PART THREE

Advanced Process Architectures

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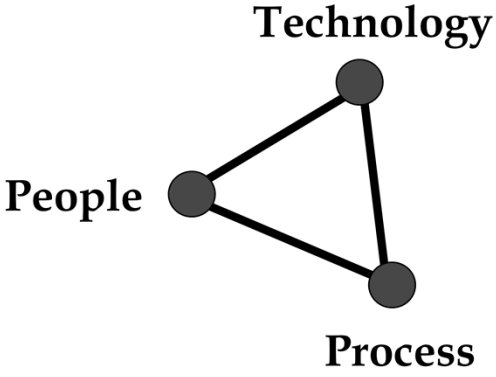
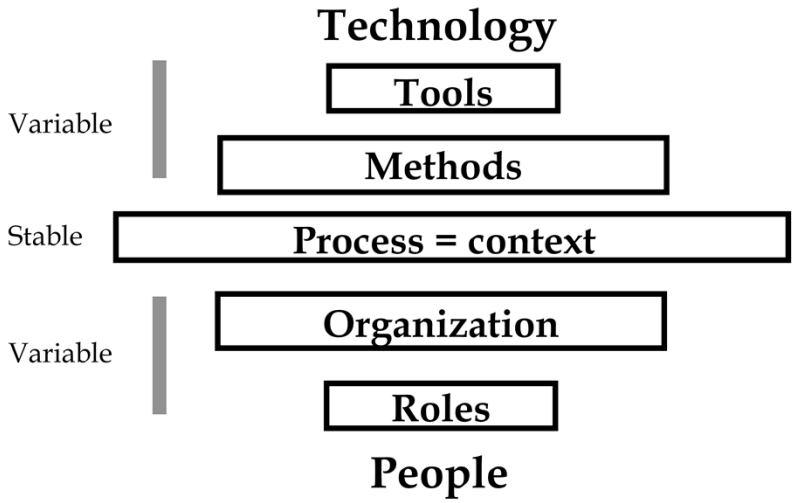
SEI's Ontology



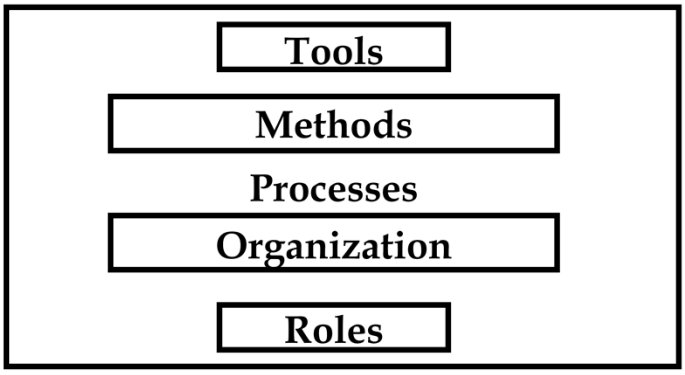
- Process is seen as solving the problem of the relation of man to technology
- Process is seen as a human technology

The Process Interface



- Process is viewed as the stable interface between people and technology

Process Means Context

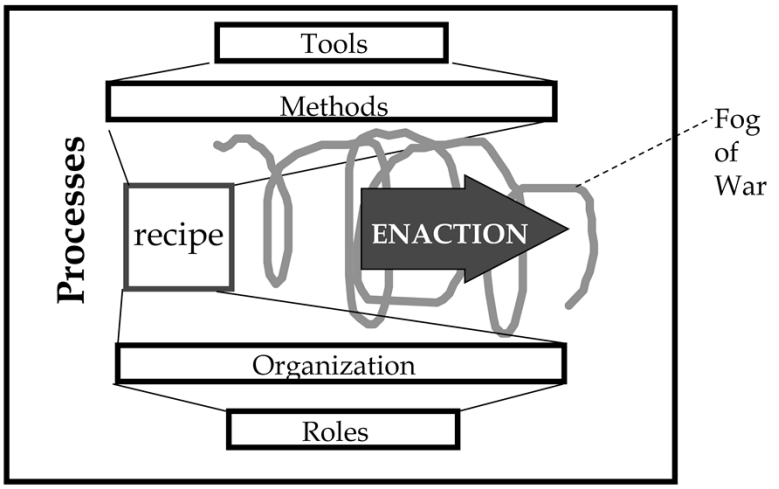


- Process as a context really encompasses the other elements of the interface
- Things are continually changing within this context
- Process description attempts to focus on the stable aspects of the context

Two Ways to Approach Process

- The reasoning that got us to focus on process . . .
  - Without methods first, tools are inadequate in themselves
  - Without process, first methods are inadequate in themselves
  - Processes provide the crucial context to make methods effective
  - Processes situate methods that are enabled by tools
  - Technological advance supplies the tools
- A similar reasoning applies to organization and roles . . .
  - Without organization first, roles have no meaning
  - Without process first, the organization does not know what to do
  - Process provides the crucial context to make an organization effective
  - Processes situate organizational structure that is enabled by roles
  - People fill roles

Exploring the Middle of the Interface

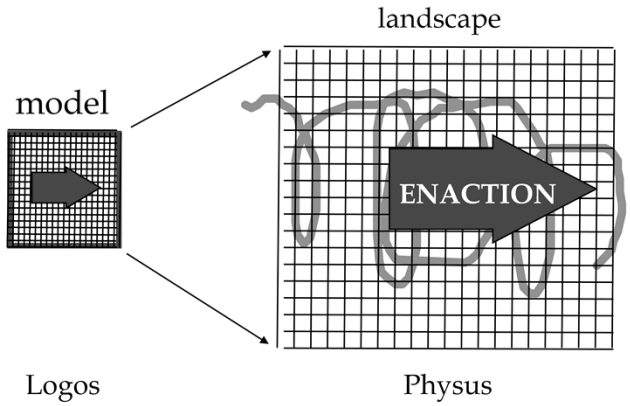


- Processes can be seen as an attempt to deal with the "fog of war" that engulfs all action in a crisis

Process Has Two Major Aspects

- Process descriptions are like recipes
- Processes break down along the Logos/Physus dichotomy into Recipes and Action
- Recipes call methods that are enabled by tools
- Actions are performed by roles within the organizational structure
- Actions of people playing at working and working at exploring the play in things

The Map is not the Territory, . . .

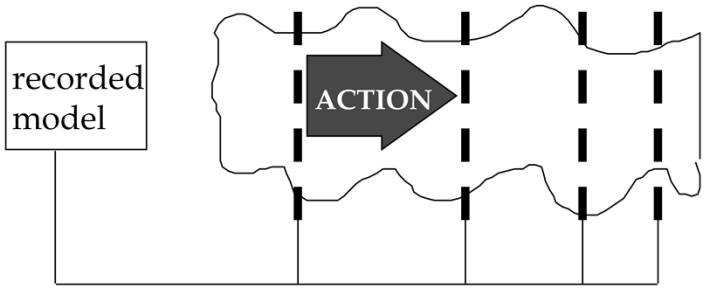


- But maps are very useful when you are lost

For a Map to Be Useful . . .

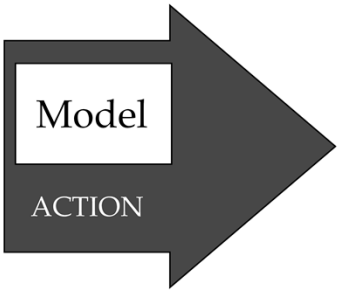
- You have to know some things first
  - Either you must know several landmarks to situate yourself
    - Creating a correspondence between positions in the landscape and the positions on the map
  - Or you must know a single landmark and have a compass
    - Allowing you to project lines with known directions from a place you know
- For a map to be useful you need to know multiple pieces of information simultaneously
  - If you do not have a compass or know multiple landmarks, then you are just as lost with a map as without one
- Without maps of processes our work can be conscious but not self-conscious.
  - Maps of processes bring information together for those who already know the landmarks or have a grasp on the way things are going
  - Unless your process is already somewhat conscious process maps are no good to you
    - This is the wisdom of Level 2 being prior to Level 3

Invisible Lines Are Drawn



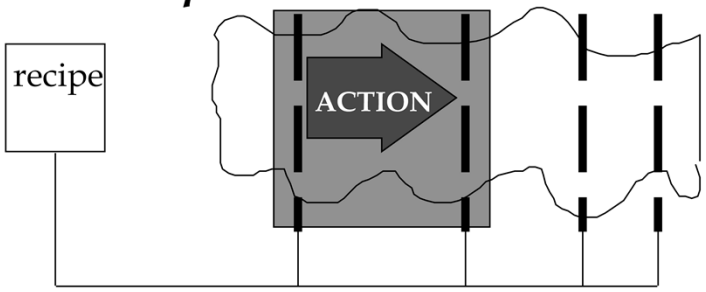
- The key aspect of the process description is that it draws invisible lines around aspects of human behavior
- It specifies constraints on action
- It stipulates the content of action

Non-dual View on Process



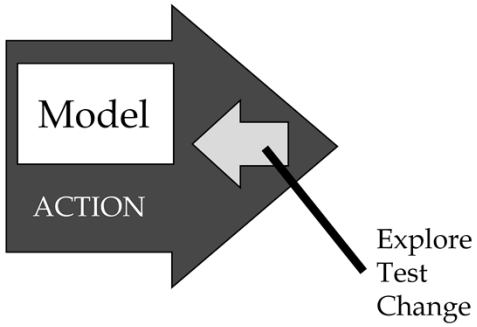
- Models may be developed in the midst of action and applied in action
- This is how we apply our tacit knowledge in everyday life
- The map can be implicit and tacit instead of explicit and written

ETVX Snapshots



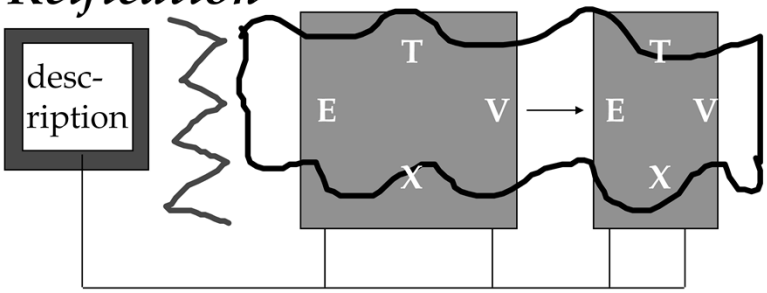
- Abstract schemas are wrapped around idealized actions
- Entry and exit conditions, validation checklists, and tasks describe the structure of the routinized process
- The result is a frozen representation that approximates what happens to some degree
- To the degree the picture is shared, it may be useful

Non-dual view on Process



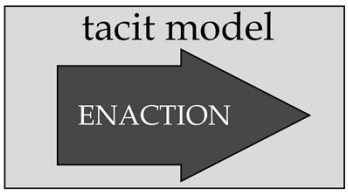
- Embodied Theory or Action Research
- Tacit modes continually tested as we explore the play the situation though in the change/learning process
- Models constructed in the process; not projected on it
- This view taken by Varela in The Embodied Mind

Reification



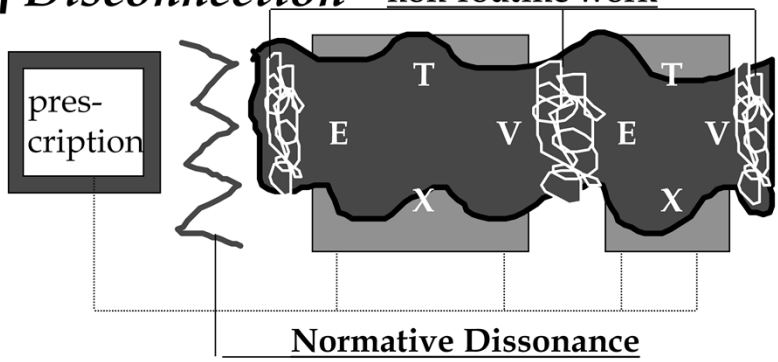
- In the process of creating the description, we are reifying human action and abstracting it
- What started out as a recipe to help us has become an objectified constraint around segments of action that lend themselves to routinization
- When descriptions are enforced, they become prescriptions for action

Non-dual View on Process



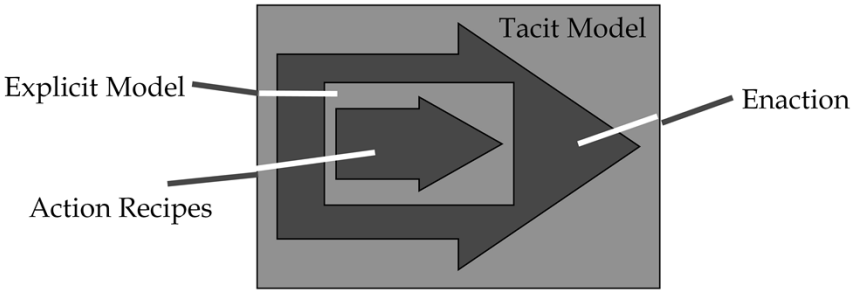
- Making the tacit model explicit may help practitioners to formulate their thoughts about what they are doing
  - Rational action continually guided by the tacit model
  - The process description needs to attempt to make explicit the tacit model without replacing it our interfering with it
  - Process descriptions are theories about tacit models
    - The theories may be tested by . . .
      - reviews
      - observation
      - interviews

Disconnection



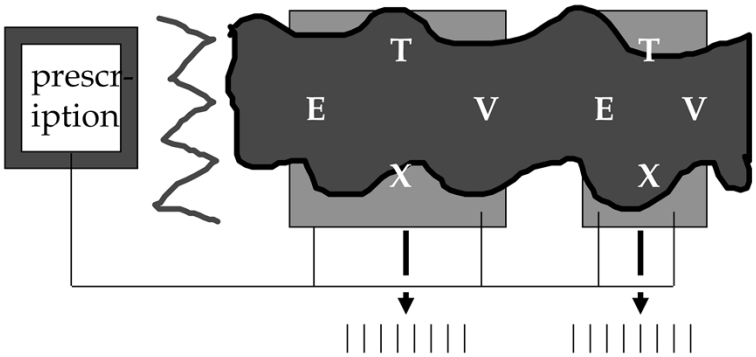
- When there is a disconnection between what is actually done and the description, the result is normative dissonance
- This normative dissonance injected in the action stream causes confusion
- This adds to the confusion already present and the inherent disorder of non-routine work within the enacted process

Non-dual View on Process



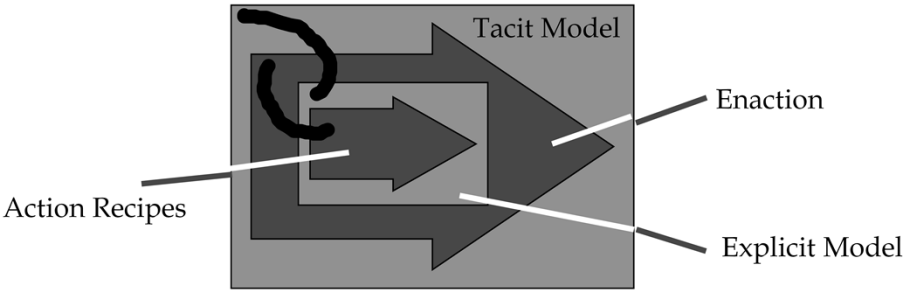
- Constructivist approach integrates landscape and model through nesting
- The enaction is within the tacit model which contains the explicit model that in turn has action recipes
- Theory guides practice and theory is constructed as a by-product of the action through action research

Metrics



- Does the gain from metrics on process variables make up for the creation of normative dissonance?
- Can a process be architected to minimize dissonance and maximize the benefits of measurability?

Non-dual View on Process



- Nested contexts give rise to robust descriptions
- Descriptions are no longer objective, nor subjective, but become intersubjective
- People share their models rather than their being imposed from the outside
- Tacit and explicit models; Action recipes and Enaction patterns complement each other

Advanced Architectures

- The process architecture connects descriptions to enactment
  - The primary problem of process description is to find a way to describe the dynamics of work which is useful as the work progresses and can be easily changed as the work changes
- Process descriptions are like software in that they are changeable descriptions of what is done
  - But the execution of the descriptions is done by humans and not computing machines
  - The limit case is "process programming" which treats the human as if they were computers and uses a software language as the means of control
  - Descriptions are unlike software in their abstraction and their flexibility
- This leads us to carefully consider the architecture of process descriptions and thus of the process itself.

Abstractions

- Process descriptions are abstractions
  - They need to be written in such a way that they will not have to change continually, but they can be used in a project context that is constantly changing
  - They need to be able to cover multiple project instantiations of process within the organizational process game
- So anything likely to change should be reduced to a variable within the process description; e.g.
  - Methods
  - Tools
  - Organizational Structure
  - Project specific choices
- Selecting the right variables is an important step in process

Objectives of Process Architecture

- Vehicle for education of practitioners
- Research representation for process group
- Means of self-discovery for organization
- Covering multiple projects within an organization
- Flexibility in the face of constant change
- Adaptability to new circumstances
- Control of specific process features
- Avoid normative dissonance
- Take care of the anomalous case of non-routine work
- Allows organizational meta-gaming and project gaming

Benefits of Process Architecture

- Single structure meets multiple design goals simultaneously
- Will last longer than an ad hoc architecture
- Will need less maintenance
- Brings principal ideas of process to the fore
- Easier to communicate and train
- Will better approximate enactment needs

Process Has Full Developmental Lifecycle

- The process design step should not be skipped
  - Just as ad hoc software and systems organizations leap to code, so too the process industry as a whole has leapt to descriptions that are not always appropriate ways to capture processes
  - If a process description that has a flawed design is in place, then it should be re-designed based on fundamental process principles
- Processes descriptions and programs are long-term investments in corporate knowledge and learning
  - Process architectures that do not facilitate learning and knowledge retention should be replaced
- Like software architectures, occasionally maintenance will become impossible, and restructuring is the only alternative

Principle: Maturity Independence

- Work processes should all move through the stages of maturity separately
- The Systems Engineering Maturity Model makes that leap to maturity independence
- Without maturity independence organizations are locked into an improvement regime specified from outside
- All work processes move up and down the scale of maturity over time
- Why should some processes be stunted at a particular maturity level?
- This lack of maturity independence in the Software Engineering CMM is a major impediment to reasonable process improvement management

Principle: Temporal Independence

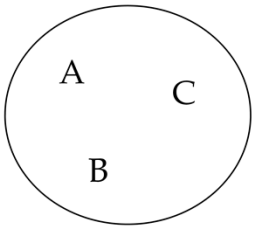
- Process needs to be completely independent of time and considered orthogonal to time
  - Life-cycles must be a variable in software process descriptions
- This can be accomplished by considering process as Kinds of Work that may be enacted at any time within the life-cycle of a project
  - IEEE P1074 Software Process Standard is a good starting point for identifying the kinds of work in Software Engineering
  - The Systems Engineering Maturity Model is a good starting point for identifying kinds of work in systems
- The separation of kinds of work from time solves the problems of describing anomalous non-routine work

Analogy

SET

PROCESS

- **unordered with single instance of each kind**



LIST

LIFE-CYCLE

- **ordered with multiple instances of each kind**

ABAACBAACBAAB

Kinds of Work

- Proposed as a way of looking at growth in cities first by Jane Jacobs in her book The Economy of Cities
  - She notes that cities only grow by adding new kinds of work to old kinds of work
  - A new kind of work does not have to be added to the same kind of work, but may be added to a radically different kind of work
  - "Who does what" is normally confused until it is rationalized
  - New kinds of work create exports from the city which creates the economic climate of growth which allows increasing returns
  - The rural work is created by the city work and not vice versa as is normally thought
  - Trade comes from cities adding kinds of work that give rise to traders as a secondary phenomena
- Radically different kinds of work can interpenetrate within the same organization within a city

Corporations

- Corporations are like the early cities Jane Jacobs describes
  - When they grow, they add different kinds of work on to each other in an ad hoc manner as the organization deals with the spiral of increasing returns
  - The kinds of work reflect the variety of the environment of the organization
  - Kinds of work operating together heterogeneously make the organization viable
  - Kinds of work are later rationalized into disciplines for purposes of organizational control
  - Disciplining work is never wholly successful, and organizations tend to oscillate between two inadequate solutions
    - Kinds of work separately gathered together on a project
    - Kinds of work organized by disciplines (functional)
  - The matrix organization attempts to deal with this wicked problem

Principle: Organizing Complexity

- Kinds of work . . .
  - Are commonly accepted and consensually defined ways of doing things
  - Though they interpenetrate, they can be abstractly defined and recognized
  - Represent natural discontinuities within the work process
  - Represent differences organizing natural complexes of action that are generally recognized within a discipline
- Kinds of work represent the natural splits along which different agents divvy up work
- However, an agent may be given many radically different kinds of work to do based on the necessity of getting things done in a timely manner
- The kinds of work can be abstracted into a functional view of work which is mapped to agents and executed by agents
- Mapping is description, and execution is enactment

Interpenetration

- As work proceeds, these natural action complexes may interpenetrate in different ways at different times
- It is the ability of kinds of work to interpenetrate, yet be radically different, that allows work to appear to have continuity when dealing with different aspects of the environment
- The interpenetration of radically different kinds of work is the basis for the ongoing viability of the organization
- But what allows the organization to be viable also creates unmanageable variety
  - Every interpenetration and interaction of kinds of work creates a difference that appears in the representation of the product

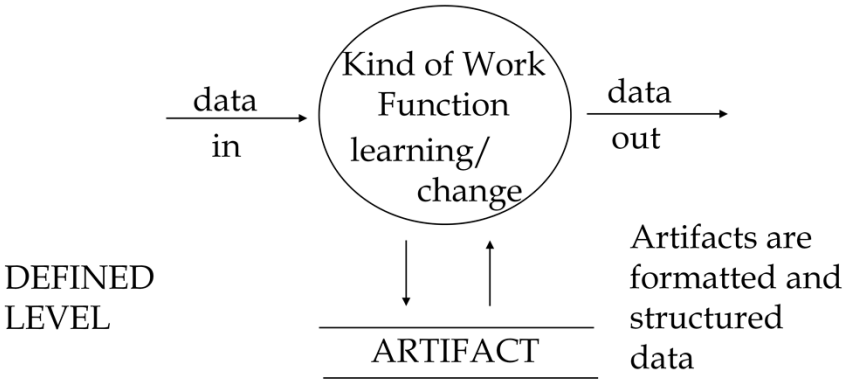
Isolating Kinds of Work

- A kind of work should be a broad general category of action within a discipline
- Each kind of work should be easily recognizable by the practitioner
- A kind of work may be considered as a function that operates on information or material flowing within the production process
- A kind of work should have integrity and coherence within the overall work process

  Examples:

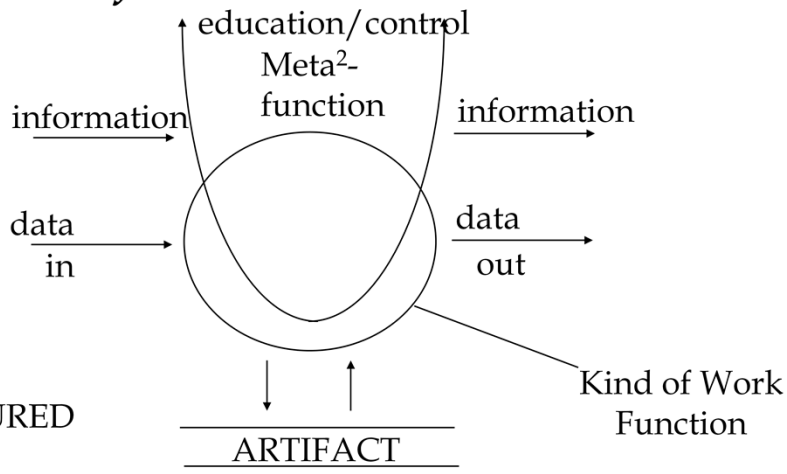
  Configuration Management
  Software Design
  Project Monitoring & Control

Dataflow Model of Kinds of Work



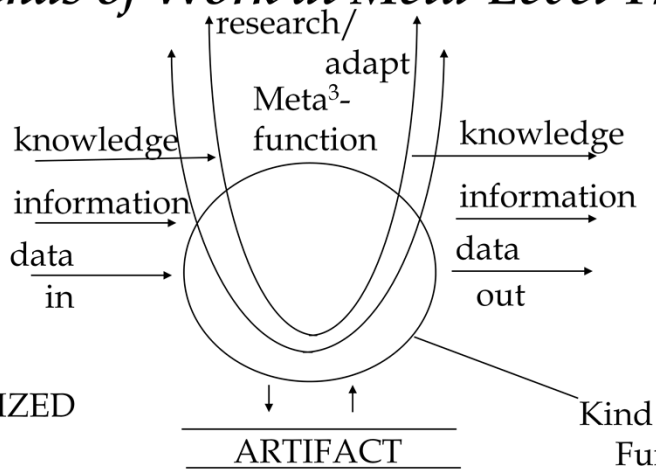
- Kinds of work operate on information at the lowest level and produce new information and artifacts (products)

Kinds of Work at Meta-Level Two



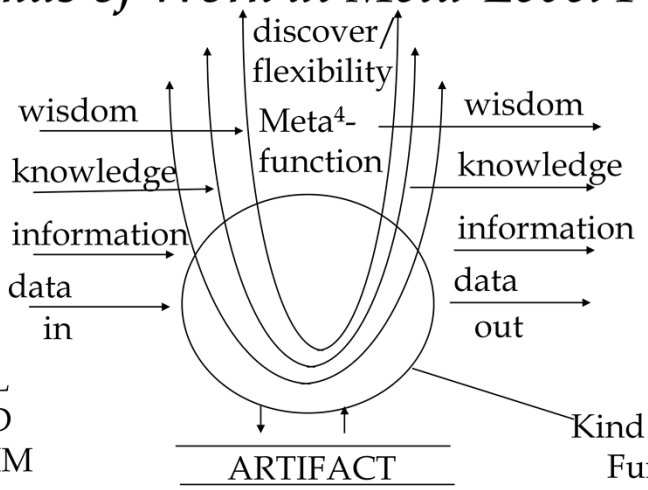
- Kinds of work open out to the process meta-levels
- Measurements are information about defined processes

Kinds of Work at Meta-Level Three



- Research works on knowledge and produces knowledge, and knowledge makes adaptation possible
- Optimization must be based on knowledge of the process

Kinds of Work at Meta-Level Four

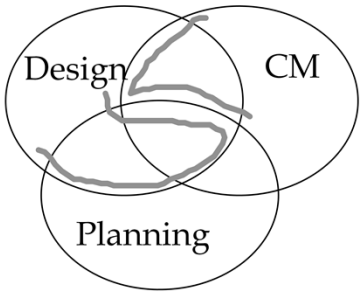


- Beyond process maturity is process wisdom produced by discoveries through creativity and emergence that make us flexible

The Hyperspace of Work

- Meta-levels of each kind of work track maturity levels but go at least one stage beyond them
  - Defined = first order kind of work
  - Measured = second order kind of work
  - Optimized = third order kind of work
  - Process wisdom goes beyond maturity
- The meta-levels of each kind of work connect them at a distance to many other kinds of work (like through hyperspace)
  - Each kind of work has its unique routine / non-routine ratio
  - Because of the out of time connections between different kinds of work, it is possible for radically different kinds of work to exist together and cooperate to achieve a goal in a synergetic fashion
- Non-routine hyper levels of work make work coherent and cohesive as natural complexes

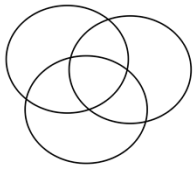
Overlapping Kinds of Work



- Different kinds of work naturally interpenetrate to produce different qualities of work in their overlaps
- These overlappings must be analytically separated out in the act of producing a reified description
- How this is done is a matter of aesthetics, there is no single right answer

Quality versus Quantity

QUALITATIVE



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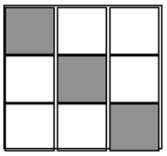
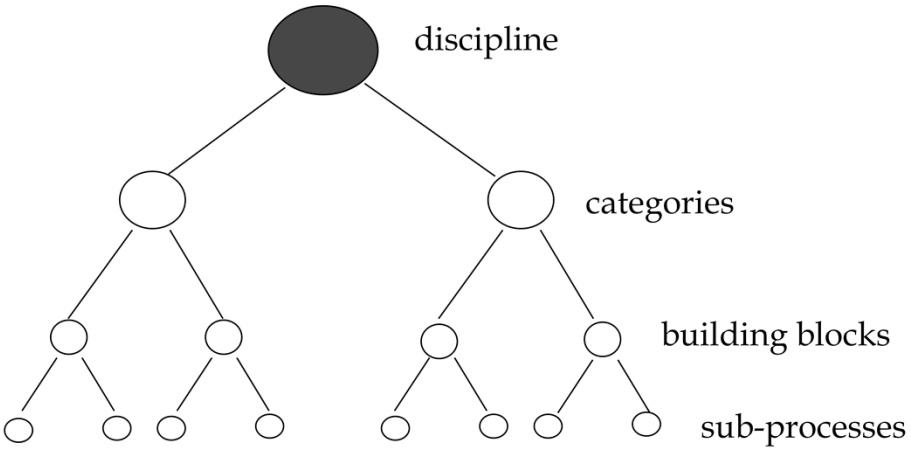
QUANTITATIVE



n^2

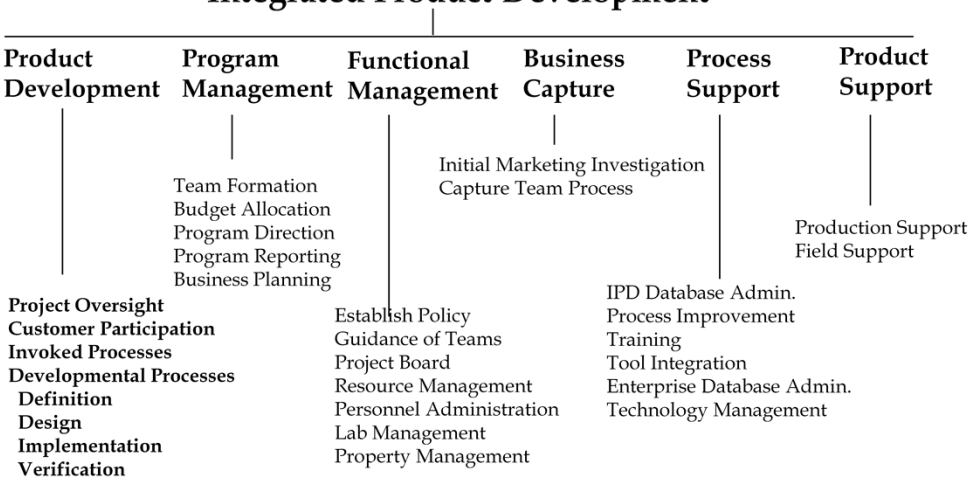
- The process of separation of kinds of work transforms them from qualities of work into components of work with definite relations
- This separation may be done many ways and will lead to very different work process designs

Hierarchy of kinds of work



- Separated kinds of work form a functional hierarchy
- For engineering as a whole, the disciplines are entangled

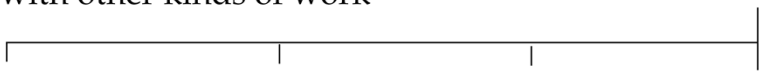
Engineering Process Hierarchy



- Functional decomposition of kinds of work provides a framework for implementing IPD

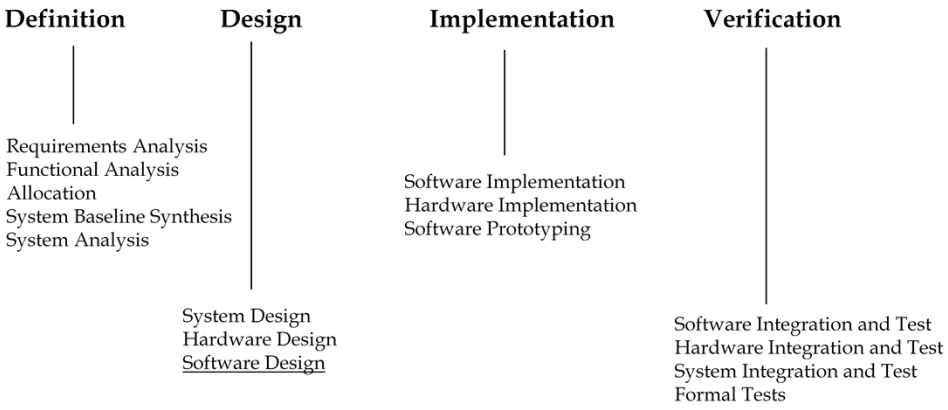
Product Development Processes

- There are many ways of arranging the hierarchy of kinds of work
- Invoked processes are used many places in conjunction with other kinds of work



Project Oversight	**Customer Participation**	**Invoked Processes**	**Developmental Processes**
Project Planning	Not defined	Generate Cost Estimate	**Definition**
Project Control		Reviews	**Design**
Metric Collection		Documentation	**Implementation**
Configuration Management		Element Reuse	**Verification**
Technical Subcontract Management			
Reliability Management			
Parts Management			
Safety Management			
Quality Engineering			

Developmental Processes



- Difference in Systems, Hardware, and Software disciplines shows up at this level

Software Design Process

- Create Design Sketch
  - Produce and Maintain Design Sketch
  - Enter Sketch into Design Baseline
- Produce Implementation Model
  - Review Essential Model
  - Introduce Implementation Constraints
  - Document Implementation
  - Baseline Current Implementation Model
  - Generate Tractability Mapping
- Perform Structural Decomposition
  - Produce Structural Decomposition
  - Document Structural Decomposition
  - Baseline Structural Decomposition
- Perform Distributed Design
  - Capture Current Context
  - Generate Communications Design
  - Allocate to Processors
  - Verify Resource Usage
  - Document Distributed Design
  - Baseline Distributed Design
- Develop Critical Algorithms
  - Outline Algorithm
  - Simulate Algorithm
  - Document Algorithm
- Tasking Architecture Design
  - Identify Tasks
  - Identify Task Communication Mechanisms
  - Identify Interrupt Mechanism
  - Document Tasking Architecture
  - Baseline Tasking Architecture
- Encapsulation Design
  - Identify Component Interfaces
  - Specify Component Functionality
  - Document Encapsulation
  - Baseline Encapsulation
- Global Design
  - Construct System Architecture
  - Analyze System Architecture
  - Document Global Design
  - Baseline Global Design
- Packaging
  - Group Design Elements
  - Create Packaging Files
  - Compile Specifications
  - Organize and Maintain Packaging Files
  - Estimate Source Size

Example Description Format

- Number ID in hierarchy
- Name
- Description
- Policy
- Tutorial
- Entry criteria
- Sub-processes
- Validation checklist
- Exit criteria
- Procedure or sub-process flow
- Artifacts
- Methods
- Tools
- Metrics
- Requirements
- Compliance Audit
- Guidelines
- Notes

- These will change for different processes
- Must all be orthogonal with respect to information content
- All key process information must be covered
- Same format covers both routine and non-routine work
- Higher meta-level outputs
  - level 1 Artifacts
  - level 2 Metrics
  - level 3 Knowledge Books
  - level 4 Lessons Learned

Common Processes Across Engineering

SOFTWARE SPECIFIC

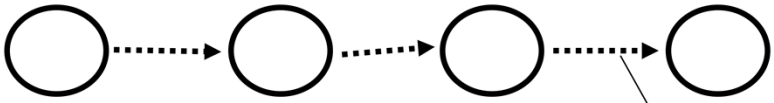
- Requirements
- Design
- Implementation
- Integration
- Test
- Prototyping
- Reuse

COMMON

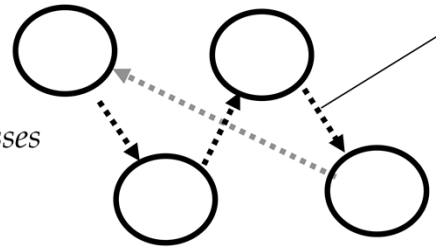
- Planning
- Control
- Metrics Collection
- Configuration Management
- Sub-contracts
- Quality Engineering
- Process Improvement
- Training
- Technology Management
- Environmental Support
- Estimation
- Review
- Documentation

Paths Between Processes

routine work has well defined paths between processes



non-routine work has chaotic seemingly random jumps between processes during execution



path of an agent executing a process in time

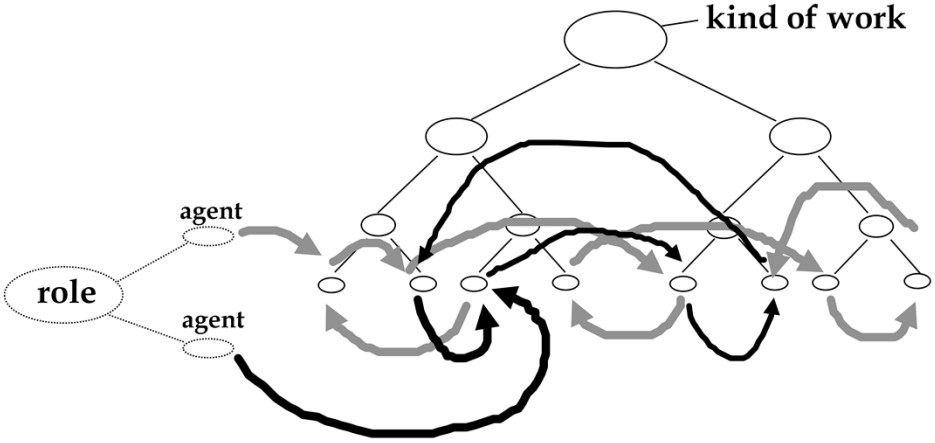
- Atemporality allows a single process description to cover both routine and non-routine work by ignoring execution paths

Non-Routine Work

- Can still be categorized into atemporal kinds of work
- Descriptions may be made more fuzzy to accommodate the indefiniteness of the work itself
- Iteration and recursiveness are supported by atemporality
- Unknown paths supported by atemporality
- Expertise supported by knowledge books

- Taking work out of time context helps resolve the difference between routine and non-routine work as far as the description is concerned
- Allowing fuzzy descriptions of work for non-routine processes also helps support flexibility

Role and Agent Relationship



- Two agents executing different sequences of kinds of of work
- Roles are groupings of kinds of work by execution agency

Agents are . . .

- Independent and autonomous
- Related to physical embodiment
- embedded in spacetime
- Secondary processes -- living or computational creatures
- Opaque to inspection
- Carriers of functionality or kinds of work
- May be nested in a hierarchy or exist in swarms
- Grouped into roles that carry non-routine aspects of work

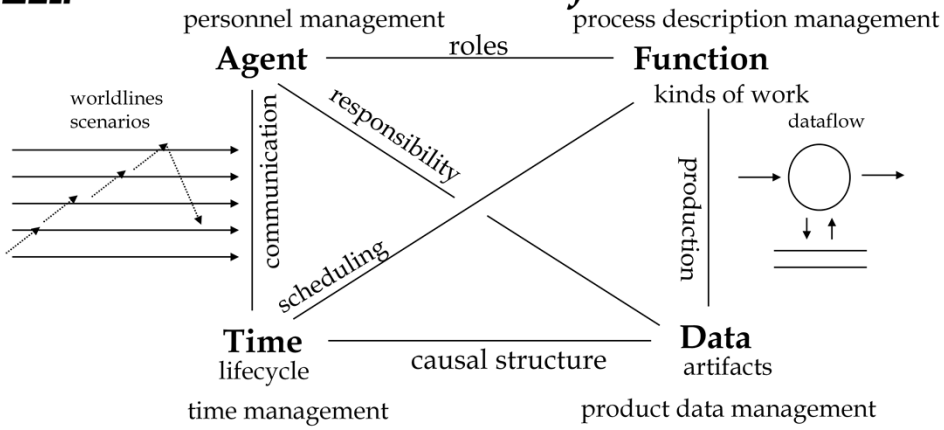
Roles are . . .

- The normal intersection between agency and kinds of work
- The assignment of groups of kinds of work to agents based on probability of execution
- A standard sociological concept
- Kinds of agents who perform certain kinds of work
  - Systems Engineer
  - Software Engineer
  - Applications Specialist
  - Configuration Manager
  - SQA Engineer
  - Technologist
  - Process Engineer

Non-Routine Work and Roles

- Roles are the major way for us to manage non-routine work
  - A set of kinds of work with a similar non-routine component is assigned to a role
  - What is more important about a role is the kinds of non-routine work that are handled, than the kinds of work that are done along the way.
  - Through roles, non-routine work is encapsulated by assigning it to a type of person who does a certain set of kinds of work along with handling their non-routine components
- A role in sociology means a certain expected pattern of behavior that is typified within society
  - Roles are normally connected to particular domains, and one person can have multiple roles
  - Roles are the opposite of causal flows of work

Fundamental Views of Instantiation



- There are four fundamental views on any real-time system
- Methods are the bridges between viewpoints
- This captures relation between process description and enactment

Facets of the Management of Enactment

- Four key types of management represent the basic viewpoints on enactment
  - Product Data Management
    - Treats artifacts as a hierarchy of objects to be managed
  - Time Management
    - Occurs at a personal level where people manage their time and to do lists
  - Personnel Management
    - Addressed by Human Resources CMM
    - Called "staffing" in project management
  - Process Description Management
    - Keeps the process description up to date

Product Data Management

- Processes form the context for PDM
- PDM is an order of magnitude more complex than constructing processes
- PDM should be attempted only after the processes are in place which describe the data that is used to produce the artifacts that result from the process
- Details of the data that go into products and their organization within different products are an advanced topic
- Coherent models of PDM details are the prerequisite to workflow automation

Time Management

- Has entered our working lives via the ubiquitous *Planner*
- Besides scheduling, an important aspect is the concept of the *Action List*
  - Action Lists are the way we prioritize things to be done
  - But the key point of action lists is they collect all the unforeseen work that appears during enactment
  - Action lists are the best model of enactment
- Organizational inefficiencies need to be addressed in order to save time
  - Communication overhead accounts for a large amount of time spent on projects
  - Administrative overheads need to be studied for reduction

Personnel Management

- The Human Resources CMM addresses this area
- Current reward structures are the major impediment to process improvement efforts
- The lack of process oriented courses in academia results in process illiteracy among new hires
- Most companies stress the fact that the people are important but this appears in most cases to be rhetoric
- The corporation as a bureaucratic structure has major drawbacks in the way it separates responsibility for action from the people doing the work
- The opposite of this are the entrepreneurial start-ups where all the responsibility is borne by the principals of the company
- What is needed is a reward and responsibility structure between these two extremes

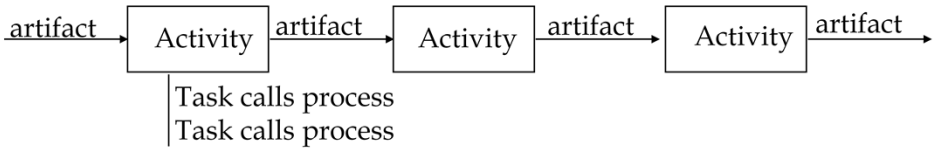
Process Description Management

- Process descriptions come in implicit and explicit varieties
- Implicit descriptions "within peoples heads" are the most important ones
- Explicit descriptions are aids for the clarification of tacit process fragments that are assumed but not externalized by the people in the organization
- A good description would be very dynamic and would continuously change as it is updated in process of being enacted
- Scenario:
  - Everyone keeps their own explicit process description on World Wide Web servers on their computers
  - Everyone updates their descriptions as they are changed while working
  - Everyone has access to everyone else's current versions via Netscape

Causal Control Structures

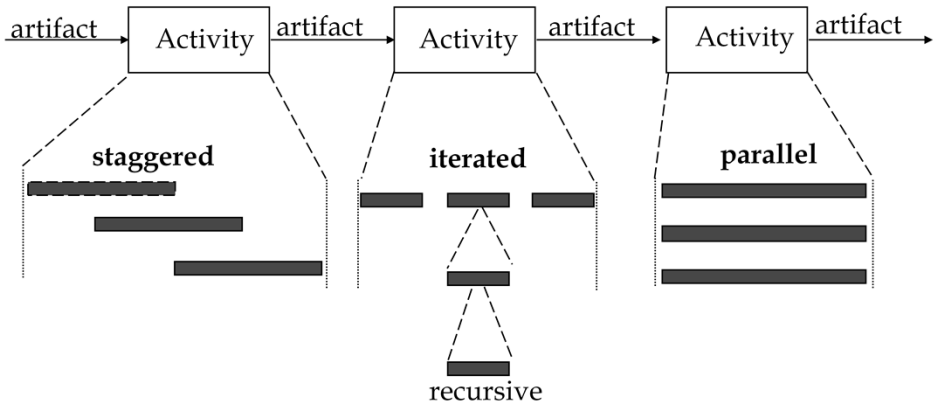
- These are the connection between Product Data Management and Time Management
- They are mechanistic, not organic
- They create rigid relations where those are necessary
- The causal control structure is the core of any process
- It reifies the production lattice so that a large group of people can work together and integration of work products will occur at the right time in the production process
- These are necessary, but should not be the totality of the process, as they are in many cases today

Causal Structure: Life-cycle Template



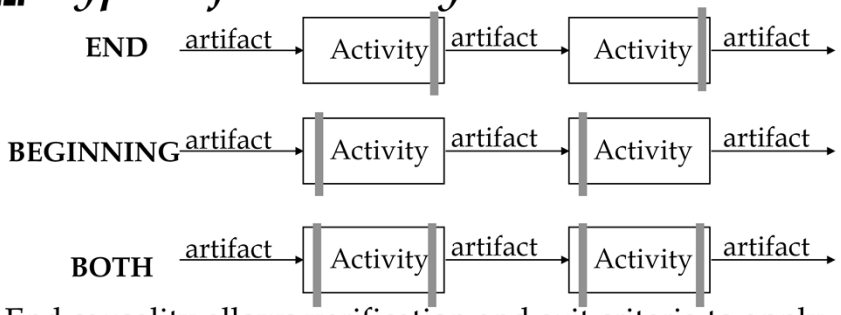
- Makes sure precedent artifacts are created before dependent artifacts need them
- Control oriented and therefore limited in applicability
- Expresses routine part of workflow
- Might be thought of as a life-cycle template
  - Using the template we can create the GANT and PERT structures embodied in the life-cycle
- The opposite of roles -- has no non-routine content

Instantiation of Activities



- Each activity may have many instances on a project
  - the same work is performed on different products
  - different activities may be interleaved to form complex patterns

Types of Causality



- End causality allows verification and exit criteria to apply only at the end of all the instances of an activity to allow for goal seeking as each instance tries to approximate the validations and exit criteria that is necessary
- Beginning causality demands precedents are in place before an activity starts
- On critical path both begin and end causality may be combined

There Are Many Ways of Relating to the World

- Causal Control Structures
  - Create the illusion of continuity within the process description
  - Are the hardest crystallization of work that an organization can produced
  - Only apply to a very narrow range of experience
- We need to recognize their limitations and place these control structures in a wider context of different ways of relating to the world
- Only if we open up our descriptions of process to encompass different ways of relating to the world can they ever hope to be accurate depictions approximating what actually occurs in the dynamics of our organizations

Ways of Relating to the World

Being[1] (pointing)	**Pure Presence**	**Frozen Representations** (causal control structures)
Being[2] (grasping)	**Gestalts** (showing and hiding)	**Processes** (continuities)
Being[3] (bearing)	**Breakpoints**	**Breakdowns** (discontinuities)
Being[4] (encompassing)	**Rhizome** (mixture of continuity and discontinuity)	**Endless Variety**

- Causal representations of processes that are purely present and static are only the most superficial way of relating to things in the world
  - Only the shadow of processes can be captured by these static descriptions
- It is necessary to delve into deeper ways of relating to the world in order to capture process as it occurs in enactment

Pure Presence

- The assumption that all aspects of the process are fully available and can be represented unambiguously is false
  - We can make only a small part of the process available and represent it unambiguously
  - We should only try to do that for the most critical paths
  - Cost of representation goes up exponentially the more of the process we attempt to make fully present
- Causality between products is not complete and does not follow classical notions of discrete causality
  - Attempting to make everything present and available actually distorts the processes in significant ways

Showing and Hiding Gestalts

- Processes are continually showing and hiding aspects of the work being performed and the products being created
  - Most process relations are statistical instead of discretely causal
    - Good Statistical Process Control uses the statistical nature of process to find correlations between products and process variables upstream to the process
  - The focus of attention is continually changing as the project progresses
    - Everything cannot be held in the forefront of our attention all the time and made purely present -- things are continually being hidden by other things as different things vie for our attention
    - In these gestalts figures appear on backgrounds, and as our attention shifts, different figures appear on the background field

Processes are Partial Systems

- What is a System?
  - A system is not the same thing as an object
    - Objects are static while systems are dynamic
  - Systems participate in showing and hiding relations
    - Systems are *Gestalts*
- Processes are partial systems
  - We may consider systems complete when:
    - All objects are known
    - All relations between these objects are known
    - The dynamics of all objects and changes in relations are known
  - But processes are essentially incomplete systems because we cannot know everything about the gestalt of the system as it participates in showing and hiding relations
- A system is a static image of a dynamic gestalt built up as we observe the different aspects that appear and disappear over time

Breakpoints

- Systems not only are inherently partial, but . . .
  - Many systems are also discontinuous in their dynamics
    - Discontinuities appear in the dynamic showing and hiding relations of inherently partial and non-linear or discontinuous dynamical systems
    - These discontinuities are explained using structural models of systems
- We can call these discontinuities in processes breakpoints
  - Breakpoints become breakdowns where the process fails
    - When not handled properly
    - When they appear unexpectedly and get out of control
    - Large grain breakdowns give us surprises as we execute the process
  - The art is to recognize these breakpoints and exploit them for change
  - Fuzzy mathematics and logic are a way of describing these possibilities of breakpoints prior to their actualization

What Is a Meta-System

- A meta-system is the arena within which other systems interact
  - Examples: operating system, or city
- A meta-system is the origin of systems
  - Example: reproductive family
- Meta-systems are more than just showing and hiding structures
  - There is always some aspect of the meta-system that no system can see
  - This is the place where the rules for system interaction are created and stored
  - They are proto-gestalts, i.e. they have "implicate order" instead of explicit ordering
- No word for meta-system in our scientific or technical language
  - We generally call them systems in spite of their fundamental difference from systems
  - *"Archon"* is a candidate name for the meta-system

The Visible and the Invisible

- Manifest,
  seen directly
  - Systems
  - Games
  - Project operations
  - Project process instantiation
  - Explicit process descriptions
  - Work as a rigid causal structure
- Hidden,
  not seen directly
  - Meta-systems
  - Game-makers
  - SEPG background activities
  - Organizational processes
  - Tacit process descriptions
  - Play as adaptability and flexibility in work

Process Meta-Systems

- Meta-systems are described by higher order meta-models
  - Organizational processes are meta-systems within which the systems of projects operate
- Games are systems, and game-makers are meta-systems
  - Process descriptions describe the organizational process meta-system, and these are instantiated as games or systems by different projects
  - The parts of the process that are organizational specific are those parts that are purely meta-systemic and are not seen by the project directly
- Processes are the origin of products and their shadows in human history
  - By creating processes along with products we become self-conscious about our production
  - Processes are conscious, and meta-systems are self-conscious

Rhizome

- Rhizomes are . . .
  - Tubular organic structure which grows in all different directions at once without apparent order
  - Have no beginning or end, but are always entered in the middle
  - A model from the natural world of wild variety production
- Processes are . . .
  - On a fine grain level are shot through with both continuity and discontinuity
  - At a micro level processes are *Chaotic* which means an intricate combination of order and disorder
    - They have multiple entries and exits at every point
    - It is not just ordered and not just disordered, but a production of endless variety of orderings and disorderings at multiple meta-levels
- **Rhizomatic processes have heterogeneously interactive properties and activities which no static representation can capture**

Domains

- Domains are . . .
  - The subjects of disciplines
  - Meta-meta-systems
  - Particular ways of looking at things that highlight certain aspects of existence and hide other aspects
  - Perspectives on the world which filter the world seen from that viewpoint
- Using domains the rhizomatic nature of process is reduced to manageable hierarchies of things and relations
  - The rhizome contains multiple interacting and intertwined hierarchies
  - A thing can function in multiple domains simultaneously

Process Domain

- The process discipline establishes several points of view on human processes
  - Data view
  - Agent view
  - Function view
  - Event view
- Each different paradigm (mindset) establishes a different approach to the domain
  - Statistical Process Control
  - Socio-technical Systems
  - Gaming
    - Within the human process domain are the work and play aspects of human behavior
    - Work considered without its complement, play, is a fragmentary domain
- The approaches taken together suggest the outlines of the process discipline which is a critical dialog between the approaches
- When the discipline becomes a science, then it engages in a normative research using different approaches to uncover anomalies

Primary Process

- The primary process is *Manifestation*
  - Manifestation is composed of all the different ways to relate to the world
  - All processes within the world are subservient to the primary process of manifestation
- Characteristics of primary process
  - Overwhelming
  - Intersubjective
  - All embracing
  - Differentiated
  - Kindness
  - Aspectival
  - Unfathomable depth
  - Wondrous

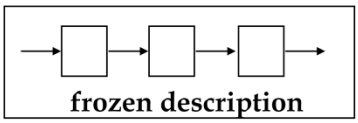
Secondary Process

- All viable things that appear within the stream of primary process are secondary processes
- Characteristics of secondary processes
  - Transforming
  - Active
  - Hierarchical
  - Autopoietic
  - Unreified
- Human behavioral processes are secondary
  - Behavioral processes include
    - work/play
    - laughing/crying
    - myriad opposites

Tertiary Processes

- Tertiary Processes are reifications of primary and secondary processes within a domain through applying viewpoints to the secondary processes
- Characteristics of tertiary processes:
  - Artificial boundaries
  - Entropic
  - Intrinsically inactive or set in motion
  - Reified
  - Limited
- Work is a tertiary process
  - Leaving out its opposite, play, renders a partial and distorted view of human behavior
- Disciplines set up tertiary processes to understand secondary processes within the all encompassing primary process

Different Views of Processes



classical causality;
complete availability;
no non-routine work;
severely reduced variety

teleonomic progress

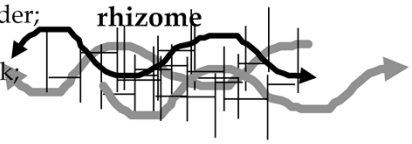
statistics and correlations

macro discontinuities

structural models;
fuzzy possibilities;
breakdowns

micro-scale order/disorder;
endless variety; chaotic
intense non-routine work;
continuous breakdown

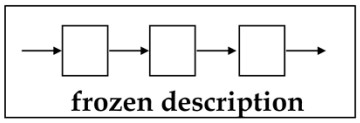
rhizome



- None of these views captures the whole story of what is going on, but when used together, they give a close approximation

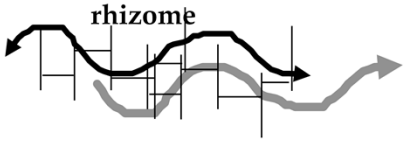
Representations of Processes

System
tertiary process
representations



Meta-
System
secondary process
representations

Domain
primary process
representations

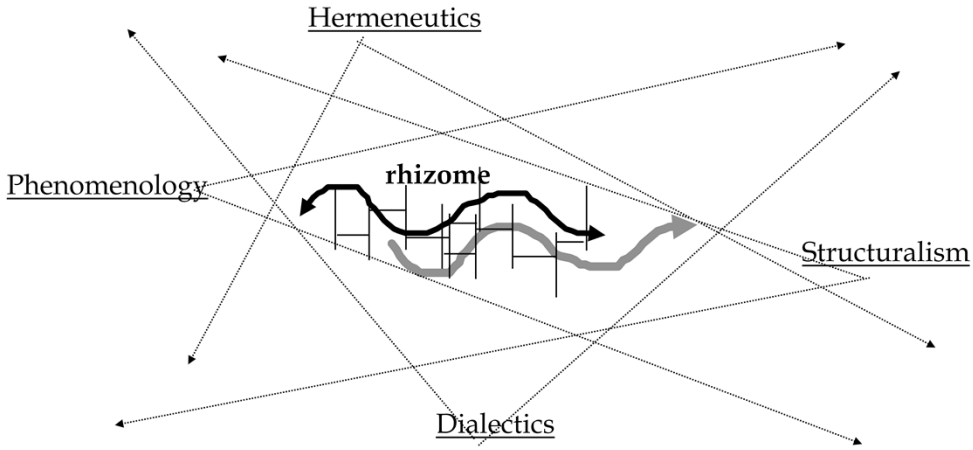


- There are different ways to represent processes related to the kinds of processes and the systemic meta-levels

Types of Humanistic Inquiry

- Phenomenology
  - Attempts to see what is manifesting without presuppositions
- Dialectics
  - Attempts to look at the synthetic operations between opposites that occur in manifestation
- Hermeneutics
  - Attempts to look at meaning of what is manifesting
- Structuralism
  - Attempts to look at deep structures (meta-forms) that underlie the surface phenomena of what manifests
- Heuristic Research
  - Attempts to dwell in the phenomenon without distancing to understand it as deeply as possible

Humanitarian Viewpoints on Processes



- Each distancing viewpoint sees something different

Phenomenology

- A sophisticated kind of introspection
  - Looks at processes themselves and how they manifest
  - Concerned with description of processes as they occur
  - Uses bracketing to ignore assumptions about processes
  - Concerned with uncovering the essence of processes and their limits
  - Would be used to identify different kinds of work as distinct essences
- Process developers need to understand this approach because it gives them the best possible view of what is actually occurring within human processes
  - Participative research in engineering is non-existent in the social sciences
  - Those who study engineering from the inside need to use the most sophisticated techniques available

Structuralism

- Sees systems as structural
  - I.e. composed of micro formalisms that control the transformations of content
  - Structuralism attempts to reduce everything to some more basic level of existence
  - Structuralism looks for the laws that govern transformations
- Structuralism constructs models of transformations within the formal-structural system
  - Klir's Architecture of Systems Problem Solving is an excellent example of a structuralist approach to systems theory
- In process, the attempt to find universal basic units of work is structuralist
  - Example: Fleishman, E.A. and Quaintance, M.K.; Taxonomies of Human Performance: The description of Human Tasks

Hermeneutics

- Attempts to uncover meaning
  - Deals with the semiotic aspect of work
  - Uses hermeneutic circle to focus in on the meaning of things within the process
- Processes are clearly meaning and sign systems
  - Hermeneutics studies the variations of interpretations of sign and symbol systems
  - Hermeneutics would study the communications by team members and their mutual understanding of things within the process
- A process is a description that, like the CMM, needs to be interpreted in order to be put in practice

Dialectics

- Studies part-whole relations
  - Shows how conflict between opposites can lead to higher syntheses
  - Is concerned with the relations between quality and quantity within the process whole
  - Those parts may be systems that are in conflict within the meta-system
- Each part of a process is a synergetic whole composed of parts that cannot be totally disentangled
  - The process as a whole is greater than the sum of its parts
  - Dialectics shows how the whole is forged out of its parts

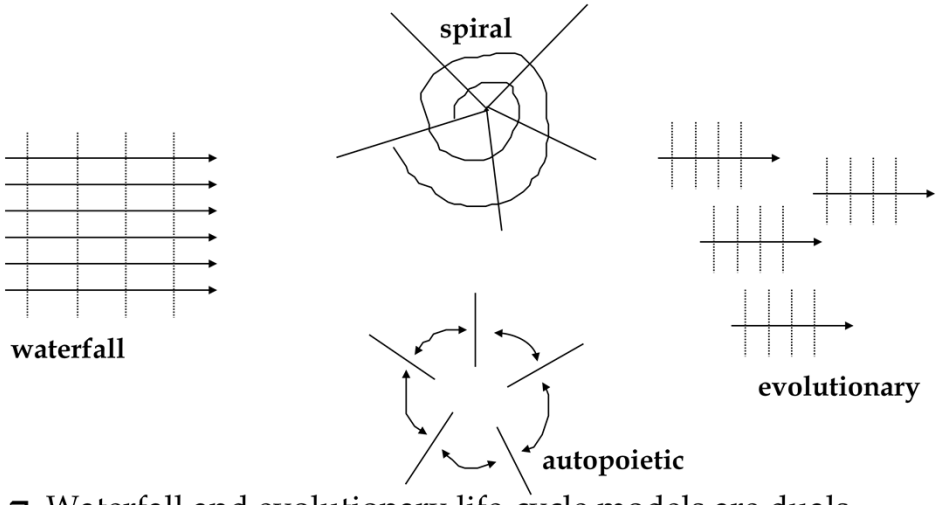
Heuristic Research

- Dwelling with the subject of study until there is understanding through identification with the subject
  - Unlike other humanitarian viewpoints, it does not assume distance of the observer from the observed
  - In heuristic research, you dwell within the subject of study and attempt to become the same as it to understand it
- In process, it is necessary for those who create processes to live within processes and see what that is like
  - It is important for us to do participative research, but also to actually become an engineer or whatever thing is being studied by the process engineer; it is not enough to observe from the outside with detachment
- Heuristic research needs to be balanced with and enhanced by the other distancing viewpoints on the domain of processes

How We Should Approach Processes . . .

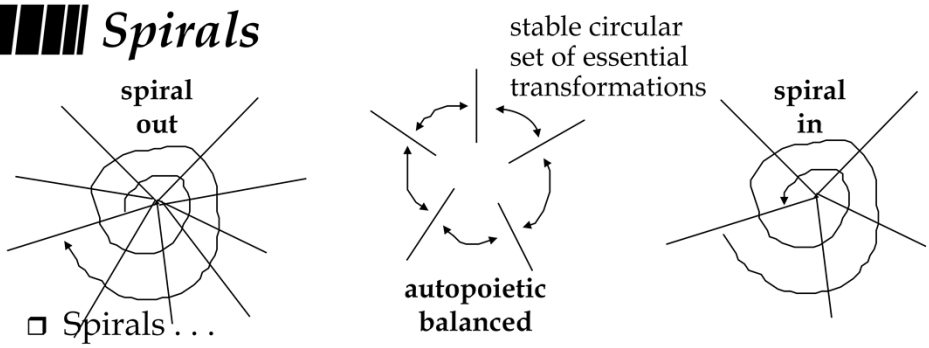
- Using Roles, Agency and Kinds of work
  - Model the static structure of agency and kinds of work (function)
  - Construct roles to combine agency and kinds of work
  - Look for spirals in which agents spiral through sets of kinds of work
    - Spirals are not static, but may include more or less kinds of work on different cycles through the spiral
    - Use spirals as a basis for modeling the relation between continuity and discontinuity in the process
- Be flexible . . .
  - Avoid over dependence on either the top-down causal models or the bottom-up rhizomatic models
  - Allow for teleonomic behavior in continuous processes
  - Allow for macro discontinuities that are modeled by structures

Possible Life-Cycles



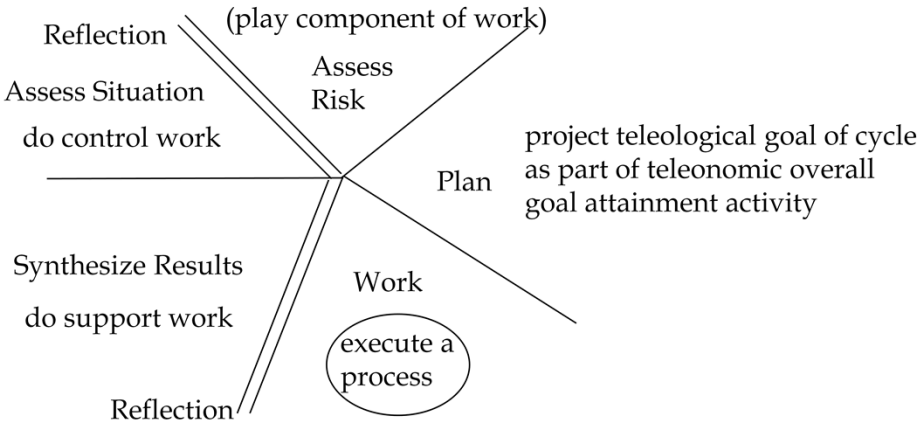
- Waterfall and evolutionary life-cycle models are duals
- Spiral and Autopoietic lifecycles are also duals

Spirals



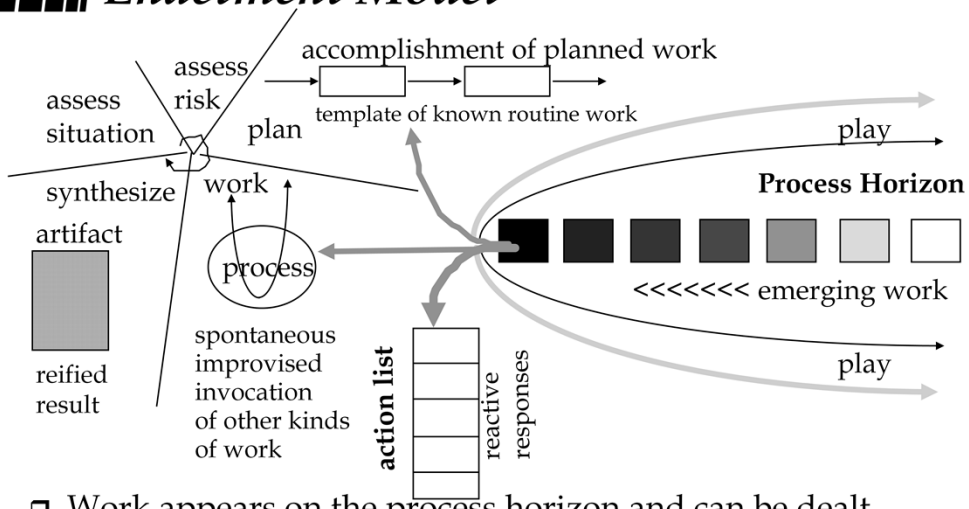
- Spirals . . .
  - Exist between the extremes of linear flow and random jumps
  - Move through a series of kinds of work revisiting them in sequence again and again
  - May move to encompass more kinds of work (spiraling out) or fewer kinds of work (spiraling in)
- When a balance is found in which a series of kinds of work forms a closed ring, then there is an autopoietic lifecycle

Spiral Life-cycle



- Based on SPC evolutionary spiral model
- Gives basic teleonomic structure to other spirals of work
- Includes play, change and learning components of work

Enactment Model



- Work appears on the process horizon and can be dealt with by rote, by reactive strategy or by spontaneous improvisation

Process Horizon

- Managing work that appears out of nowhere a most difficult task
  - Reworking work to fit the situation constantly causes changes in process instantiation and plans
- Processes are dynamic horizons
  - Good places to look for new work
  - Kinds of work describe these horizons
  - Even though we represented kinds of work as atemporal, they are, in fact, the continuous horizons on which new work appears
- The process descriptions must be written in such a way to allow for this continuous arising of new work within a kind of work
  - The differences between kinds of work represent the essential discontinuities within the enacted process

Breakdown and Breakpoints

- Process enactment is not a continuous function but is full of breakpoints
  - When process enactments encounter breakpoints, they are liable to break down because the plans do not cover the radically new situation that has been encountered
  - Breakdowns are due to the discrepancy between the projected plans and reality which may go contrary to our plans
  - Breakdowns have myriad of reasons, but the main one is that we cannot foresee the future direction of events
  - We may not be able to foresee the future, but we can predict when the breakpoints will occur
- Flexible plans are one good way to deal with breakpoints
  - But complete replanning is often necessary to bring the plans into sync with reality once again
- Breakpoints are opportunities in disguise

How to Talk About What Actually Happens

- Line of Work
  - What you actually do on your job regardless of what others think you should do
- Going Concern
  - The whole greater than the sum of the parts of all the lines of work
- Production Lattice
  - Specific contact points where what I do is actually dependent on what you do
- Web of Computing
  - Connection of computer systems to what people actually do
- Web of Process
  - The rhizomatic interpenetrating lines of work within a going concern that enacts a production lattice

Variety and Viability

- The heart of enterprise is the human being
  - Humans naturally produce variety
  - This is the way they maintain viability of their social groups
- A good process will guide variety production, but will not try to repress it
  - Variety production is our means of learning and changing at the same time
  - All the meta-levels of learning-change coexist in the rhizomatic web of process
  - Destruction of variety threatens viability
- The question is always: What amount and kind of variety is necessary in the current situation?

How Should We Guide What Actually Happens?

- Frozen representations from all four viewpoints and their relations -- sufficiently complex rather than simple modeling
- A way of dealing with process horizons -- rationalization of enactment
- A way of dealing with breakpoints and breakdowns -- spirals
- A way of dealing with variety -- tendencies-in-situation or propensities

Rationalization of Enactment

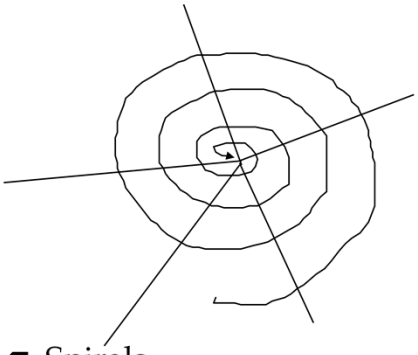
- Orientation
- Process Familiarization
- Resource Check
- Formalization Selection
- Formalism Trial
- Exploration
- Elaboration (production)
- Assessment (is this way working?)
- Verification (reality check)
- Evaluation (is it any good?)
- Inference (what else is involved?)
- Integration (hows it fit in?)
- Validation (process check list)
- Walkthrough (show results)
- Invocation (call other processes)
- Metrics Collection
- Process Evaluation
- Postmortem (lessons learned)

- Assumptions:
  - We assume that enacting a process involves the application of a formalism
  - There are orientation, trial, familiarization, and exploration activities prior to productive work
  - Productive work is continually assessed as it goes along
  - The real crux of the process are the follow-up steps after production has occurred
  - The follow-up steps may indicate that the work has to be reiterated or recursed
  - Each kind of work can fit this rationalized structure

Work Is Sporadic and Occurs in Spurts

- People cannot do the same thing continually over a long period of time without suffering
  - They are sporadic in the execution of different tasks
  - Generally people work in spurts of activity followed by resting and reflection on what was accomplished and communication with others
  - Any process approach must take the sporadic and spurting nature of work behavior into account
- Variety production is what renders the object of work visible
  - Without variety production the awareness of the context of the work vanishes
  - People introduce variety not only in what they do, but how they do it

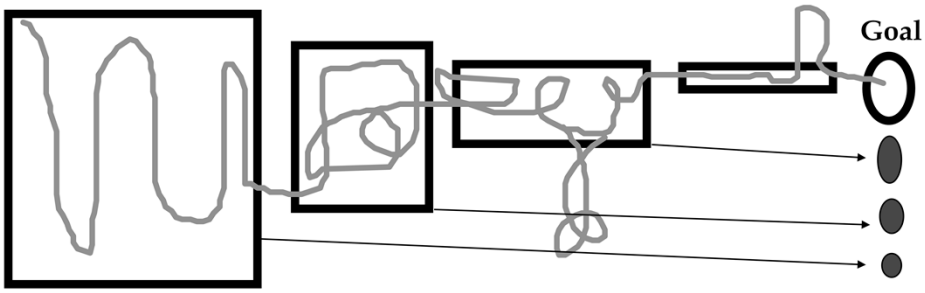
Spirals Are Natural Flows for Work



- Cycle = spurt
- Nexus of variety of work = sporadic
- Spiral = teleonomic adaptation
- Discontinuities between
  each kind of work visited
  cycles of spiral
  spirals of project
- At each cycle a different set of kinds of work may be invoked in a different order

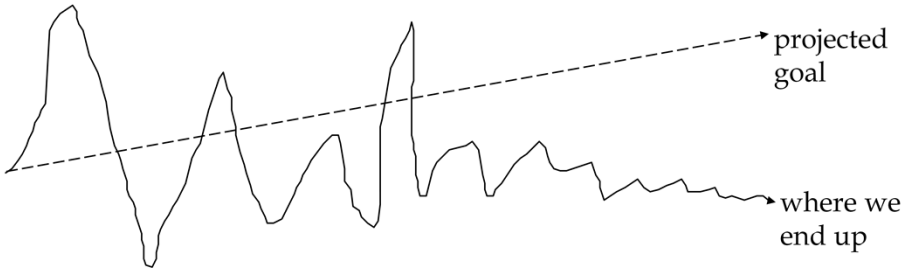
- Spirals . . .
  - Produce variety in the work which renders sporadic execution manageable
  - Naturally segments work into spurts of activity
  - Allows for discontinuities that arise unexpectedly
  - Allows for teleonomic adaptation

Teleonomy



- Teleology is goal seeking where the goal is known prior to search
- Teleonomy is goal seeking where the goal is not known prior to search
  - Teleonomy narrows down the goal as the search progresses
  - Teleonomy cannot occur when beginning causality is required

Teleonomy Is the Key to Spiraling



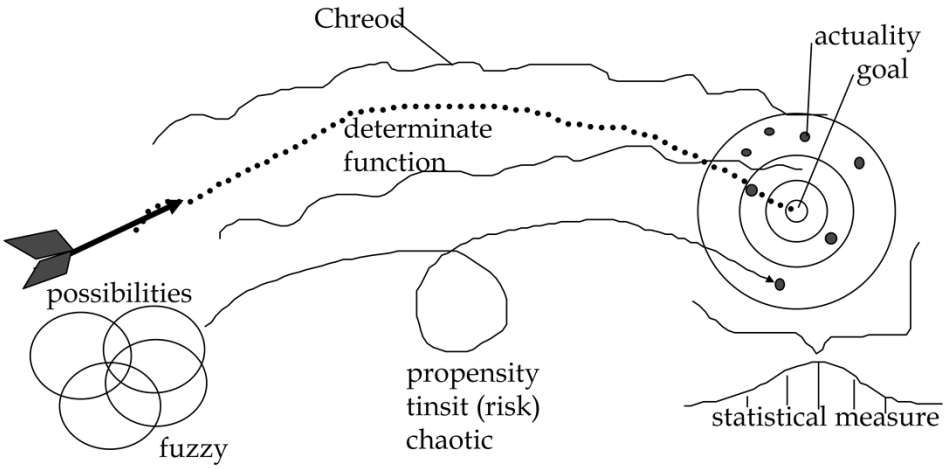
- We do not know the goal before we start except as a very hazy projection
  - All plans are void as soon as we enter the fog of battle
  - We must approach the goal asymptotically, getting a clearer and clearer picture as we go
  - This involves combining randomness and order (or exploration and elaboration) alternately

Variety Reduction

- Chreods -- Paths of least resistance within a landscape of possibilities [Waddington]
- Tinsit -- Tendency in a situation (propensity) [Coutu]

- Variety production has value for the meta-levels of learning and change
  - Variety production allows us to adapt and become flexible with respect to the environment
  - Variety production allows us to continually become educated and do research and sometimes make discoveries
  - Variety production becomes mal-adaptive when the variety is unnecessary
- We follow habitual paths of least resistance based on our mindsets (chreods)
  - We have fundamental tendencies in any given situation to react in certain ways (tinsits)
  - Habits and tendencies lead to divergent variety production
  - When a standard process is put in place this causes normative dissonance

Actualities



- The different ways of looking at the world work together
- Possibilities are turned into actualities through propensities
- Determinate functions gloss what is really happening

How Things Work

- Propensities are incipient tendencies to do things in a certain way, and the Chreod guides the unfolding behavior
  - Introduction of process descriptions and prescriptions go against the grain of the tendencies and paths of least resistance
  - The descriptions are idealized functions laid across what is actually happening
  - Statistics measures only the actualizations after the fact and does not deal with possibilities before the fact and the tendencies that create a mindset by the propensity to actualize certain possibilities over others that leads to actualities
- Possibilities are opportunities, and propensities appear as vision which is guided by intuition and guides risk taking

How Things Should Work

- Our view of process must be deep enough to include . . .
  - The fuzziness of possibilities
  - The chaotic nature of propensities
- To enact holistic human processes . . .
  - We must be able to make discontinuous jumps to new possible opportunities
  - We must be able to change our intention to create new propensities toward action
- This calls for an internal before-the-fact view of process rather than an external after-the-fact view that is created by using process descriptions and statistics alone
  - Processes need to be created by the practitioner out of their view of possibilities and their own vision of the future based on intuition and risk taking.
  - Processes should be created on the fly, as they are needed, not imposed from above or outside
  - Processes need to be self organizing and not other organized

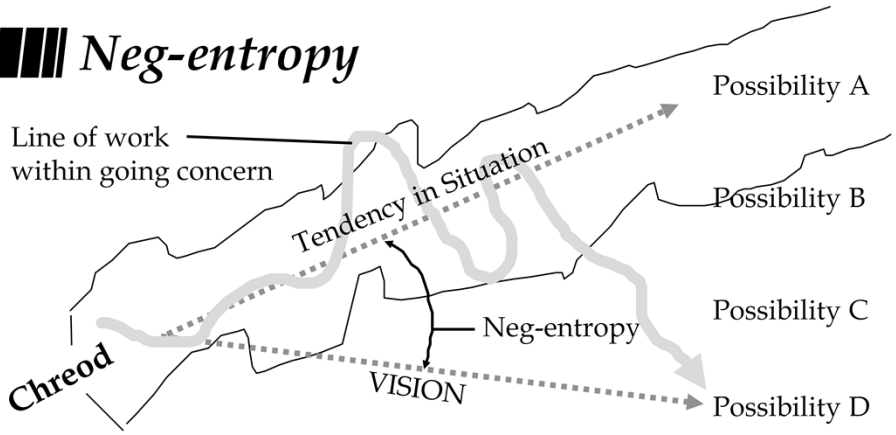
Inadequate Optimization

- Optimization based on Statistical Process Control measures and descriptions alone can never be adequate because they . . .
  - Always looks backward
  - Do not arise out of the work itself
  - Do not allow for . . .
    - Non-routine work which is always incommensurably different
    - Possibilities = Opportunities
      - Utterly different alternatives that are different gained by discontinuous jumps
    - Propensities = Vision
      - Intuition
      - Risk taking (playfulness)
- Systems thinking similarly concentrates on determinate and statistical approaches

Creation and Destruction of Work

- As we have new visions and embrace new possibilities, we are able to create and destroy work
  - The limiting case of autonomy is the capacity to create and destroy work in line with the possibilities one is attempting to actualize and the vision that one is embracing
- Creation and destruction of work embody the opposite of Statistical Process Control and Systems Theory
  - Both of these study tertiary processes as systems
  - Creation and destruction of work is performed within a secondary process which is viable and autonomously transforming itself
- Creation and Destruction of work is dependent on the play of the imagination which has entered into the work realm to change the rules of the game or to create a new game
  - Creation and destruction of work can only occur at the meta-system level -- it is work on work or non-routine meta-work

Neg-entropy



- Net difference between vision and tendencies leading to alternative possibilities
  - Creative advance
  - Spontaneous organization
  - Perfected harmony

Autopoietic Processes

- Autopoietic processes . . .
  - Dual of the spiral model -- balanced between spiraling in and spiraling out
    - Bring together the system and meta-system views with the domain perspectives
    - Secondary; not tertiary -- natural embodiments of viable systems
    - Based on maximizing neg-entropy
  - Exist where a team creates their own processes along with their products playing a process game within the meta-game of the organizational process
    - A team that "clicks" is the natural prototype for autopoietic process descriptions
    - Accounts for non-routine human variety within a stable configuration

Process Description Flexibility

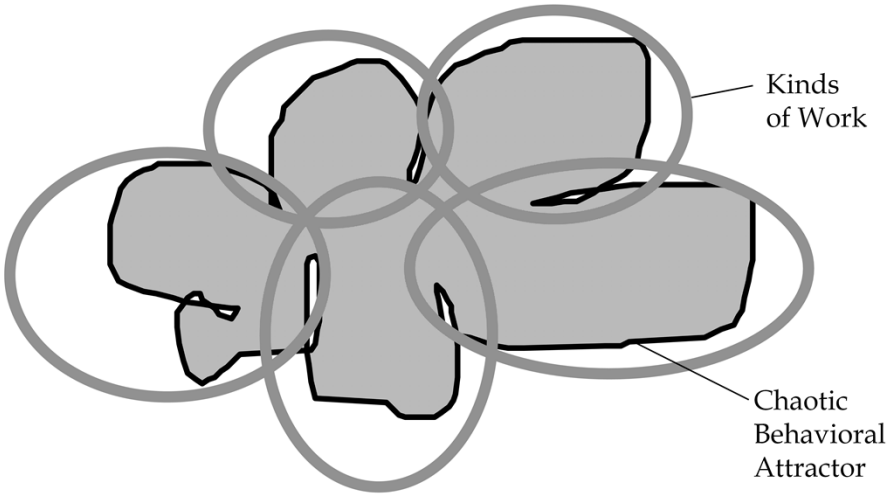
Formal Static	**procedures**	**step by step recipe**	**control/educate**
Dynamic Continuous	**guidelines**	**considerations**	**adapt/research**
Dynamic Discontinuous	**policies**	**advice**	**flexible/discovery**
Dynamic Chaotic	**requirements**	**boundaries**	**non-learning/ unchanging**

- Different parts of the process description attempt to give flexibility to accommodate the different types of work that occur
  - It is very important to fit the type process description to the types of work described
  - Atemporal descriptions of work help the practitioners create their instantiated processes with the most flexibility possible

Chaotic Model of Processes

- Chaotic work is often the most mature and most wise, not the least mature and ignorant as portrayed by SEI's maturity model
  - SEI maturity rejects "chaotic" processes as immature and ad hoc.
  - Some aspects of chaos are actually an aspect of level five, not level one
  - A fundamentally chaotic model of processes is exactly what is needed to handle the meta-levels of non-routine work
- We need a conscious chaos that enables non-routine work
  - Chaos is the mixture of order/disorder and continuity/discontinuity in which both the environment and the system and meta-systems of process are in flux
  - We need to start at chaotic processes and build back toward formal static models of routine work rather than the other way around in order to have a robust model that encompasses all types and kinds of work

Chaotic Work Attractors

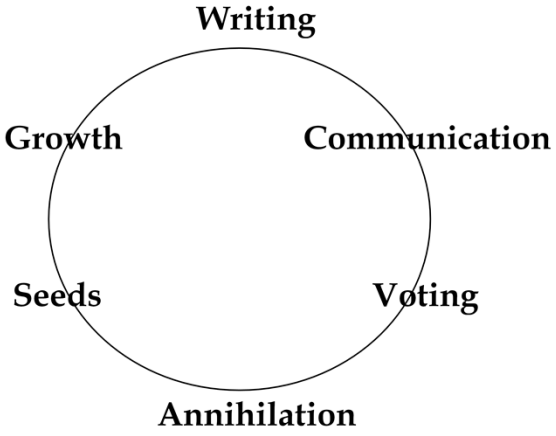


- Complex Chaotic Attractors have structure -- Ben Goertzel
  Chaotic Logic

Magicians

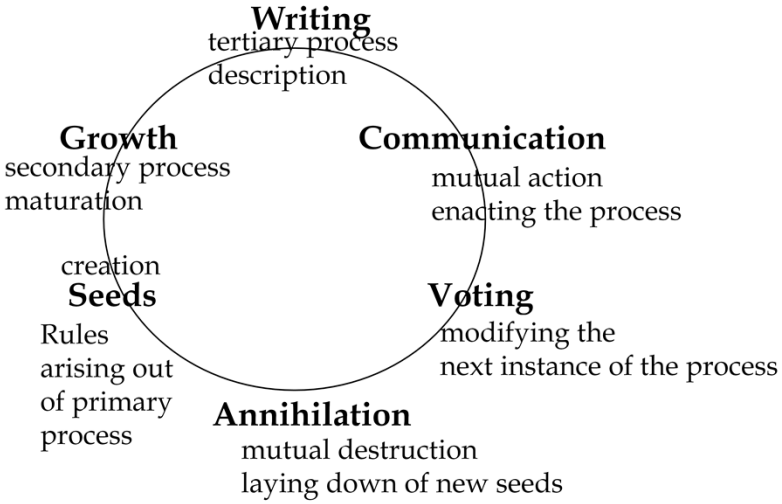
- Ben Goertzel's Chaotic Logic provides a model of chaotic processes called Magician Systems
- Magicians . . .
  - Do not assume continuity
  - Create and destroy each other
  - Are quantum computable
  - Vote on survival as a group
  - Causality only by collusion
  - Model cognitive chaotic processes in the mind
  - Can be easily changed to model chaotic social processes
  - Have a group life-cycle
  - Can also model meta-systems

Magician Meta-System Life-Cycle



- Magicians go through a life-cycle that produces the generation from seeds that grow into individuals who write and communicate and then vote for survivors before mutual annihilation

Magician Meta-System Life-Cycle Process



- Creation and destruction, making and modifying process descriptions, and enactment are all covered in this life-cycle

Magical Workplay Model

- Magicians meta-system model contains all the different ways of relating to the world
- As constraints are added to the basic model that assumes discontinuity, continuity can be simulated so that continuous and formal static models of process can be built on this foundation
  - The voting and seeds stages model propensities within the magician group
  - The creation and annihilation stages model the discontinuities at a meta-system level and the breaks between different possible worlds
  - The writing and communications (mutual interaction) model the chreods of habit as preprogrammed behavior unfolds inwardly and outwardly

All Modalities Supported

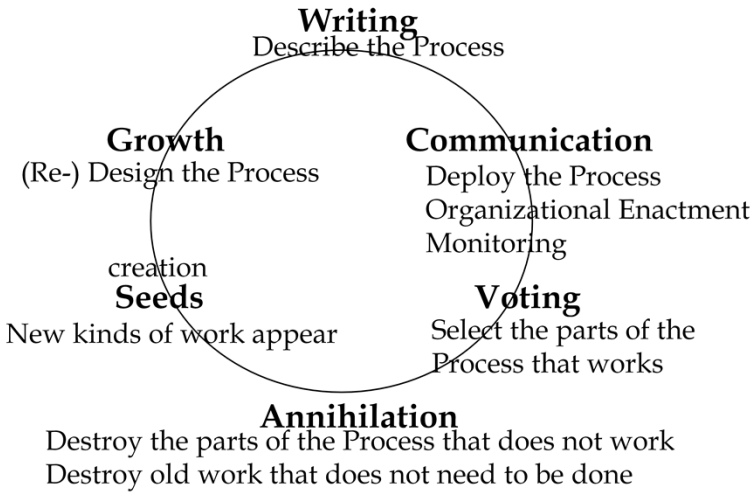
Presence	**Frozen representations**	**collusion**
Gestalts	**Self-producing processes**	**mutual interaction and voting**
Breakpoints	**Breakdowns**	**writing**
Rhizomatic	**Variety**	**creation and destruction**

- Magician systems support all the modalities of being-in-the-world

Scaling Back the Magician Model

- Having a model of complex chaotic processes gives us a starting point for modeling chaotic work processes
  - The magician meta-model can be transformed into a model by not assuming complete destruction in each generation, but only destruction of some of the magicians in the group at each molting period of annihilation
- We can introduce constraints at each level in order to simulate the lower meta-level ways of relating to the world
  - Assume that all magicians are not destroyed each generation
  - Assume that there is no creation and destruction
  - Assume no growth of seeds
  - Assume no communication and writing

The Magical Process



- We have gone full circle!