Escaping the Matrix:
A Systems Approach to the
Intentional Design of Organizations

Kevin Nortrup, Principal
Sugar Creek Solutions

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www.sugarcreeksolutions.com
Session Objectives

- Understand the motivation, concept & implications of a systems approach to companies & to organizations
- Recognize how a systems approach can identify and recommend better alternatives to a matrix organization
- Consider applications and implications of a systems approach in own work
Personal Objectives

- to review, without insulting
- to explore, without boring
- to elaborate, without confusing
- to challenge, without offending
- to suggest alternative paradigms & methodologies, without maligning others

“your mileage may vary” ☺
The Matrix Revisited
# Matrix Organization

(possible additional dimensions: geographic region, time)
Matrix organizations have historically:

- increased inter-silo cooperation & communication
- helped to bridge local & global functionalities
- cultivated & concentrated subject-matter experts
- distributed resources & talent across organization
- facilitated “cherry-picking” diverse project teams
- tasked specific individuals with responsibility for completing a project on-time and on budget
... but they come with increasing cost

- many “assets” just work-arounds for liabilities
  - silos, inflexibility, unresponsiveness, poor training
- conflicting authorities, agendas, priorities
- accountability without authority (fire alarms)
- management begets management (1,2,3 lawyers)
- informal structures superseding formal structures
- few empowered champions; many “stake-holders”
- maximal dispersion/scattering of key attributes
  - power, authority, expertise, familiarity, vision, passion
The impact of the Information Age on matrix organizations

(meteors & dinosaurs)

• more complex products & processes
  – staggeringlly massive, on-going information-exchange
    • (to & from individuals “too busy” to process it properly)
  – far more risk of something “falling through cracks”
  – far greater need for coordination
    • interdisciplinary design & integration
    • continuity of responsibilities & “ownership”

• lower-cost tools; greater-access skills
  – secretaries, draftsmen, travel agents

• (myth of) multi-tasking & interrupts
  – 15-to-25-minute recovery to "get back into zone“
  – estimate 25% of interruptions: “organizational issues”
The Problem **versus** “the problem”

Above the waterline
“The perceived problem”

Below the waterline
Most of the actual problem

(hidden & growing complexity)
“How do we solve a problem like the matrix?”

Is the solution:

- **convolution?**
  - (aggressive realignment)

- **evolution?**
  - (progressive refinement)

- **revolution!**
  - (re-start at the very beginning)
Managing complexity ...

Project Manager, Organization Development

- Develop change management plans
  - partner with other OPD team members
  - drive a thoughtful and simple delivery framework
  - ensure alignment at all levels and all times
- Support continuous improvement of project management approach, standards, tools and methodology for sustaining change efforts
- Identify training needs and project costs/benefits
- Stay aware of external programs and developments
- Review and evaluate the effectiveness of programs
- Personally conduct selected programs
- Serve as a technical resource for programs that are developed and presented locally
- Assess & analyze change Impact and readiness
- Create a Findings and Recommendations report
- Lead the development of appropriate plans to support the change initiative, including:
  - Communication plan
  - Leadership engagement plan
  - Resistance Management plan
  - Reinforcement plan
  - Transition plan
  - Training plan
- Integrate approved plans into the organizational life
- Execute approved plans, reporting status/effectiveness
- Design effective meetings with senior executives, managers, and stakeholders as appropriate
- Identify and remove barriers that slow or prevent the successful change initiative & administrative efficiency
- Work collaboratively with project team members to identify mitigation strategies, take early action to resolve issues and address cross-team impacts, working with appropriate resources, including but not limited to Human Resources, Information Technology, and a variety of departments and units
- Ensure that ‘Core HR,’ ‘Compensation,’ ‘Performance’ and ‘Recruiting’ modules are fully implemented, work flow processes are documented & content is uploaded
- Restructure employee file documentation process and set up employee data filing process – go paperless
- Adjust employee orientation program after successful systems implementation.
- Set up training workshop for how to utilize the portal and how to update employee master data according to the new employee files documentation process
- Provide support on PMI tasks and set up overall training schedule for rollout of policies and other programs within the organization.
... or compounding it?

Project Manager, Organization Development

Key responsibilities (*paraphrased*):

- swallow the spider to catch the fly
- swallow the bird to catch the spider
- swallow the cat to catch the bird
- swallow the dog to catch the cat
- swallow the goat to catch the dog
- swallow the cow to catch the goat
- swallow the horse to catch the cow
- have succession plan in place for inevitable result of swallowing horse
Perhaps, instead …

… with “change” as the new constant, due to:

- continuous improvement
- marketplace responsiveness
- economic uncertainty
- agile everything

… might it not be better, just to cough up the fly?
Designing for Purpose. Organizing by Design.

- **Purpose**: to cough up all of “the flies”
- “Design”, not “de facto”
  - intentionality, not happenstance
- **Genuine design requires**:
  - objectives / vision
  - methodology / process / tools
  - evaluation, verification & validation
  - ability to manage complexity toward desired ends
Declaration of Interdependence

• Matrix organizations add complexity through increased dependencies and cross-purpose/conflicting priorities.

• A systems approach provides both the “why” and the “how” to design simpler, more robust organizations with:
  – greater localization & efficiency
  – fewer dependencies & cross-purposes
“Make everything as simple as possible – but no simpler.”

— Albert Einstein, paraphrasing William of Ockham
What is a “systems approach”? 
(and why is it important?)
System: \((n)\)

“an assemblage of interconnected, interdependent and interrelating elements, forming a complex & unitary whole”
Systems Approach

fundamental awareness: elements of a system are interconnected and interdependent with other elements

(often in complex, hidden and/or unexpected ways)
When we embrace a systems approach:

... we can better identify, understand & manage the complexity of:

- our goals & objectives
- the requirements that drive them
- the constraints that shape them
- the mechanisms that achieve them
When we ignore a systems approach:

Critical dependencies are often hidden amidst complexity and therefore overlooked, leading to:

- mysterious failures
- deceptive symptoms
- difficult root-cause analysis
- uncertain remediation
- likely recurrence
“We need to look at it from a systems approach, a human/technology system that has to work together.

This involves aircraft design and certification, training and human factors.

If you look at [any single factor] alone, then you're missing half or two-thirds of the total system failure...”

— Captain C. B. “Sully” Sullenberger
(pilot of US1549 “Miracle on the Hudson”, about AF447)
Escaping the Matrix: *A Systems Approach to the Intentional Design of Organizations*

What are the elements of a systems approach?  
(and how can they be applied to the design of organizations?)
**Systems approach:**

- **Systems thinking**
- **Systems design**
- **Systems troubleshooting**
General Systems Theory (GST)

- Karl Ludwig von Bertalanffy
  - biologist (1901-1972)
- focus: holistic interrelationships
- interdisciplinary practice & application
  - astronomy, ecology, biology
  - sociology, government, business
  - economy, technology, computers
“The Fifth Discipline”

**Systems Thinking** = integration of:
- personal mastery
- mental models
- shared vision
- team learning
Recipe for Systems Thinking

• understand big picture (internally, externally)
  – examine from multiple perspectives
  – employ appropriate abstraction & hierarchy
  – challenge & verify all assumptions & models

• understand behavior & interrelationships
  – observe & analyze data (patterns, trends)
  – identify all dependencies
  • linear (cause-effect)
  • circular (feedback)
Circular dependencies: feedback loops

- negative (compensating) (goal-seeking)
+ positive (reinforcing)

oscillation (delay)
Redeeming “Hierarchy”

• **not** an obsolete artifact of “command-and-control”
  – inherently about layers of abstraction, not power/worth
• essential to grasp/manage complexity of the world
  – allows brain’s limited “working memory” (7±2? 4? 3?) to grasp the infinite “cosmos of quanta”
• basis of biological classification (taxonomy)
• basis of computer structured analysis & design, object-oriented programming, etc.
• basis of computer file systems
Abstraction & Hierarchy

• essential to understanding, analyzing and designing complex and/or vast systems

• at any one time, consider only one hierarchical “slice” of a complex system
  – lower subsystems abstracted as simple elements
  – higher system abstracted as “external” inputs & outputs (requirements & deliverables)
Abstraction & Hierarchy

- human body consists of systems
- systems consist of multiple organs
- organs consist of multiple tissues
- tissues consist of multiple cells
- cells consist of multiple molecules
Modeling a company as a system

Each element is actually a subsystem; must be individually optimized & collectively aligned
Objectives & Strategy

• Inputs to (not elements of) the system
• Objectives:
  – vision / mission / purpose / charter
  – products, services, markets, customers
  – social responsibility (footprint) towards
    • employees
    • customers (internal & external)
    • community
    • nation
    • planet
• Strategy: how to align elements with objectives & with one another
Culture & Policies

• *de facto* values defined/communicated by:
  – directions chosen & decisions made
  – corporate policies (*official & unofficial*)
  – behaviors prohibited, tolerated or rewarded

• prioritization / balance / synthesis of:
  – initiative ↔ directed effort
  – flexibility ↔ methodology
  – consensus ↔ control
  – accountability ↔ forgiveness
Organizational Structure

• Fundamental division of labor:
  – who does what,
  – alongside whom,
  – directed by whom,
  – dependent upon whom, how

• Function follows form:
  – organizational structure matters
  – especially interdependent with process
Processes & Workflow

• Description of what, how, when, where
  – flow between operational steps
    • abstract: data, permission
    • concrete: materials, work-product, people
  – operations that occur at each step
  – timeframe of responsibilities

• Interdependent with all other elements
Tools & Technology

• Equip organization to do process
  – physical tools
    • office equipment & hand tools
    • vehicles & heavy machinery
    • areas, rooms, buildings, parking lots
  – virtual/electronic tools
    • software, intranet & documents (IT)
    • time-reports, travel-arrangements, etc.

• Interdependent with all other elements
Training & Development

• Training: on company & responsibilities
  – corporate vision / mission / objectives
  – culture, organization, processes, tools
  – products/services and market/customers

• Development: individual/personal
  – professional continuing education
  – personal growth & wellness
A company is (also) *part* of a system

Each element is actually a subsystem; must be individually optimized & collectively aligned.
"I think everyone in this country should learn to program a computer. Everyone should learn a computer language because it teaches you how to think. I think of computer science as a liberal art."

— Steve Jobs
**Systems approach:**

- Systems thinking
- Systems design
- Systems troubleshooting
Design is …

• Clearly documented objectives
• Thoroughly gathered/analyzed requirements
• Intentional, directed craftsmanship
  – not ad-hoc emergence
• Applicable to:
  – comprehensive solutions (products/services)
  – processes that create/deliver those solutions
  – corporate structures that encompass them all
Systems Design

• Technical disciplines: systems engineering
  - manage abstract complexity → desired results
    • telecom: world cellular ≈ 5M towers, 7B phones
    • hardware: modern CPU ≈ 10M transistors
    • software: modern OS ≈ 100M lines of code
  - objective basis for judging design & methods
• “Non-technical” undertakings
  - comparable complexity
  - similar meta-methods & skills applicable
1. **Vision**: Define the problem
2. **Vehicle**: Design the solution
3. **Valor**: Implement the solution
4. **Validation**: Test thoroughly & monitor continuously
5. **Variation**: Debug / refine / adjust / improve as needed
Define the problem

inputs → functionality → outputs

- Envision desired results
- Articulate objectives
- Collect & analyze requirements & constraints (including present status)
Design the solution
(mindful of requirements & constraints)

- recursive hierarchical decomposition
  - top-down (abstract → concrete)
    - to ensure objectives
  - bottom-up (concrete → abstract)
    - to ensure reality
  - massage up/down until alignment

- optimized partitioning (how divided)
  - minimal dependencies
  - maximum localization
Designing Companies as Systems

• Suggested 1st pass: top-down
  – objectives → culture
  – culture → organization
  – organization → processes
  – processes → tools
  – tools → training

• Iterate in both directions (↑ & ↓) to align elements with each other & with objectives
Cultivating Culture
(strongly impacts Organization)

“The society which scorns excellence in plumbing because plumbing is a humble activity, and tolerates shoddiness in philosophy because philosophy is an exalted activity, will have neither good plumbing nor good philosophy: neither its pipes nor its theories will hold water.”

— John W. Gardner
Designing Organization: appropriate hierarchy

**Team of teams** (system of systems)

- Each/every position **is unmistakably valued**
  - varying scope (abstract↔concrete), not importance
  - all positions mandate both respect & accountability
- Each/every position **adds unmistakable value**
  - communicates/coordinates upper to lower
  - prioritizes/arbitrates/abstracts lower to upper
- **360° interaction & accountability** (no status reports!)
  - cross-training, mentoring, succession-planning
  - team-mates, suppliers, customers (peers, subordinates, superiors)
Designing Organization: appropriate authority

• "Coordinated cooperation" = hybrid/synthesis of
  – command-and-control (top-down: strategy/forest)
  – consensus-and-collaboration (bottom-up: tactics/trees)

• Anywhere “things” come together, they need:
  – aggregation and oversight
  – arbitration & prioritization of conflict
  – local resolution of issues (not “bubbling up”)

• Everybody “owns” something
  – accountable, responsible, empowered
  – expert, visionary, champion, advocate
Designing Organization: appropriate partitioning

- Highly **orthogonal** (minimized matrix)
  - unique, mutually exclusive functionalities
  - self-evident “whose ball it is” at all times
  - minimal “dropped balls” & “collisions”

- Highly **holistic** (minimized “silos”)
  - interdisciplinary teams/contributors
  - consolidation of knowers/planners/doers
  - career-path of broadening scope/impact
  - minimal dependencies, maximal localization
Designing Organization: appropriate parallelism

Deliverable-oriented organization

• One-to-one correspondence of
  – hierarchy of products/services
  – hierarchy of implementing organization
  – (hierarchy of documentation)
    • developed progressively/cooperatively/hierarchically
    • specification = documentation = verification

• Far greater:
  – continuity, accountability & empowerment
  – responsiveness, agility & efficiency
  – confidence, quality & modularity
Partitioning: many inter-dependencies

(much overhead & inefficiency)
Partitioning: few inter-dependencies

(fewer people but better efficiency)
Traditional Partitioning

Product structure

Organizational structure

1999: Mars Orbiter
2013: healthcare.gov

Omission → ●

Overlap ← ●

Lisa!

Mr. Burns

Homer

Moe

Krusty

Bart

Marge

Lisa

Mr. Burns? Moe? Krusty?
Parallel Partitioning

- interdisciplinary
- object-oriented
- holistic

Product structure

Product / Process (Lisa)

- Component (Homer)
- Component (Marge)
- Component (Bart)

- Component (Maggie)
- Component (Milhouse)

Organizational structure

Lisa

- Homer
- Marge
- Bart

- Maggie
- Milhouse

Critical, distributed skills (not isolated departments)

Project management

Quality assurance

Verification & validation
Each node: Market + Prod-Mgmt + Engr/dev
Designing an Organization: Example top level (hierarchical)

Company

- Products & Services
- Sales
- Operations
- Compliance & Support *

Designing an Organization: Example top level (data-flow)

- **Product**
  - Features & specs
  - PCB, BOM; V&V

- **Sales**
  - Sales orders
  - Features & specs
  - PCB, BOM; V&V

- **Compliance**
  - Sales orders
  - Compliance

- **Operations**
  - Purchase orders & specs
  - Raw materials
  - Finished goods
Designing Process & Workflow

• Description of what, how, when, where
  – flow between operational steps
    • abstract: data, permission
    • concrete: materials, work-product, people
  – operations that occur at each step
  – timeframe of responsibilities

• Should always:
  – serve Culture & Organization, not vice-versa
  – include continuous monitoring & improvement
  – demand auto-root-cause analysis of failures/issues
  – schedule & budget at 80%, not 120%
Designing Tools & Technology

• Equip/enable/empower organization
• Should facilitate processes, not vice-versa
  – (may accommodate legacy/disruptive tech.)
• Should always be effective means, not end
  – not a “solution looking for a problem”
• Cost-justified via big-picture life-cycle
  – ROI: acquire, install, train, perform, maintain
Designing Training & Development

• "Training Department"
  – responsible for development & on-boarding
  – only facilitates most other training
• Each department develops own training
  – specific curricula for each job-description
  – courses designed/taught by in-house SMEs
    • theoretical framework & practical skills/knowledge
    • “required” in native/originating curricula
    • “elective” in others (big-picture, cross-training)
• Feedback: “How well did we prepare you?”
But what about “IT”?  

(HINT: label groups by deliverables, not by skill-set)  

- sole-sourced “IT” = frequent bottleneck  
- central groups focus on central issues  
  - servers, network and other shared resources  
  - security: policies, procedures, protocols  
- functional groups manage own resources with embedded internal members with IT skill-sets  
  - reports, scripts, screens (cf. EMR)  
  - centralized reviews if impact others
But what about “Quality”? 

Quality = “delivering the expected or better”
• verification \textit{(match the specification)}
• validation \textit{(match the market/need)}

Quality, Continuous Improvement, Agility
• cultural values & procedural mandates
• intrinsic, not extrinsic
• \textcolor{red}{not} departments
“Systems engineering ... has often produced dramatically positive results in the small number of health-care organizations that have incorporated it into their processes...

Systems-engineering know-how must be propagated at all levels...

[We recommend] that the United States build a health-care workforce that is equipped with essential systems-engineering competencies that will enable system redesign.”

— President’s Council of Advisors on Science and Technology (PCAST) (in May 2014 report to President Obama)
Systems approach:

- Systems thinking
- Systems design
- Systems troubleshooting
Systems Troubleshooting

- Systemic (holistic)
- Systematic (methodical)

- Three-fold priority: (avoid quitting early!)
  - alleviate symptoms (not mask!)
  - find/fix specific underlying problem-mechanism
  - address general issues (process, partitioning, etc.)

*fire-fighting* → *fire-investigation* → *fire-prevention*
Systems Troubleshooting

- Know how it is “supposed to work”
  - especially cause-effect chains & loops
- Identify how not working as expected
- Utilize consistent, logical methodology
  - classical scientific method
  - coincidence ≠ correlation ≠ cause-effect
Problem Statement

- Quality of problem statement → quality of solution
- Precision & specificity are critical!
  - (Help Desk or Continuous Improvement)

“When <circumstances> and <action>, I expected <desired-results> but instead I experienced <undesired-results>.”
Troubleshooting Exercise: System

- **complaint:** “alarm fatigue” in hospital
- **symptom:** nurses overwhelmed by alarms
  - monitors, pumps, ventilators, bed/exit, patient-calls
- **possible problem-mechanisms/contributors**
  - objectives = ?
  - culture = ?
  - organization = ?
  - process = ?
  - tools & tech = ?
  - training = ?
“There is nothing quite so useless, as doing with great efficiency, something that should not be done at all.”

— Peter Drucker
Summary

(What have we learned, and what are some next steps?)
Top 10 take-aways

- Complexity of Information Age surpasses tools of Industrial Age.
- Better to cough up a fly than to swallow a barnyard as remediation.
- Complex systems & systemic issues demand a systems approach.
- Systems approach = systems thinking / design / troubleshooting.
- Embrace proper hierarchy & abstraction to manage complexity.
- Strategically align culture, organization, processes, tools & training – with each other & with objectives.
- Replace matrix organization with deliverable-oriented partitioning.
- It should be self-evident “whose ball it is” at all times.
- Fire-fighting < fire-investigation < fire-prevention
- It’s a marathon, not a sprint. ("Lather, rinse, repeat.")
Caveats & Contingencies

• Systemic change: paradox of scope
  – too narrow: unlikely to address root cause
  – too wide: possibly too daunting/disruptive
  – try: systemic change of division or department

• Systemic change: paradox of timing
  – never a good time for disruption (rope swing)
  – carve out grace period (reduced expectations)

• Interdisciplinary individuals: shortfall
  – mix specialists at group level (not parallel org.)
  – cultivate own & encourage production of others
“The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself.

Therefore, all progress depends on the unreasonable man.”

— George Bernard Shaw
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