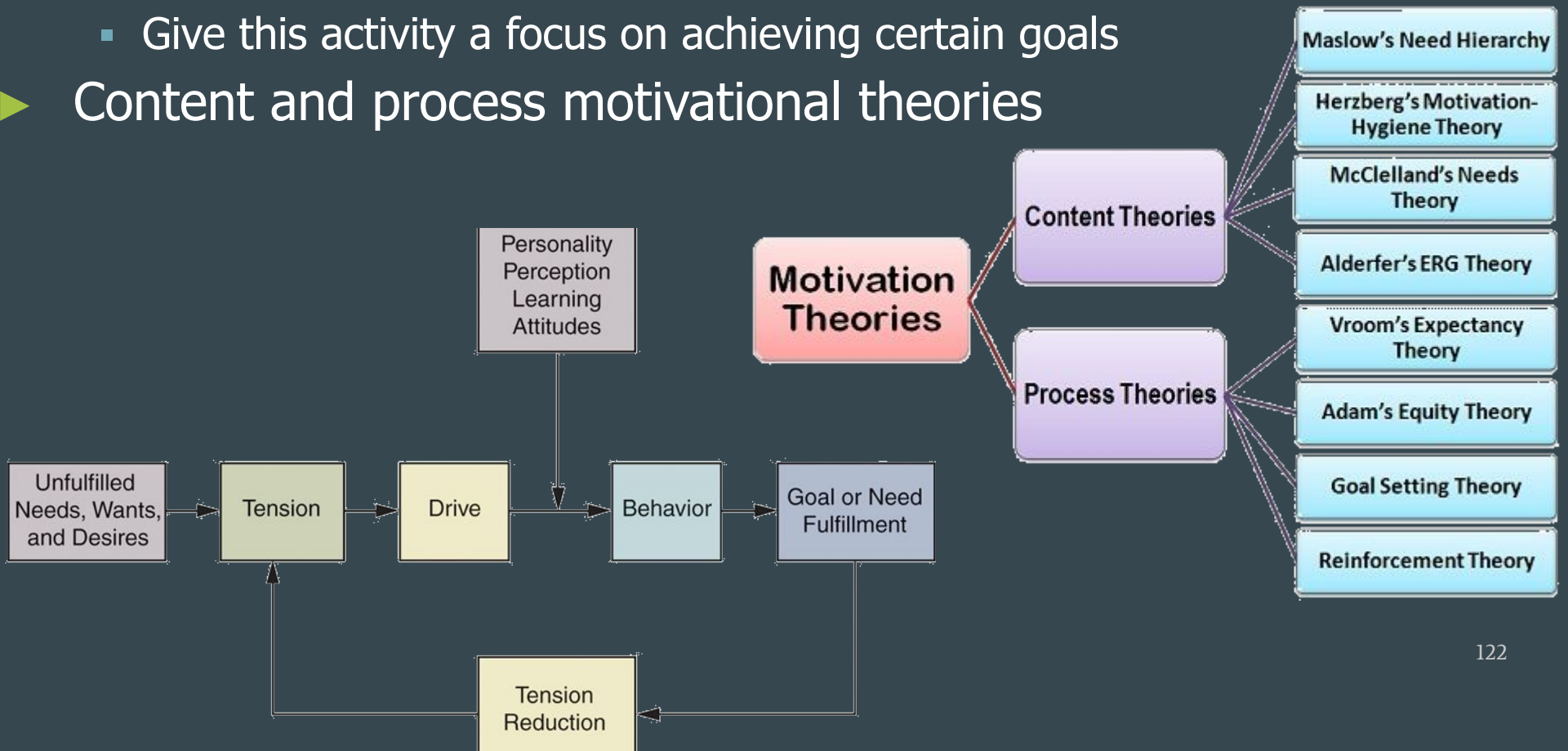
SELF-ORGANIZATIONAL STRUCTURES



Catallaxy / Invisible hand (F. Hayek / A. Smith)

Motivation Function

- Motive:
  - A set of certain driving forces that incite a person to carry out certain actions
  - Set the boundaries and forms of its activity
  - Give this activity a focus on achieving certain goals
- Content and process motivational theories

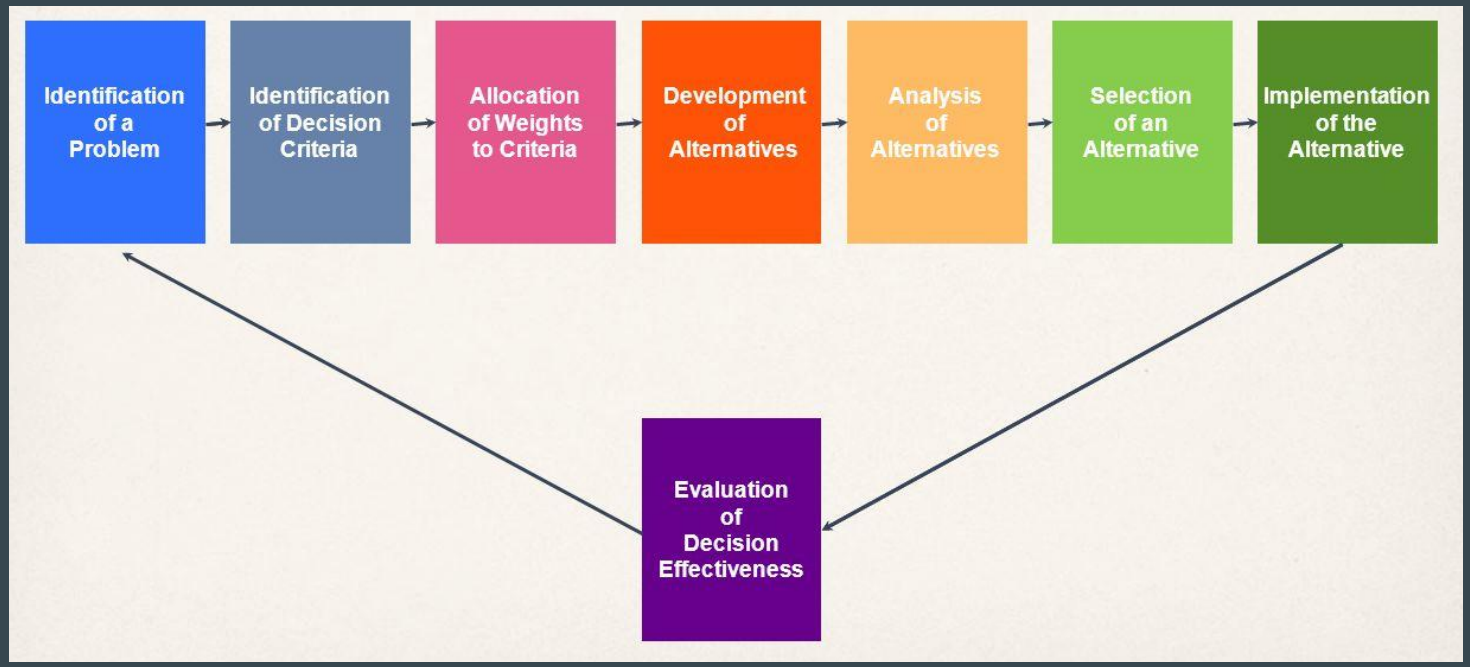


Control Function

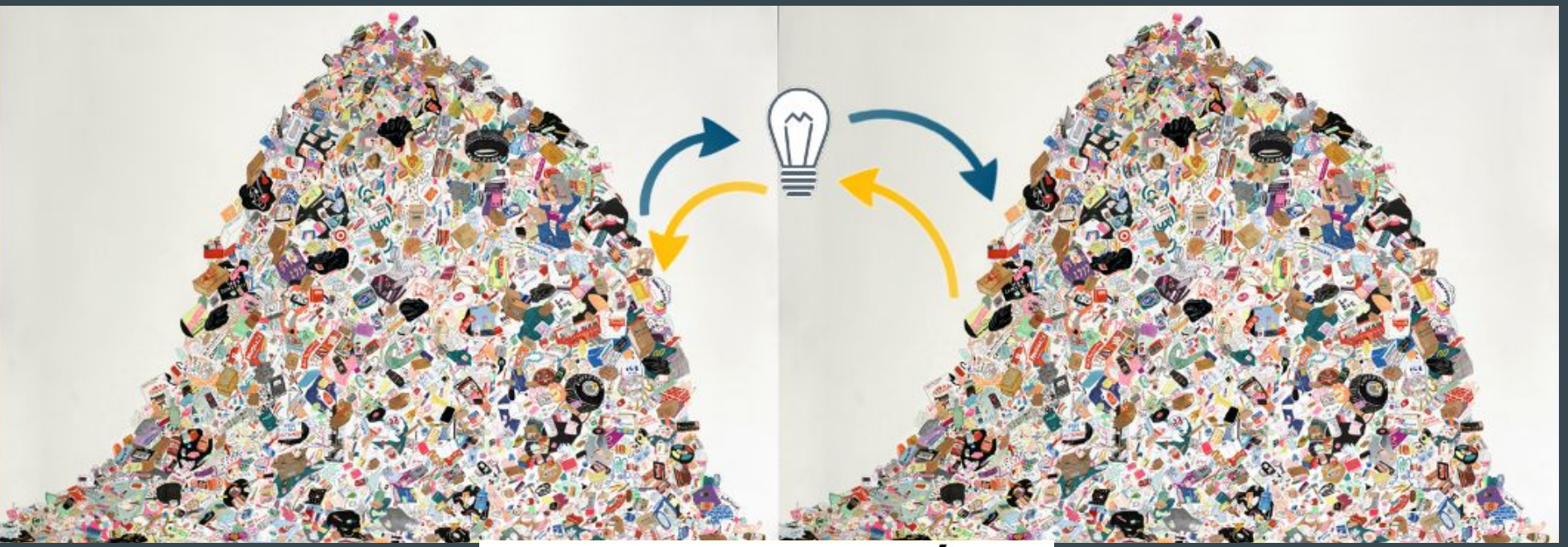
- Determining whether the goals are set, the deviation from them and when corrective measures are needed
- Preliminary, Current, Subsequent control
- Strategic, operational, tactical control
- Phases of control
  1. Develop standards
  2. Benchmarking the results achieved with established standards
  3. Taking corrective action
- Taking corrective actions:
  - Nothing to do
  - Remedy (causes) of deviations
  - Revision of standards - always

MAKING MANAGEMENT DECISIONS

1) Formulation of influence input
2) By the subject of management
3) On the managed object
4) To achieve certain goals
5) After a conscious choice
6) By a predetermined criterion

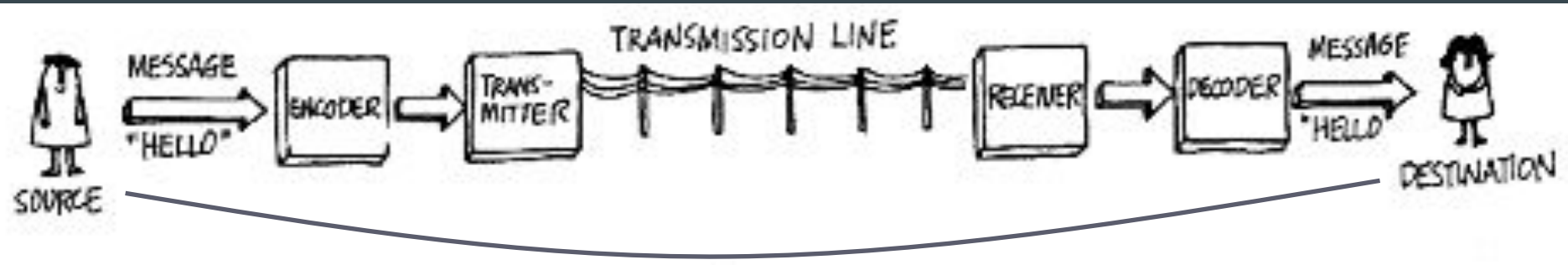


Creative problem solving

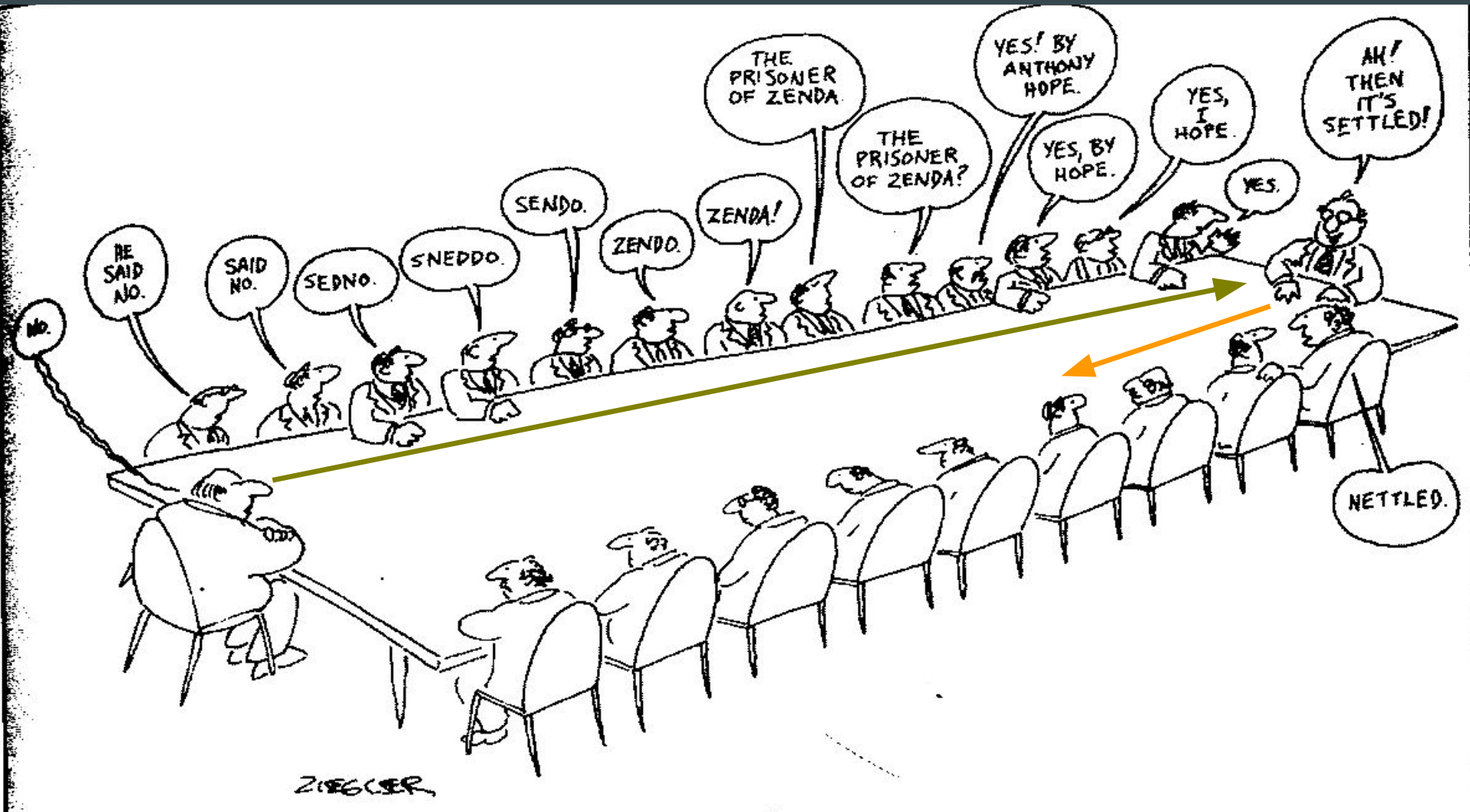


Communications in the organization

- Exchange of information between :
  - Leader and subordinate
  - Subordinates
  - Levels, subdivisions and positions
  - Management levels
- The process of communication

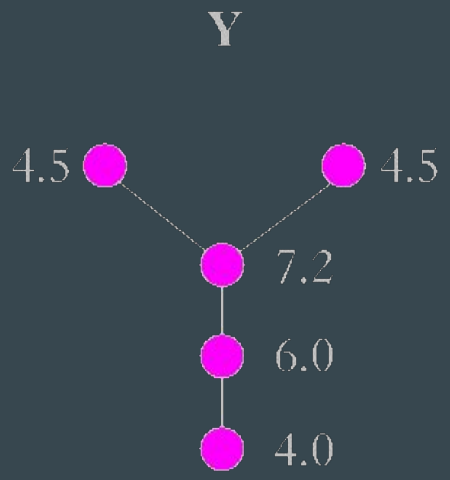


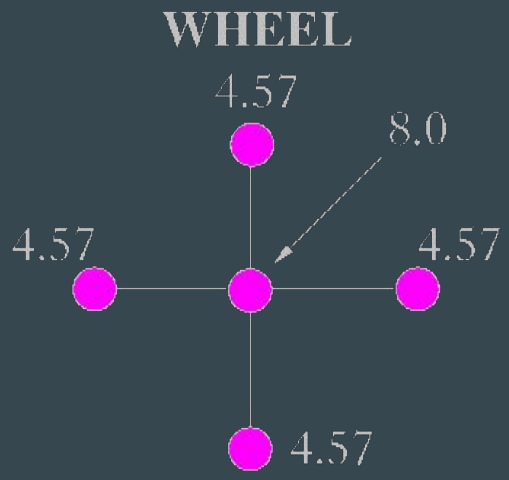
Example of process of communication

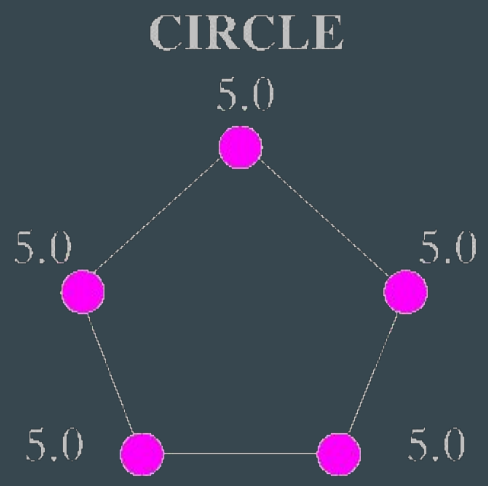


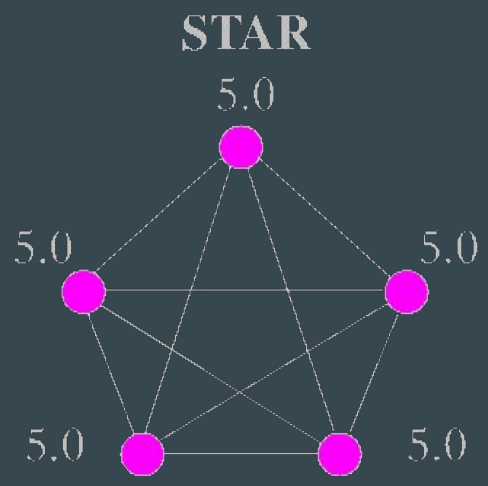
Vertical (top-down) formal communication

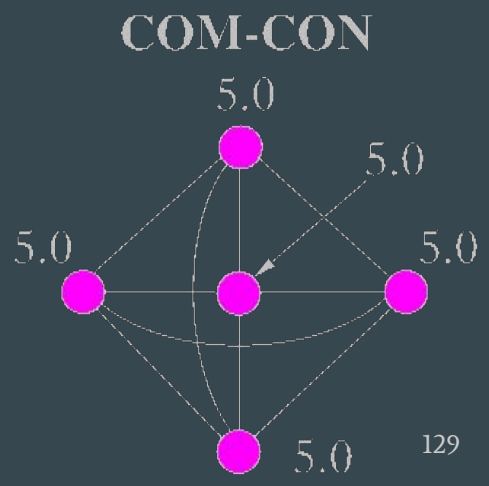
Formal Communications











NON-FORMAL COMMUNICATION

Single Strand
(Each tells
one other)

Gossip
(One tells all)

Probability
(Each randomly
tells others)

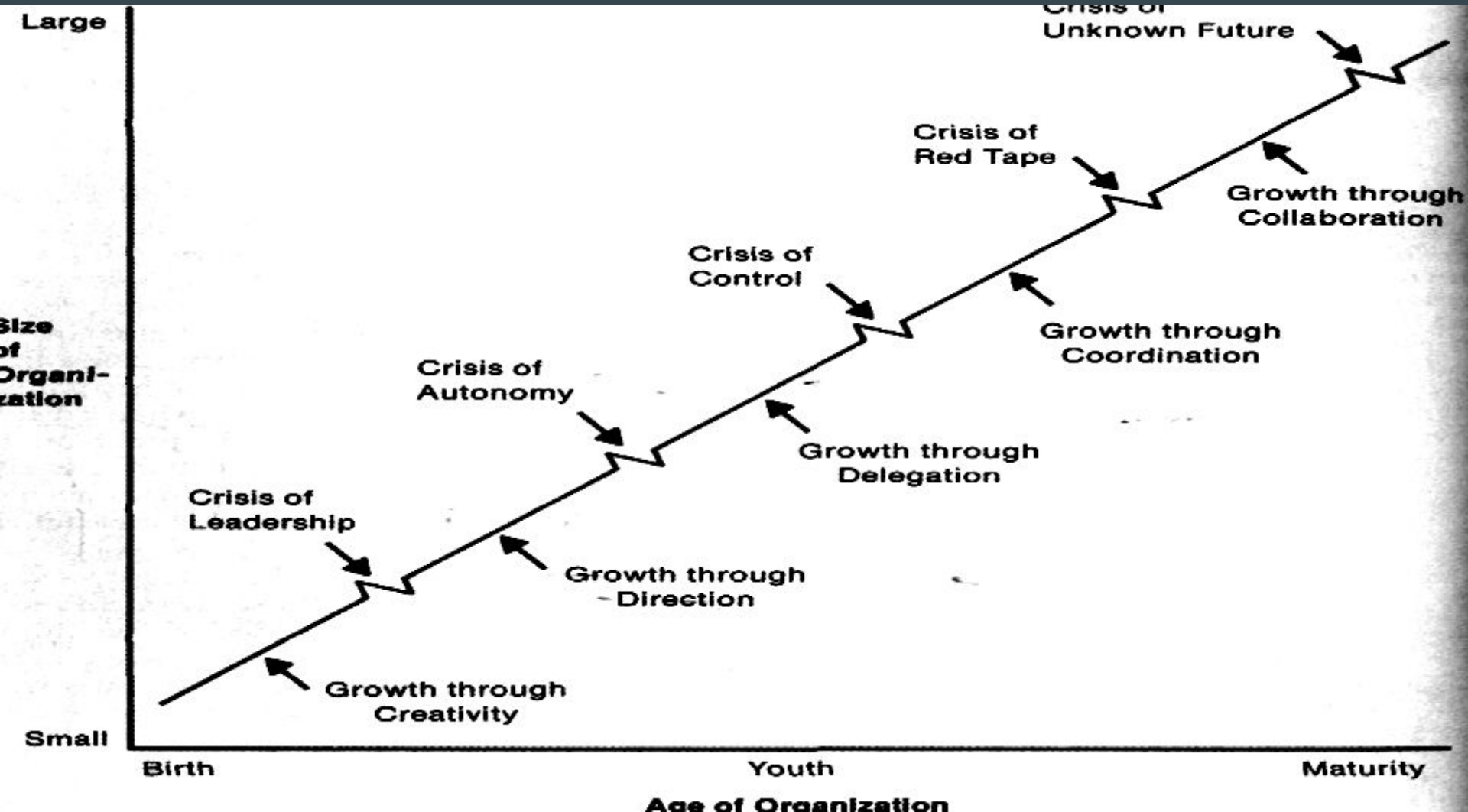
Cluster
(Some tell
selected others)

Situational approach in the management

- Managerial situation- a specific set of circumstances that have a strong impact on the organization's behavior at a specific time.
- Selection of approach depending on the situation.
- Method of the concrete situations.
- Methodology (algorithm)

1) The manager knows the means and the methods of the professional management that have proved their efficiency.
2) Each method/methodology/concept has poor and strong qualities. Manager predicts the possible consequences of their execution.
3) The manager possess the knowledge to interpret a situation in the right way.
4) The manager should apply methods / methodologies / concepts that are characterized with the most beneficial effect in the specific situation.

Development and adaptation of the organization



Decline of the organization

- WHEN the organization does not adapt to the environment and/or as a result of maladministration ...
- ... THEN it is necessary to have a reduction in size, staff, profits, assets, and so on.
- Reasons:
  - Organizational atrophy – it's typical when the organization "gets older", managers lose initiative and/or acuteness.
  - Vulnerability - if the organization can not successfully adapt to the environment or loss of connection with the environment at all.
  - Loss of legitimacy - the organization's products or services are no longer valued.
  - Entropy of the environment - changing the environment towards the disappearance of resources.

Management Gurus

- Stemming from the concept of situational approach in management
- Not necessary a management school (with similarities) but rather a set of innovative ideas
- Based on their own rich Managerial/Consultancy experience
- Their own way/method
- Often approach is the outcome of the unique personality
- Typically forward thinkers
- List is far from complete

Business leaders

- Tom Peters
- Business efficiency "in search of excellence"
- https://www.youtube.com/watch?v=NWO2mjp5Hsg

- Hans Mueller
- Time management
- https://youtu.be/hPdPTbtms4g

- Richard Branson
- Daring entrepreneurship
- https://www.youtube.com/watch?v=Bz8PLrbJ7jM

Psychologists

- Edward De Bono
- Lateral thinking
- https://www.youtube.com/watch?v=SbsKQQGwsMg

- Robert Cialdini
- Influence: The Psychology of Persuasion
- https://www.youtube.com/watch?v=cFdCzN7RYbw

- Daniel Goleman
- Emotional intelligence
- https://www.youtube.com/watch?v=Dxr9loNLY6U

Futurists

- Alvin Toffler
- Future shocked, Third wave
- https://www.youtube.com/watch?v=QCXCDYj6U4E

- Malcolm Gladwell
- Personal development: 10000 hours for mastery
- https://www.youtube.com/watch?v=OpuZoSK0JfY

- Simon Sinek
- Role of inspirational leadership
- https://www.youtube.com/watch?v=qp0HIF3SfI4