System Theory

Notes from lectures, reading and assignments

Lecture 1
Introduction

Regulating systems: making sure that a **system** shows **desired behaviour** despite **disturbances** = main theme of ST

A system: a concrete unity consisting of elements and relations between these elements and showing particular **behaviou**r (activities/**effect** of those activities). Effect is described by variables and values.

Plank sowing department as a system:

- *elements: human resources (employees), technology*
- *behaviours: sowing (structure and tasks)*
- *effect: nicely sown plank, employees are (un)happy with their work, waste produced*
- *variables: quantity, quality of sowing: sequence of these values describes the behaviour*
- *regulation: it is showing desired behaviour: # planks sawn per week (at least 100)*
- *disturbance: cause for undesired behaviour*

Recipe for regulation:

- define system: concrete and abstract
    a) concrete = the thing that you describe that shows certain behaviour (e.g. organization) - this is best described with *infrastructure*
    b) abstract = set of variables chosen to observe a behavior
- determine desired behaviour
- identify disturbances
    - formulate and perform regulatory actions

I want to enjoy a bath:

Defining system

- *elements: me, bath*
- *variables: temperature*
- *concrete system: concrete unity, showing the behaviour (bathing)*
- *abstract system: set of variables to describe the effect (temperature)*

Defining behaviour

- *temperature between 36 and 38 degrees (essential variable is in norm value)*

Define disturbances

- *temperature gets too cold as the champagne falls into the bathtub*

Define and perform regulatory actions

- *if the bottle of champagne falls into the bathtub, add warm water*
- *if the wind blows from the window, close the window*

Complexity:

- measured in terms of variety: (measured by elements in the set) {1,2,4} variety = 3
- **variety** = the number of different states a system can have
- **state** = set of values of the variables of the system at a particular moment in time

Complexity and regulating systems:

- the set of disturbances gives us certain complexity: Dist = {D1, D2, D3}, variety(Dist) = 3
- the more disturbances we have, the higher complexity and the harder it is to regulate the set
- the regulatory actions RA = {RA1, RA2, RA3} , variety(RA) = 3
- **the idea: The complexity of RAs is positive compared to the complexity of disturbances**

Two types of system theory

1. General ST (cybernetics): regulating all kinds of systems (human being, organization, dog, the Earth) - Ashby
2. Organizational ST: GST applied to understanding and regulating organizations

Model of organization: every organization has **4 basic activities**

1. Primary processes: leading to products and services
2. Operational regulation: whenever something goes wrong, primary process can continue
3. Setting goals: refers to primary processes (they determine the desired behaviour)
4. Providing conditions: designing infrastructure enabling carrying out the activities. 3 conditions:
    - human resources
    - technology
    - structure (tasks)

In system theory, we will apply the GST to first understand organizations and then design them:

Understanding: Social systems conducting experiments:

- organization **conducts experiments** (on *goals, infrastructure):* organization's environment is usually complex and uncertain. To achieve goals, activities have to be carried out, however, it is not clear in advance which steps to take to achieve the goals. That is why we test the solution we think might work - which is experimenting
- **organization is a social system:** everything happens in social interaction (communication as Luhmann has it) - current communications influence future communications

Designing:

- designing organizations means designing the infrastructure. Two principles for design:
    1. **functional design principles**: what an infrastructure should be able to do
    2. **specific design principles**: how infrastructure should be designed in order to realize desired functional principles

Survival:

- main goal of the organization
- usually we have additional goals: profit, contribution to society,...
    1) **'poor' sense of survival** = maintaining existence by realizing in whatever way whichever goals
    2) **'rich' sense of survival**: maintain existence by realizing goals that contribute to societal development - highest goal of organization

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Lecture 2
GST part 1: Ashby, cybernetics

Main theme for System Theory:

- **regulating the behaviour of the system**: make sure that the system shows desired behaviour despite disturbances
- **describing behaviour:**
    1. In terms of variables and values
    2. Desired behaviour
    3. Influence on behaviour: parametres
    4. Regulatory table

Example behaviour: *Teacher's (concrete system) variables (abstract system): hair color, eye color at a certain moment. Grey, brown: state. In 20 years, his hair color might be white and that is another state.*

Behaviour: defined as a sequence of states

- select variables
- record values at particular times
- get sequence of states (shown in graph or table)
- in cybernetics, a description of behaviour in terms of a sequence of states is called **transformation** (in a graph, using a table,...)

Desired behaviour:

- within the **norm values** - in a graph and compared to behaviour values. These can work as asymptotes
- only **essential variables** (EVs) are relevant. They express the function or the goal of the system
- if EVs are outside their norm values for too long, the concrete system won't reach its overall goal (e.g. survive)

Organism:

- *essential variables: body temperature, blood pressure*
- *if essential variable is outside the norm, the survival is threatened*

Influence on behaviour (input):

- negative: disturbance = causes EV to move outside the NV
- positive: regulatory action = behaviour regains or stays within NV
- these are called **parameters**
- regulation: “regulatory parameters” are set in such a way so that the influence of “disturbing parameters” is reduced

Regulatory table:

	R0 = no reg. action	*R1 = extra personnel*	*R2 = repair machines*
D0 = no disturbance	*200*	*200*	*200*
D1 = people get ill	*40*	*200*	*40*
D2 = machines break down	*20*	*20*	*200*

EV = number of planks per week
NV = 200 planks per week

3 forms of regulation:

1. **regulation by control**: setting goals
2. **regulation by design:** improve the infrastructure, conditions
3. **operational regulation**

OR: apply (regulation action) RA to deal with disturbances given these assumptions:

Assumptions about OR:
These are **fixed:**

1. Essential variables and the norm values (goals)
2. Disturbances
3. Regulatory potential
4. Infrastructure (concrete system) is fixed

Forms of OR:

- **effective**: for every disturbance there is a RA so that the EV = NV
- **efficient**: if you can be effective with as few RAs as possible
- **passive**: no selection of particular RA. Passive block (shield of tortoise) is built into the infrastructure and it works automatically
- **active**: regulator selects a specific RA
    1. **error controlled OR**: we react to disaster
    2. **cause controlled OR**: we prevent the disturbance from having an effect

OR examples (the kitchen):

- *waiters tell joke to make customers a bit more happy*
- *waiters reheat cold meals*

- *the restaurant does not have a sommelier so the waiter always gives the same proven advice about the wine*

Lecture 3
GST part 2: Ashby, cybernetics

When building infrastructure, make sure that:
- it has enough (operational) regulatory potential (amplification)
- it is itself not a source of disturbances (attenuation)

Regulation by design:
1. adding regulatory potential (amplification)
2. reducing probability of occurrence of disturbances (attenuation)

Amplification:
- increase regulatory potential of regulator, adding stuff on top
- *firescreen is amplification, we add firescreen so that we don't get shot with fire (passive block)*
- *buying antivirus software, install it (changing the infrastructure) and use it (passive block)*

Attenuation:
- make infrastructure less vulnerable to disturbances, fixing what's already there
- 2 ways it's vulnerable: environment (elimination, neutralization) vs infrastructure (repair of infrastructure) is the source of disturbance

3 forms of attenuation:
1. elimination: reduce the probability of disturbance by removing the event in the environment
    - *computer virus, elimination: (hypothetically) track down and arrest all who make viruses*
    - *unreliable suppliers, elimination: mandatory certification*
2. neutralization: change the relation with the environment such that the event in the environment is no longer relevant for the infrastructure (although the disturbance is still there)
    - *computer virus - only use typewriters (viruses still there but no longer relevant)*
    - *unreliable supplier: select a different supplier*
3. repair of infrastructure: when infrastructure is the source of disturbances.
    - *little knowledge of HR: training*
    - *problematic ICT: buy new one*
    - *structure: employee should have enough power and knowledge to deal with the problem herself*

Regulation by control:
- changing EV and/or NV

- EV: delivery time, NV: 3-days. We will deliver in 6 days (NV) but it will be cheaper

Experimentation + regulation:
- After goals are set (control), infrastructure is set to realize them (design). If it turns out that the regulatory potential is insufficient to deal with disturbances (resulting from conducting experiments), we need a new infrastructure or goals.

Self-regulation:
- systems that are able to regulate themselves (by performing 1 or more of the 3 forms of regulation
- *thermostat heating: If EV < 0, the heating should be off = a form of error control (OR)*
- the more types of regulation possible the better
- **complete self-regulation**: a concrete system that is able to perform all three activities

Adaptation:
- dealing with disturbances by adapting to the environment

Reflection on cybernetics:
- in real life, one never draws a regulatory table, one never *explicitly* employs the three ways of reasoning about regulatory actions
- however, one always *implicitly* have an idea on how a system behaves and which RAs work in what circumstances
- Ashby's theory is valuable: it describes necessary elements of models, steps to be taken to create behavioural models and it gives criteria for optimal models

Law of requisite variety:
- regulatory table is a starting point
- the law: if disturbances are given and fixed and the variety of EV's after regulating is minimal, but greater than 1; then the variety of EV can only decrease by increasing the regulation potential (see book chapter 2)
- this ensures regulation is *effective*
- if V(E) cannot be reduced to 1, you should add regulatory potential
- in the given circumstances, only amplifying regulatory potential will help in dealing with disturbances
- the law does not state that V(R) and V(D) should be equal

Reading:
Chapter 3: Von Foerster on Observing Systems

Two objections to the classical ST:
1. the amount of variables and parameters too big, how can one know which ones are the right ones?

2. transformations cannot be systematically derived via trial and error (experiments), because the amount of possibilities is too big

Solution:
- there is no certainty regarding EV's, but hypothesis can be composed based on experiments
- this way, regulation would be a 'loop', in which knowledge of behaviour, parametres, ets is used to deal with a concrete system
- using the results of experiments, the knowledge changes and thus the way we use knowledge changes
- **Ashby's solution:** choose variables that are relevant to the main goals

There are two types of machines according to Von Foerster.

Trivial machines (1): systems that have a fixed input-output relation. Four important features:
a) **synthetically determined**: the behaviour of the machine is completely determined by the way it is put together
b) **analytically determinable**: it is possible to analyze the relation between input and output of the machine, based on observing the input-output combination
c) **historically-independent**: the relation between input and output is always the same, regardless of its specific history of input-output combinations
d) **predictable**: given a certain input, the behaviour of the trivial machine can be predicted with certainty
- *example: switch, termostat*

Non-trivial machines (2): systems without a fixed input-output relation. Four important features:
a) **synthetically determined**
b) **analytically indeterminable**: impossible to analyze the input-output relation
c) **history dependent**: because the relation between input and output depends on the value of an internal state (main difference compared to trivial machines)
d) **unpredictable**: due to history dependence, it is analytically impossible to predict the behaviour with certainty
- *example: human being, organization*

Ashby's black box cannot be used for non-trivial systems, which are most of organizations

Cybernetics:
1. **first order cybernetics**:
    - Ashby's theory, as it is a concept to deal with observed systems (describe behaviour and perform regulatory actions)
2. **second order cybernetics**:
    - same concept, but focuses on the role of the observer of the system (the object of research is the observation system itself)
    - important addition, as Ashby does not include the role of the observant on variables and parameters

CSFs (Critical Success Factors):

- those things that must go right for the organization to flourish - **practically essential variables**
- those factors that cannot be below certain standards for too long - otherwise the organization will perish
- *external distribution company: delivery time, delivery reliability (% of orders delivered on time, % of orders delivered according to quality specifications)*
- **critical information**: the actual values of CSFs *(e.g. the current percentage of orders delivered on time)*, also information about what can influence CSF *(e.g. info about the number of items in stock)* **(is the behaviour desired or not?)**
- **critical decisions**: make sure that values of CFSs remain within norms **(regulatory actions)**

Lecture 4:
Luhman: Organizations as social systems

Organizations as social systems (Luhman): "Organizations are autopoietic social systems with as elements 'decisions' (specific type of communications) and as structure 'decision premises' (specific expectations about expectations)

Autopoietic Systems: system consisting of elements that interact (by means of the interaction, they produce new elements of that system) - self-producing systems

- *Example: mushroom-like system. Elements: mushrooms consist of many of those elements. They might interact - lead to two other elements… those interact and produce more…*
- *Example: human beings interact and produce new cells ;)*

Structure: that which directs or guides the interaction (we want to select the proper mix of interaction, not the one where elements combine and die)

Autopoietic Social Systems:

1. **elements (communications)** - 3 aspects:
    - information: message
    - utterance: how
    - understanding
2. **social system itself (sequence of meaningfully connected communications)**
    - one communication produces another
3. **structure (expectations of expectations)**
    - determines if there is meaningful communication
    - participants in communication have developed exp. about exp. in the course of time
    - **"expectations about expectations":** A expects of B that B expects certain behaviour of A…

- *Client of a butcher expects that butcher expects something of the client… the client will not ask for a pair of shoes and so the butcher will provide meat*
- *person A asks for time to person B, person B replies with either "football", "12:10", "flower", "I don't know",... but A expects the reply "12:10". This guides the behaviour of B. If B doesn't know that A expects behaviour, he is clueless*
- E of E: guide our behaviour!
- context dependent: influenced by culture, law, change,...

Communication: *Example: typical Dutch family: father, mom, dad, son… mom thanks the dad for preparing the dinner. dad understands and says you are welcome… then silence, then father asks: son, have you done your homework?...son understands and says yes sure*

- *mom dad son are not elements of communication, but the interaction of message, utterance and understanding*
- *sequence of communication: direct or indirect - if it follows directly from the same topic or not*
- *which communication belongs to the social system "family": depends on the exp of exp that developed in this family: parents expect of their children that they expect that their parents care about them*

3 problems with communicating:

1. person can misinterpret the message
2. person could interpret wrongly that there is a message
3. person could fail to realize there is a message

2 ways of production of communication:

1. **direct**: comm are one after the other in content of time *(family meets again after the dinner)*
2. **indirect**: comm are one after the other based on structure

3 types of social systems:

1. society: the biggest system consisting of smaller social systems
2. interactions: short-term system in which participants are physically present
3. organizations

For a system to survive, new elements need to be produces and produced well

So what are *organizations* as Autopoietic Social Systems?

- To answer this question, we treated 4 sub-questions:

1. **Elements of organizations as social system:**
    - elements: communication,
    - decisions - spec type of communication - we select x out of set of alternatives
    - *communication of decision: "look I chose a blue M&M!"*
    - We communicate that we have chosen a specific employee, set of goals, ICT application, machine, supplier,...
    - elements are **event-like**: if a new element occurs, the previous one disappears. Elements are events = they start disappearing the moment they appear

2. **Organization as a social system**:
    - whole of meaningfully connected decisions
    - organization is a sequence of decisions
3. **Structure of organization as a social system**:
    - decision premises: (spec type of exp about exp) if some decision belongs to that system
4. **Autopoietic nature:**
        1) At a particular time we have a certain decision.
        2) From there many other decisions arise.
        3) But from exp of exp, only few are relevant.
        4) Then only one decision is selected and the cycle continues.
    - this shows that organizations are 'meaning processing systems'

Decision premises:

1. **membership**: only a formal member of the organization can participate in a deci
2. **communication pathways**: the decision making follows a certain hierarchy
3. **decision programs**: correct or incorrect behaviour
    - **goal programs**: decision should relate to goals of the organization *(if you don't want to produce pollution, don't buy polluting machinery)*
    - **conditional programs**: IF situation X THEN select Y. (Y is the decision) *(e.g.: IF stock is below 500 THEN order 2)*
4. **personnel**: - expertise
5. **position**: combination of all previous ones
6. **planning**: necessary for dealing with the event-like character of decisions
7. **self-descriptions**: help to distinguish the organization from its environment, define identity
8. **organizational culture**: societal values and such
9. **cognitive routines**: people get used to making certain decisions

Phenomenon of meaning appears as surplus of references: The surplus of references means that at some moment in time, a communication refers to a set of possible follow up communication

Is it possible to change the structure of a social system at any moment in any way you want? No, the function of the structure is to guide the interaction (communication). Participating in communication can only come about if the set of expectations regarding your own behavior is relatively stable. If it is completely random (at any moment) it loses the capacity of guiding the communication. You just don't know what is expected of you anymore.

Lecture 5
Beer: VSM, Functional design principles

Main question: "What does the infra need to do for the organization to stay **viable**?"

Viability:

- Being able to maintain a separate existence
- This is difficult because of complexity… These systems who try to stay separate are complex
- Complexity paradox: three systems are involved: environment, organization, management
- Complexity described by variability: #states: variables+values at certain moments
- The complexity is normally very large
- Var(env) >> Var(org) >> Var(man)
- Environment is a possible source of disturbances and since Var(env) >> Var(org) so there is less regulatory actions coming from the organization to fix the variety of the disturbances coming from the environment - **mismatch**
- number of disturbances extremely large but the number of regulatory actions quite small -**complexity paradox** (how on earth can an organization exist when this holds?)

Beers general answer to solving complexity:

1. setting goals
2. attenuate variety and amplify regulatory potential
3. recursion

Setting goals (1):

- by means of setting goals, much of the states in the environment are irrelevant. If the organization is producing a product, many many states become irrelevant
- the same holds between organization and management: if management sets goals, for department A, what department B does is irrelevant

Attenuation and amplification (2):

- try to attenuate some relevant states
- for the remaining states, use amplification
- *IRS: income tax declaration forms need to be processed in one department - EV: processing time: the higher the #illegible handwriting, the harder the processing.*
    - *Amplify: adding regulatory potential: contact the person who filled in the form*
    - *Attenuation: do it digitally*
- also works between org and man:
- *Employee 1,...Employee 16 who work in a sequence*
- *if there is a problem, an employee needs to talk to boss, then continue*
    - *amplification: boss can buy a good communication system*
    - *attenuation: have the employee to solve the problem himself*

Recursion (3):

- we need to have a concrete system (elements showing behaviour), has characteristics A,B,C,...
- we need to define a concrete sub-system - the elements are part of the elements of the CS. It also has characteristics A,B,C
- *Example 1: Suppose we have matrioškas: this is recursion. Characteristics: form and color - same for all matrioškas.*

- *Example 2: Organization: at a larger level there is concern with characteristics (can set up infra and design) Sub-system is a business unit with same characteristics (can set up infra and design)*
- Recursion helps with complexity
- *Example 3: University: education and research. Faculty also: education and research. Section: also education and research. Unit as well. 4 levels of recursion!*
- *Disturbance: #requests of examination - ampl. (ask what are the conditions) and atten. (no exception!) If the unit deals with this, the higher system does not need to do this.*
- 2 ways - low level solves the problem for higher levels, higher level sets example for lower levels *(university already has a rule there are no exceptions)*

5 functions necessary and sufficient for viability = Beer's specific answer to dealing with complexity to be viable:

1. **Collection of primary activities** (ecoenergy has PAs: wind, solar, tidal energy)
2. **Coordination**: to deal with inferences that can occur between primary activities (inferences because of shared resources or shared market)
3. **Control**: setting and monitoring targets for function 1, setting goals for and monitoring the activities of function 2, evaluate goals of innovation (function 4)
4. **Intelligence**: monitors the environment and plans for innovation
5. **Policy**: regulation friction between **'strategic discussion'** and decision making wrt them

Function 3 and 4 engage in **strategic discussion**. F4 proposes plans for innovation, F3 evaluates them.

- conservatism: F3 dominant
- innovativism: F4 dominant

Remarks:

- functional model: we know what functions there are but we don't know how to realize them
- recursive model: at concern level: F1...F5 - if we again find F1...F5 at lower level, we can use recursion

Example of viable system model:

- *bicycle shop:*
- *F1: two primary activities: selling and repairing (these start to infer each other)*
- *F2: interferences: find balance between selling and buying - make schedule*
- *F3: if customer satisfaction is important, we make the schedule, we don't yell at customers*
- *F4: number of elderly people increasing: start selling and repairing electrical cars*
- *F5: make a decision if that's to be done*

Lecture 6
de Sitter: Specific design principles

Specific design principles:

- we use general system theory to build organizations: understand and design
- to **understand** they are social systems conducting experiments
    - we use theory of Luhman to understand the social parts of the systems and Ashby to understand the experiments part of the system
    - we combine them: decisions are about goals
- to **design** the infrastructure
    - functional design principles: what, by Beer (5 functions)
    - specific design principles: how to build it? (HR, tech, structure)
    - Sitter's design theory uses Ashby's theory. Sitter focuses on division of work

Infrastructure should:

- make it possible to carry out primary processes
- not be a source of disturbances itself
- provide a sufficient amount of regulatory potential

Dealing with disturbances, in two distinctions:

1. **internal vs external:**
    - internal: RAs to deal with the task at hand
    - external: the task needs to involve the environment to deal with the disturbance
2. **routine vs non-routine:**
    - routine: the task and network of tasks remain unchanged
    - non-routine: the task and the network of tasks change

4 types of regulatory activities:

1. internal routine regulation: the regulatory activity does not involve other tasks and does not change the task or network of tasks
2. external routine regulation: the regulatory activity involves other tasks but does not change the task or network of tasks
3. internal non-routine regulation: the regulatory activity does not involve other tasks but changes the task or network of tasks
4. external non-routine regulation: the regulatory activity either changes the task's essential variables and norms or changes the task's environment

External functional requirements:

- requirements that, acc to Sitter, a modern organization has to meet to ensure viability

1. quality of organization (efficiency)
2. quality of work (taking care of employees)
3. quality of working relations (effective communication, shared responsibility)

Structure:

- The way tasks are defined and related to a network
- **decomposition**: dividing tasks (transformations) into smaller parts - **vertical and horizontal**
- *Example: Butcher has 3 apprentices, 4 activities*

1. **Vertical decomposition of structure (into parts):** dividing tasks into sub-tasks, each coming after the other
    - *apprentice 1 chops the meat, apprentice 2 displays it, apprentice 3 sells it,.... There is a sequential order, Butcher checks everything and deals with disturbances*
2. **Horizontal decomposition of structure (into aspects)*:*** Each task has the same start and end
    - *all apprentices do all tasks*

Vertical vs Horizontal:

- vertical is better because of **specialization** - they get better and better at their activities
- horizontal is better because it's more **flexible** - if apprentice 1 is ill, the others can carry out his task
- horizontal is better because you learn a lot as an apprentice

Adequate structure:

- What does Ashby have to say about infrastructure? Infrastructure realizes primary processes. Infrastructures are vulnerable to disturbances. Infrastructure should have regulatory potential.
- From Ashby's ideas, we can define adequacy of structure
    1. Efficient PPs
    2. As invulnerable to disturbances as possible
    3. enough RAs
- structure should help with realizing 1, 2 and 3
- De Sitter: Adequate structure is the one which has **design parameters with a low value**

Design parameters:

- characteristics of organization structure: these values can be low/high… they need to be low!

1. Functional concentration
2. Separation
3. Specialization of operational activities
4. Spec. of RAs

Functional concentration (1):

- degree to which operational activities are related to all order types
- *3 chairs, 4 tables (7 order types), 16 employees, 4 activities (sawing, drilling,...) so 4 departments*
- *high: all departments work on all order types (4)*
- *low: separate departments for chairs and for tables (4 * 2), we can even make separate departments for each chair and table (4 * 7)*

Separation (2):

- degree to which OAs + RAs are assigned to different tasks
- low: regulation and operation in one task together

- high: someone else deals with disturbances of activity of someone (this can annoy that person)

Specialization of OAs (3):
- degree to which operational activities are split up into sub-activities *(short-cycled sub-transformations)*
- output of one activity is input of the other one
- high: operational process is split into many many tasks **(conveyer belt)**
- low: operational process is basically one task **(craftsman)**

Specialization of RAs (4):
- degree to which regulatory activities are split up into sub-activities
- low: one big regulatory activity that covers everything
- high: hierarchy of regulators

Parameters 1 and 2 are examples of horizontal decomposition, 3 and 4 are examples of vertical decomposition.

Low vs High values:
- by decomposing transformations horizontally and vertically, and by assembling the resulting sub-transfromations into tasks, a structure emerges that has a particular score on parameters (high, low, somewhat in between,...)
- **high**: complex network of simple tasks
- **low**: a few parallel sets of operational activities, teams of employees performing tasks from start to beginning, the team itself has regulatory potential
- De Sitter argues: structures with high values on those parameters are themselves a source of disturbances and don't have enough regulatory potential

High values are problematic:
- **probability of disturbances high:**
    - **disturbances dependant on number of relations:** every relation is a possible source of disturbances the more relations, the higher the probability of disturbance
    - if ***specialization*** and ***separation*** high, the number of relations increase (spec: T1 leads to T2, this is a relation) (sep: separating regulation from operation creates a relation)
    - **disturbances dependant on variety of content:** material or information content flowing through a relation - the higher the variety the higher the probability of disturbance
    - if boiled egg is the only thing on the menu, the content is very small
    - if content increases, the number of disturbances increase: if the menu is extensive, many things to know, it gets problematic…
    - related to ***functional concentration***: If high, one person needs to know all recipes - problematic
- **diminished regulatory potential:**
    - high ***separation***: regulator separated from operator, possibly regulator of regulator of regulator, (boss of a boss). There is a distance with respect to time (takes time

to intervene) and relevance (if operator and regulator the same, it is easier to see context)

Low values are good:

- low probability of disturbance, high regulatory potential
- low separation: no relations anymore, it is one object, not time and context problem
- low specialization: not many many many tasks, rather one big one
- low functional concentration: lower variability

4 types of influences on occurance of disturbances:

- (previously mentioned) relations of the task
- (previously mentioned) variety of relations
- nature of change of the environment (more dynamic, uncertain environment, more disturbances)
- specificity of the norm (more specific the norms regarding the output are, the less freedom one has to deal with output variations)

Controllability:

- ratio of potential for regulation and the required regulation
- ratio = 0 is ideal (there is exactly enough potential for regulation to deal with all disturbances
- ratio < 1: there are more disturbances than potential for regulation
- ratio > 1: there is too much potential for regulation, which is inefficient

Relation to attenuation:

- reduction of functional concentration
- integration of tasks: the number of relations decreases

Relation to amplification:

- integration of regulatory potential to operational tasks: now tasks dispose of the potential to deal with disturbances ads they see fit, no need to contact anyone

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Lecture 7
Dealing with HR, Poor survival: disciplined organizational behaviour

What we do in the course:

- use general system theory to understand organizations
- to understand organizations as social systems (Luhman) doing experiments (Ashby)
- to design a proper infrastructure:
- functional design principles: functions for it to work well
- structural design principles: how to design it to work well
- today we look at HR: **Systemic reflection on dealing with HR**

Dealing with human resources:

- HR are part of infrastructure
- we want it to show particular behaviour
    - we need to know what is desired behaviour
    - How can we make sure HR show this?

Michigan model:

- proper performance defined by job descriptions
- *select* good people who show this *performance*, monitor them: good? - *reward*, bad? - *develop*

Foucailt's disciplines:

- set of 7 (disciplines) methods developed in 18th century (industrial revolution)
- goal: to produce 'docile of productive bodies'
- first systematic attempt to make HR show desired behaviour

Analysis of Space (1):

- make layout that serves production *and* control of employees
- *steam engine dictated layout of the factory and a boss can quickly walk around the engine to check on employees*

Analysis of production processes (2) and analysis of body movements (3):

- every subpart of production process (2) (called basic operation) is split into small parts (type of specialization) and can be realized by set of body movements (3)
- *a soldier has to do many things, one of which is loading a rifle (basic operation) done by body movements - how you hold the rifle, make sure the bullet enters the rifle,...*
- *we want to optimize these movements to load the rifle fast and well*
- body movements were studied to see how to do things most optimally

Synthesis of space, behaviour and processes (1,2,3) into a 'structure' (4):

- layout with control, subparts of process can be operated with certain bodily movements

Hierarchical surveillance (5):

- boss checks stuff (separation - hierarchy)
- panopticon: I know I can be monitored, *but not when*

Normalizing sanctions (6):

- purpose: improve behaviour
- should be related to the desired behaviour
- not just any punishment, but normalizing
- compulsory training, overtime work,...

Examination (7):

- improve the outcome of all other disciplines
- perhaps there is a better way to sanction, to do body movements,...

Feedback loops:

1) behaviour of body movements is monitored and sanctioned if needed - results in other body movements
2) 1,2,3 lead to structure, which we can then restructure (7) - we produce a structure and think of ways to improve the structure - gives another structure

Asbian aspects:

- every way of dealing with HR is done by goals, design, operational regulation:
- **Control:**
    - by setting goals: by primary processes or by HR
- **Operational regulation:**
    - panopticon surveillance and normalizing sanctions (5, 6)
- **Design:**
    - the second feedback loop
    - when structure can be made better, that's what we do

Luhman aspects:

- Social systemic background to dealing with HR:
- theory put forward by Luhman can also be used to show how we can make sure HR shows good behaviour
- set of decisions meaningfully connected
- HR should show desired behaviour which has something to do with decisions that connect to previous decisions in a meaningful way - this can be done through structure
- it is expected of them that the decisions are aligned with the structure
- decision: information, utterance and understanding
- decision shows a certain responsibility: I am responsible for choosing a relevant decision
- because of **responsibility**, HR members want to do good decisions

Disciplines system problems:

1) human being seen as trivial machine (input, output; same input always produces same output)
2) minimal goal: we want controllable and useful behaviour, nothing more = not necessary living a fulfilled life
3) blind internalization of norms: we follow norms set by someone else for us
4) system of fear: improper behaviour leads to punishment
5) lack of involvement and responsibility: it's made impossible to be involved (you also never see the final product)