

from silos to buckets The idea of a general theory of systems has gone in and out of fashion over the last century. The nendulum has swung away because of the narrowing of academic and professional disciplines. We now have many specialized vocabularies for describing systems. Indeed, the very notion of what a system is has fragment ed. This development runs counter to a core premise of systems thinking: the world is understandable only insofar as we see how parts relate to wholes. How far can we get if only a thin sliver of the whole is considered at once? Even if a unified general theory is unrealistic, the value of an ongoing conversation across disciplinary silos is clear. Yet without common points of reference, how can such a conversation take place?

This inventory offers common points of reference in the spirit of visual-vocabulary building. The inventory began by looking at system as a genre across disciplinary literatures; that is, as a set of persistent features over time and across contexts (Siskin, 2017). Everything from mechanical control systems to natural ecosystems has been taken into account. The various system elements and dynamics were grouped, abstracted into generic classes, and organized into six buckets. Much "lumping" and "splitting" is going on here. Despite best efforts, the inventory is nonexhaustive; there will inevitably be something missing, so this inventory is in no sense "done." The labels and distinctions are ones "in good currency" (Schön, 1970), which may not be the trendiest coinages nor reflect the nuances of every school of thought. But that is very much the point of a common reference.

Moreover, systems operate at many differ

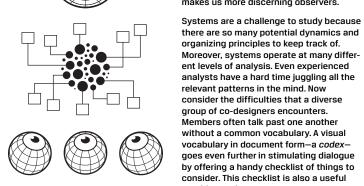
consider the difficulties that a diverse

Members often talk past one another

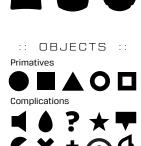
vocabulary in document form-a codex-

aroup of co-designers encounters.

system sight We learn much about our world by singling out particular patterns for special consideration and assigning labels. We are visual creatures. so we add an archetypal image to that label in our memory-we "dual code" the concept. Without these menta distinctions, we would glance past much of what we see as insignificant noise That is how a large visual vocabulary makes us more discerning observers. Systems are a challenge to study because







:: LINES Boundary ■ ■ ■ ■ ■ Signal Link / Effect • • • • • • • Time Delay ■ ■ ■ Axis

FRAMES XIICO

concept but an evocative instantiation. In other words, even though the meaning of each icon may not be entirely self-evident initially, the shapes are somewhat illustrative. This helps make the concepts vivid in the imagination as the definition is under stood. Thus, once learned, the set of icons becomes easy to parse; it has "reference value" as the visuals evoke the concept in the mind more efficiently than words. REFERENCE. Donella H. Meadows, Thinking in Systems (White River Junction, VT: Chelsea Green Publishing, 2008) Donald Schön, "Change and Industrial Society," Reith Lectures (London: British Broadcasting Corporation, 1970). Clifford Siskin, System: The Shaping of Modern Knowledge (Cambridge: The MIT Press, 2017). Thomas Twaites, The Toaster Project (New York, NY: Princeton Architectural Press, 2010). NOTES. The distinction between diversity A DRIVER IS THE ACTIVE CAUSE OF SOME HAPPENING WITHIN THE SYSTEM IT CAN ALSO BE THOUGHT OF AS A MOTIVE FORCE, MOVER, FLOW, AGEN OR ACTANT DEPENDING ON THE SYSTEM IN ALL CASES, THERE IS AN ACTOR AND AN ACTION, ALTHOUGH ONE OF THOSE MAY BE SOMEWHAT IMPLICIT

PHYSICAL FORMS: SCENTS, SOUNDS VISUAL STIMULI. ELECTRICAL PULSES. MESSAGES, ET CETERA. A TRANSMITTED SIGNAL IS NOT NECESSARILY RECEIVED NOR INTERPRETED CORRECTLY. REPELLER An object that pushes other objects away from itself; an

GOAL SEEKING

designed systems, goals

A combination of factors of

process that increases the

nagnitude of an effect; a

source of leverage; a

reagent or accelerrant.

may not align perfectly.

AMPLIFIER

SHAPE :: SUPERELLIPS

FEED-BACK nformation about the aversion to an undesirable position, object, or state; a feared danger or harm. The objective or target of a part of the system or the system itself: even withir

outputs of an action are outed back as inputs to urther action (or inaction Residual left behind after an action; the accumulated effects of past actions show ing a pattern; traces left to RANSMITTER An object that sends out a signal; the encoding of neaning for purposes o

A SIGNAL IS COMMUNICATION THAT

CAN POTENTIALLY TRIGGER SOME

ACTION, A SIGNAL CAN TAKE MANY

change at each juncture; RECEPTOR 6 An object that receives a signal, often ignoring or iltering irrelevant signals; the decoding and nterpretation of signals STATUS DISPLAY Regularly updated inform-Physical or virtual annotaation about a particular tions in the environment (or object; an identifier for objects therein); informaerification; an indicator o guide action.

SHAPE :: EPITROCHOID

Algorithms that determine

agent (inter)actions; pro-

grammed decision- and

ngs and protocols.

earning procedures; encod-

HROUGH-PUTTING

through a chain, with the

potential for the signal to

The transmission of signals

The declining usefulness of information and data over time: the weakening of signal caused by distance a process or activity; a

Building blocks with which # system structures are formed expediently but with integrity; the materials and componentry of a system Putting items into a forma arrangement that serves system requirements sequencing or prioritizing items in a process. Redistributing activity or items to even out capacity i use across a system; shift-

A STATE IS A CONDITION OF A

MODE. PHASE. AND STATUS ARE

TERMS OFTEN USED FOR STATES

THE CONDITION MAY BE STATIC

A LOT OF UNDERLYING TURMOIL.

OR DYNAMIC, ALTHOUGH MANY STATES

STOCK

A discrete collection of

storage or pooling of

CAPACITY

consumable or expendable

resources for future use;

The finite ability to handle a

optimal volume(s) at which

particular quantity of

activity or items; the

a function operates.

A stock of items being

transportation or

REDUNDANCY

ASSEMBLY

Multiple stockpiles or

parallel sub-systems that

act as a back-up, fail-safe,

distribution of objects

moved under containmen

conditions; the controlled

THAT APPEAR "STEADY" CAN MASK

SYSTEM OR OBJECTS WITHIN IT.

The decay of an object due to repeat exposure to actants; degradation of system parts due to wear STANDBY Capacity held in reserve

than one type of task and nake judgements about task suitability; contrast with unitasking function. MAINTENANCE he restoration of operations after a malfunction ongoing preservation activities to retain Self-diagnosis, selfroblem identification; detection, prognosis

nonitoring, and system-**DIVERSITY BETWEEN** Differences between categories of object; the reflect a variation in kind or The ability to expand

A barrier that allows passage through at a gradual process or make use of; **BOUNDARY SHIFT** The movement or negotiation of a fixed boundary: the expanded parameters of an edge.

PERMISSIONS The control of activity with in a bounded area; the formal and informal condition of access to a domainbounded activity.

with constrained dynamics **BOUND POSSIBILIT** A system stuck within subset of possible states due to mental or physical limits phase states unexplored of deemed problematic.

LIMINALITY

Moving into the space

between domain bound-

sub-systems or modules,

boundary sides with different qualities.

COMPARTMENT

A go-between two or more actors or processes that erves a function; a mechanism of translation matching, or brokering. AGGREGATE

A group of objects or actors of the same type based or haracteristics relevant to

ADJACENCY

CROSS-POLLINATION Aspects of two or more objects are combined to create a hybrid: the urposeful breeding of a new type of entity.

of outputs by scavenging o

When the whole of the system is replicated within the parts of the system. usually as a means for the system to propagate. PREDATION

Attacking or plundering of one entity by another or by a process; the use of another actor as consumable

SYMMATHESY Simultaneous contextual learning or influence etween entities through

The existence of disorder or chaos in a system; sources of disarray within a system and the extent to which they hold sway.

CROSS-DOMAIN RISK A driver in one domain has a knock-on effect resulting in a vulnerability in another domain due to complex

DESIGN + VISUAL THINKING

SHAPE :: **HEXAGON**

OBSTACLE

DESERT

STRATA

scarce to begin with: harsh

nvironment for productior

Levels of activity and

layers; sub- and super-

TURBULENCE

Scattered environmenta

tress actors; irregular,

abrupt changes in flow;

diffuse pockets of energy.

Embedded subsystems of

systems, causing mutua

nfluence without being

fully integrated necessarily

flowing through a system;

he constraint caused b

he congestion of activit

AUTO-ENVIRONMENT

The variable contours of an

environment or space; an

physical-spatial or symbolic

x-scape, with "x" being a

Recovering from use by

UNCERTAINTY

Aspects of a domain that

emain unknown or poorly

nown: outstanding gues-

tions to be resolved about

an aspect of the system.

CONDITION SHOCK

Circumstances at the edge

or beyond what system ca

rdinarily cope with; majo

emporary contextual

setting aside or curbing use

for an interval; reaccumul-

ation of depleted resources

context that responds to

presence and configures to

society.

systems inside other

The volume of activity

TRAFFIC

within a domain.

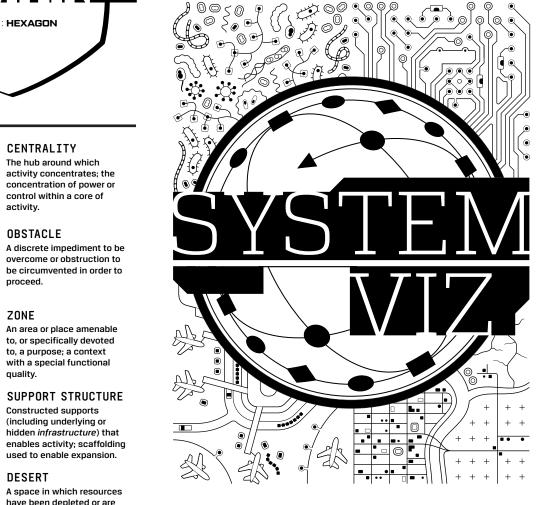
TOPOLOGY

FALLOW

listurbances that jostle and

location that overlap and

ınderlie. includina hidden



V. 1.3.2 BY PETER STOYKO

systems thinking

"It's all very simple," we're often told come to the wrong place. The main about our messy world just before a conclusion I draw from the literature pat claim is offered. Or a chronic proon systems-in the natural sciences, blem is "boiled down" and assigned a the social sciences, the managerial three-step "solution" by a well-meanpractices, the design disciplines—is ing "fixer." Or a pundit offers a "hot that there are a great many common take" that stridently turns initial system elements and dynamics to impressions into a confident read of keep track of. It is worth itemizing the situation. All that to say, we what these commonalities are and habitually turn to reassuring simplifi become familiar with their qualities. cations to guide us in uncertain That is how we tune our gaze. It's a times, even when that habit has a daunting task, to be sure. It's easy to dismal track record of success. get lost in the details. The hope is that this codex makes that learning a

Thinking in terms of systems can little easier. curb that impulse. Indeed, seeing our world as a tangle of crosshatching Before proceeding, it helps to stipulate what is meant by "system." As systems is quite humbling. Even the Donella Meadows puts it, "A system is simple objects that surround us are a set of things—people, cells, the product of various systems and subsystems operating behind the molecules, or whatever—intercon nected in such a way that they scenes. Try tracing the development produce their own pattern of behavior of that paper-clip on your desk. Can over time." (Meadows, 2008) She vou even fathom the systems that adds that there is a coherent organi created the metal alloy the clip is made of? And the larger impact of the zation to this set, one intended to achieve something (a function or mining and smelting to the surroundpurpose). This codex surveys many ing ecosystem and communities? schools of thought on the subject, Thomas Thwaites (2010) famously each with their own conceptions. built a toaster completely from scratch without the benefit of stand-Nonetheless. Meadows definition is a big enough tent to encompass the ard manufacturing systems. It took various theories, schools, and nine months. And that was with help disciplines that talk about systems from countless other systems that

enabled him to operate in modern I started by pooh-poohing the crude simplifications we habitually reach for to explain our world. I should clarify Paper-clips and toasters are the one the analytical priorities of this product of clearly demarcated and codex. I do not have anything against tightly controlled systems. Many of reductionism, per se. Indeed, building society's difficulties are entangled in bridges across the various discipfar less predictable systems that lines is unavoidably an exercise in interact in ways we scarcely distillation to some extent. Yet, too understand. The dynamics seem both many accounts of systems are paradoxical and intractable, perhaps frustratingly hand-wavy about what even mysterious. These "wicked specific mechanisms and dynamics problems" are enough to make us are at play. It's that vagary that can throw up our hands in exasperation get in the way of a deep understand and settle for short-sighted coping ing of how everything fits together. strategies. Not so fast. These are still An essential part of learning involves early days in our attempts to properly singling out items for special attentune our way of seeing to adequately tion assigning clear meanings and grasp how systems affect our lives. exploring the implications. Knowing a lot about the trees does not neces-

This codex starts from the premise that such understandings are sarily mean losing sight of the forest; possible. However, if you are looking actually, it's guite essential to figuring for quick and easy guide, you've out how the forest works.

visualizing systems

Complex systems are difficult to there important aspects of system understand without the aid of visuals. that are poorly captured by these There are too many moving parts to techniques? If so, are there alternamentally keep track of. The parts tive methods of visualization? Each nteract in too many ways. The whole notation and diagraming technique system is cognitively overwhelming contains its own assumptions about nsofar as it cannot be absorbed in what a system is and what elements one go without the aid of an external are most important. By asking these reference. That is partly due to questions, the hope is to identify numans' inability to juggle more than blind-spots and create new technia few complicated ideas in working ques for better expressing systems memory at one time. Thus, visuals are a simplifying and organizing device The reverse side of this codex that complements the way human presents an example of the visual naturally think if they are designed vocabulary in action. The point is to well. The SystemViz project explores provide a detailed example of how what it means to design such visuals the inventory can be used to analyze

disciplinary literature on systems to create a visual vocabulary. One larger goal of the project is to compare this inventory of elements to the notations and diagramming techniques for visualizing systems generally. Are

to use the vocabulary to explore

Author. Peter Stovko is an interdisciplinary social scientist and information designer at and download materials at: Elanica, a consultancy with an international remit that specializes in service design, systems, and governance.

www.systemviz.com The Visual Vocabulary of Systems was designed to complement the Visual Vocabulary of Culture, part of the

a realistic design case. The hope is to

further clarify the potential usage

scenarios discussed below. Perhaps

the examples will even inspire others

WORKFORCE TIPPING POINT: CARD SORT EXERCISE 5.2 - Poster (Ottawa: The SystemViz CultureViz project. To learn more, visit: and complex distinction Project, 2022). For purposes of open-source It is often difficult to give a VISUAL TEMPLATE used above. For example usage scenarios www.cultureviz.com **⊕**... ENABLER licensing, see citation guidelines below. business strategists ofte dialogue session an impetus, Brainstorming can revolve around use some variant of PEST momentum, and focus withou individual vocabulary items or having something to channel analysis (left). Another The visual vocabulary has severa small clusters of items arranged GOAL DRIFT: GOAL Technology attention: something to respond example is used in in a poster-sized template. Such a applications for diverse teams of Elanica's consulting work, DISPLACEMENT TRAP to in the moment. The system designers working together through template presents an analytical a cross-disciplinary set of elements have been turned into framework with blank spaces dialogue. Dialogue is an free-form ANNOTATION LAYER decks of cards or chips, with **NPPOSER** 'elemental spheres" (right) for participants to fill in additiona conversation in which everyone car VISUAL MAPPING the six big categories represent-This framework is often The vocabulary also serves a diagnostic function, as information. Visual arrangements express themselves openly to jointly ing suits. A group flips through helpful for bridging the A group can explore the various parts of a system create something worthwhile. an already visualized system or data display can be can be simple tables to elaborate the deck, singling out particular worlds of design, social Several activities can jump-start visually by charting it out on a large canyas. The further analyzed by matching vocabulary items to charts, with visual vocabulary items science, and organization cards for discussion as they on back. anchoring each cell area. Instead these conversations and help them various vocabulary items can populate the map to science. The example on explore a particular system inventory and submit proposals for modification. show particularly interesting qualities, functions, grapple with any multifaceted

goes even further in stimulating dialogu by offering a handy checklist of things t consider. This checklist is also a useful teaching tool. design The inventory icons follow a set of visua tropes and stylistic rules. A trope is a

non-literal signifier of something. Many of the tropes used are common to both popular culture and specialist notations For example, arrows are used for forces, causes, flows, and the like. As another example, brackets are used for sets. The stylistic rules add further consistency cross the set. For example, drivers have a different line thickness than boundaries. Plus signals and time delays have different line styles. This design is useful to maintain coherence as others add to, and adapt, the inventory. The icon building

blocks are shown to the left (methodological notes available separately). The design begins with outline shapes for each of the six categories. The contrast etween shapes is maximized while maintaining equivalent optical volume so that interior icons appear similarly proportion ed. Each category represents a major organizing theme running across the sysem theory literature. Those who think of systems primarily in terms of "stocks and flows", or "networks and organizing principles," or "signals and boundaries," or context and perspective" might not find all categories equally useful. That's fine. But users are invited to broaden their conceptual repertoire.

Each interior icon is not a stand-in for the

throughout a system. TENSION An opposing tendency or trade-off between forces priorities, or goals; how it is resolved, balanced, or ignored affects system.

A sequence of knock-on effects; a chain reaction; a order, third-order (and so

targets, including losing sight of raison d'être; an ongoing shift in priorities affecting system activities DIFFUSION A multiplicative effect or diffuse spread; a ripple- or viral effect; the widespread distribution of an element

FIELD force that acts on others

CONFOUND An unexpected, unwelcome factor persisting in a system; a free radical or ghost in the system: unplanned for case causing difficulties Acting upon an object may

produce different outcomes depending on the state of

the system or contextual Influence projected from an object that diminishes over space; an intermediate

behavior of collectives at accumulated experiences 0

makes the system understandable; conceptual quides to sensing and Reactions to surveillance.

Relevant cards can then be

arranged spatially with notes

as a record of the conversation.

nterpretive paradigm which even if subtle, unknowing or unintended; biases

used by observation o

0

Icon, label, and

IVERSION False or misleading signal about an actor's status, qualities, or actions; a feint, smokescreen, or pretence; an evasion.

EMERGENT PROPERT A characteristic or function that comes into being without direction; multipl objects have qualities the parts alone do not have. The synthesis of two or more objects or substances

The threshold beyond which

a dynamic becomes self-

sustaining; critical mass

OBJECTILE

An object that change

function; not defined by

state according to a

static form but as a

continuum of variation

necessary for an activity to

bringing together the capabilities of multiple

DISTAL DRIVER:

AGE STRUCTURE OF

and dynamics within the system. The items can also

otherwise go overlooked, which can guide research.

alert designers to parts of the system that would

TIPPING POINT happens; the dynamic unleashed by a sudder

rapid, large-scale change EXAPTATION The repurposing of existing functions beyond their original or intended use;

make-shift adaptation to

new domain conditions.

items; the taint of an

outside object or agent across a containment Extent to which sensing through boundaries is possible; a matter of degree of openness, transparency

FUZZY BOUNDARY

A boundary with edges that

are hard to detect or are

otherwise ambiguous: a

boundary with inexact

CONTAMINATION

An unintended mixture of

The failure of a boundary to function as designed; the damaging of a boundary by a force; the dissolution of a

configuration, or position

nearby opportunities or risks; a proximate or related

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+

aries: the reorientation that comes from travelling FLEXIBLE BOUNDAR A boundary that changes configuration in response to conditions; a boundary that is not in a fixed shape,

A relationship in which one party is harmed or destroy-

ed while the harming party enefits or is unaffected; Bi-products of activity (e.g. waste, detritus, residual) used by others; repurposing

Parts (or potential parts) that are near or adjoining

06

MUTUALISM

RANK

SET

A relationship whereby both

parties benefit: reciprocity.

or beneficial cooperation; a

elationship characterized

The hierarchical status

bestowed on an object or

actor; vertical ordination

Capable of compatible

connection or transfer

system; a functional

between two parts of a

interface: interoperability

The complete collection of

bjects necessary for an

assembly; a group of

organizational unit.

COMMENSALISM

An arrangement in which

one party is dependent

upon another but that

dependence is neither

into homogeneous groups;

the tendency of like-actors

to affiliate with like-actors

Imbalance of power, risk.

resources, access, or

opportunity; unevenness

can cause realignment

A situation whereby one

actor copies or simulates

the behaviour of another;

An arrangement of inter-

connected parts that

interact directly through

mmon linkages: the cor

stellation of connections

The tightness or looseness

of ties between parts of a

system; the degrees of

freedom of a particular

actor in a relationship.

The mitigation or reconcili

ation of conflict between

using one type of system as

within the system

MIMICRY

NETWORK

COUPLING

MEDIATION

ALIGNMENT

SYNCHRONY

The coordination of

Disparate agents or

activities given a commor

but not necessarily full

or complementary direction

activities in space and time;

patterns of activity that

coincide at particular

harmful nor helpful.

HOMOPHTIV

The self-sorting of actors

ASYMMETRY

UD

components for a functional

based on criterion deemed

salient to system operation

A DOMAIN IS THE CONTEXT IN WHICH

EXISTS. THE PHYSICAL ENVIRONMENT.

WILL INFLUENCE HOW PARTS OF THE

SYSTEM ACT. CONCEPTUAL SPHERES,

PARADIGMS, OR EPISTEMES SHAPE

CONSTRUALS WITHIN THE SYSTEM

SETTINGS, MEDIUM, OR SURROUNDINGS

The physical or virtual area

hereof) exist; the para-

of the space.

PERIPHERY

in which a system (or parts

Existing on or near the outer

edges of a space, boundary,

he hinterland of a domain

group, or field of activity:

an area of relative neglect.

A source of passive resist-

ance that hinders activity

vithin a domain; a mild

drain of energy because of

effort needed to overcome

REFERENCE POINTS

Features in the context that

evices, including markers

to the factor inputs needed

for a process: sustainable

and predictable supply of

SYMBOLIC MILIEU

Widely shared and observed

symbolic meanings required

or interpretation; prevailing

linguistic conventions for

sense-making in a domain.

Demarcation of time into

discrete spans, often with

each assigned a meaning;

specified intervals; tempora

domains between epochs

LEVELS OF SCALE

different orders of analysis

stices: the concentration of

The existence of more than

objects and activity.

DOMAIN OVERLAP

one domain or partial

domain within the same

physical or virtual space;

The mechanisms by which a

system is able to expand or

AMBIENT CONDITIONS

physical environment or

cultural milieu with the

CROWDING OUT

 \mathbf{T}

CD

potential to affect system

When the prevalence of on

item or activity drives out

of finite space that fills

GOAL SHAPING

influences the goals of

actors within: context-

derived needs, wants,

CIRCUMSTANCE

in the moment.

ENTROPY

motivations, and objective

The conflation of contextual

affecting system activities

exigencies to be dealt with

factors at a time and place

others; a group occupatio

and abstraction; different

System attributes at

levels of detail from

DENSITY

The relative proximity of system elements to each other; the size of inter-

SCOPE

features singled out for

can act as orienting

special consideration

RESOURCES

The availability and access

THE SYSTEM (OR PARTS THEREOF)

The build up of additions patches, and work-arounds many of which out-live an

This codex draws from the inter

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from Nora Bateson, Small Arcs of Larger Circles: Framing Through Other Patterns (Axminster: Triarchy Press, 2016) The signals and boundaries distinction, plus the notions of "directed edge" (here called directed boundary) and aggregate agent, come from John H. Holland, Signals and Boundaries: Building Blocks for Complex Adaptive Systems (Cambridge, MA: The MIT Press, 2012). The term "levels of scale" comes from Christopher Alexander's ifteen fundamental properties of wholeness" (from *The Nature of Order, Book 1*, Berkeley, CA: Center for Environmental Structure) although other aspects of Alexander's list are not drawn directly from that work; "echos", "roughness", and "strong centers" are different from echos (narrower in meaning), friction (broader), and centrality (broader) respectively. The concept of holon comes from Arthur Koestler, The Ghost in the Machine (New York, NY: Macmillan, 1975). The notion of assembly included here is in the spirit of Alexandr Bogdanov's notion of "podbor" as a principle for creating sophisticated organization via a "concordance" of parts, fit together with "expedient integrity." See Simona Poustilnik's "Alexsandr Bogdanoy's Tektology: A Science of Construction. in Pia Tikka, Culture as Organization in Early Soviet Thought (Helsinki: Aalto University, 2016). PEST analysis is originally attributed to Francis J. Aguilar, Scanning the Business Environment (New York: Macmillan, 1967). For liminality, see Dave Gray, *Liminal Thinking* (Brooklyn, NY: Two Waves, 2016). *Cross-domain risk* based on a literature review of interconnected risk in Nyström et al., "Anatomy and resilience of the global production ecosystem." Nature, vol. 575, 2019, "Objectile" is attributed to Gilles Deleuze, The Fold (Minneapolis: University of



An object that draws other objects towards itself; a bias in favor of an appealing position, object, or state; the value in a growth pole. PROXIMATE DRIVER A necessary and sufficient cause that directly affects

another variable; a cause that is immediately evident in time and space. ENABLER A contributory cause; can (reinforcers) or reduce resistance (enforcers).

encourage change (promo-CYCLE A repeating process or iterative effort towards a goal; an ongoing circulation

or recycling of elements

agent; an antibody; an anti-

thetical influence.

The original impetus or

event or seed object.

trigger of a sequence of

events; an initiating cause

or stimulus; a foundational

Underlying motivation of an

internal (instinct, need) or

external (incentive, persua

A time delay or perceived

delay between cause and

effect that has implications

for system behavior; loose-

An atypical case that a

system has to handle; a

improbable occurence or

The divergent path of an

agent or process; a bifurca-

tion point can be controlled

or very unstable depending

A factor causing a system

outside perturbation (anti-

gen or exogenous shock)

A turning point or critical

circumstance or a shift in

uncture; a change in

direction caused by

Complicated activities

propagation through

patterned repetition.

ENTRAINMENT

broken down into smaller

iterative, repeating actions

Changes to an actor apply to

a related sub-set of objects;

actors caught up in another

math); direct following.

DISTAL DRIVER

An indirect, ultimate cause

of a changing variable; a

"big picture" cause that is

evident at a high level of

succession of second-

abstraction.

CASCADE

on) effects.

GOAL SHIFT

Evolving objectives or

priorities; a pivot.

RECURSION

deviation or breakage, either

on the type of system.

rare edge case; an

OUTLIER

condition.

BRANCHING

DISRUPTOR

INFLECTION

ness of timing: latency time.

sion, inducement).

agent to seek a goal; can be

within a system; loop.

OPPOSER

GENATOR

MOTIVE

DAMPENER A combination of factors or process that reduces the magnitude of an effect; a muting; sapping of energy, A factor discouraging or resisting change; a counter-

ANTICIPATION An expectation or prediction of a future happening; an acting or counter-balancing imagined future or scenario: may itself trigger actions, including self-fulfilling ones CONDUIT

A path along which actors are expected to move; the medium that connects nodes in a network or CONTROL POINT Contact between a subject

and object whereby power

a time and place where

direction is expected.

Incidental results of an

action, often unanticipated

or harms not accruing to

A work-around or coping

strategy used to overcom

blockages; a temporary or

Unevenness (surge or flux)

in activity occurring within

a system; the build-up of

Concurrent processes that

complement each other: the

with similar timing.

PARALLELISM

EQUIFINALITY

DERIVATION

Multiple activities lead to

of a system dynamic or

Predictable result from a

combination or set of

inspired by preexisting

AGGREGATE AGENT

A collection of agents take

on the characteristics of a

singular agent: agent-like

higher levels of analysis

conditions; variation

the same outcome because

arrangement of constraints.

factors acting in concert or

makeshift augmentation

that endures over time

the causal agent.

KLUDGE

an *externality*, with benefit

or influence can be exerted

0 Active scanning of a process or domain to compare with an expected state: the 0

detection of anomalies; electively attending to signals based on the their ompliance with protocols r possession of qualities

Signals competing for

by mixed or conflated

XCHANGE

attention: confusion caused

signals; potentially harmfu

ncluding the rituals and

Meaningless observations

etection of useful signal

difficult; false signals that

that distract, making

EED-FORWARD

META-MEANING

formation about an

impending action is sent

nferences derived from a

set of signals about more

general patterns; big-

ORRESPONDENCE

erceived to be of a kind;

now well an object can be

natched with like objects

nd categorized; strictnes

The vantage point and field

of view by which a system (or

parts thereof) is perceived:

picture patterns that

egotiation of the terms of

A signal about the appro-

priate timing to begin or end iming marker to coordinate

A warning signal intended

to mobilize a response; an

attention grabbing notifica-

tion caused by an input; a

Indirect or partial signal of

deeper cause; a summary of

status; a symptom of a

the status or actions of a

Inadvertent signal gener-

ated by actions; residual

activity that get transmit-

Processing of signals and

encodings across several

tion; collective interpreta-

Sensitivity to signals, risks,

or drivers; reactions can

differ in magnitude, speed.

and so forth; potential for

Conversion of one type of

xpressing a message o

encoding using a different

Signals that require context

to be fully interpreted; the

meaning given to some-

thing in the moment or

TRANSLATION

signal into another;

REACTIVITY

signs of presence and

O-PROCESSING

ted: data exhaust.

efensive signal.

ng burden from over- to

A malfunction or error that

or causes general failure;

often unnoticed or creates

DIVERSITY WITHIN

Differences within a parti-

cular category of object:

butes within an otherwise

Correction or compensation

faults on a system after the

fact; the activation of work-

All the possible states of a

each point can be thought

of as a system micro-state

DYNAMIC BALANCE

Maintaining balance while

continually compensating

for varied forces that push

towards state of imbalance

The balance or steady state

a balance is maintained;

return to a set-point.

created by opposing forces;

the axis around which such

undergoing change;

system given its many

that minimize impact of

FAULT RECOVERY

PHASE SPACE

mpedes system activities

EROSION

until it is needed, often as a back-up or in case of surging demand: readiness for

SHAPE :: MOKKOUGATA

Changing from one state to

another, often depicted as

phases or stages of change

the process of developing a

A set of items made more or

ess uniform; conformity to

acceptability; interchange-

(RE)DISTRIBUTION

he dissemination or circu-

ation of resources through-

out a system, including the

(DE)ACTIVATION

The transition from passive

object to active entity, or

isa versa; emerging from

or descending into, a

The performative function

esponsibilities or tasks;

conditions or earlier state;

reboot or redo that restores

manate outwards: scatter:

Reduce in concentration or

disperse a substance into

The ability to perform more

ne surroundings for

default settings or recali-

brates using new data.

an actor adopts in the

noment to complete

Returning to original

eallocation of stocks in the

a set of basic criteria of

STANDARD

A BOUNDARY SEPARATES DIFFERENT

IMAGINARY, IMPERVIOUS OR POROU

THE MAJOR DISTINCTION BETWEEN

OPEN AND CLOSED SYSTEMS DEPENDS

ON THE EXCLUDING CAPACITY OF THE

SYSTEM'S OUTER BOUNDARY (OR EDGE)

CONTAINER

A boundary that groups and

restriction of movement to

a confined space or domain

isolates objects: the

SEMI-PERMIABLE

A barrier that blocks some

allowing others to pass

A controlled opening in a

barrier; a barrier opening

objects that meet certain

A barrier preventing damage

to an object by blocking or

reflecting unwanted forces

Spatial separation of

TERRITORY

objects; a discontinuity in a

conduit; the distance that

prevents mutual exposure

The boundaries between

demarkation of spatial area

with a particular meaning of

control structures; the

symbolic significance

Removal of materials.

agents, or threats from a

bounded space; disposal

A boundary or zone that

wise alters a driver or its

impact while passing

diminishes, delays, or other-

REACTIVE BOUNDAR'

A boundary that responds

to forces and acts as an

actant in its own right; a

The combination of two or

boundaries, each of which

more complementary

may have different

ABSORPTION

ınctional qualities

dvnamic boundary

LAYER

EXPULSION

that allows passage of

PROTECTOR

through; a filter.

objects or substances while

BE FIXED OR MOVABLE. REAL OR

PARTS OF A SYSTEM. BOUNDARIES CAN

SHAPE :: ASTROID

DIVIDER

BARRIE

A boundary that keeps two

or more distinct objects or

concepts apart from each

other; a hard distinction or

A boundary that prevents

objects or substances from

passing through from one

ATH CONSTRAINT

or trajectory of agents; the

substances within certain

NOTIONAL BOUNDARY

A conceptual boundary or

delineation; can be tangible

Outer boundary that defines

system: an isolating barrier

of a closed system or an

A passage over or across

one or more boundaries; a

separated by boundaries

connection between

different domains

BOTTLE-NECK

LEAKAGI

A boundary that limits the

passage of objects to a

narrow gap; constraints

forcing a flow to concen-

The escape or inadverten

release of items from a

containment boundary; the

A place along a boundary for

the two-way movement of

traffic; the connection poin

between conduits that car

DIRECTED BOUNDARY

A boundary that functions

differently depending on

Some dynamics within a

system are contained in

gradual seepage of items

NTERCHANGE

pen-system demarcation

the scope of domain or

in its effects; includes

useful distinctions and

arameters.

A barrier that limits the flow

domain to another; a

A RELATION IS THE DYNAMIC BETWEEN

OBJECT) IN A SYSTEM, A RELATION MAY

BE A SHORT-LIVED INTERACTION OR AN

CLUSTER

Elements defined as a

group by virtue of proximity

nd coexistence; a neigh-

rhood or conglomera-

actors that share patterns

f behavour or thinking; a

The continual exertion of

power and control over a set

objects or actors; over

DIFFERENTIATION

A contrast between other

establishing a productive

niche; progressive

INTERSECTION

The point of contact

COORDINATION

between two entities: the

The orchestration of actors

in the execution of tasks

through self-organization

Cross-regulating actors:

COMPETITION

PROPINQUITY

The process by which

affiliated actors become

nore alike over time; the

nogenization produced

The exchange of something

for something else under

rough a third medium o

articular terms, often

INTEGRATION

Connecting systems of

parts thereof in order to

COMPLEMENTARITY

Different actors or objects

are able to do more together

han they would otherwise:

synergistic or positive-sum

INTER-MEDIATION

Striving in self-interested

ivals; attempts to best

pursuit of a goal shared by

thers by acquiring powe

eeping activity of opposing

actor within an acceptable

and processes, either

cross-roads at which

actors, forces, or ideas

tems or actors in a system;

of domain or system.

elming power across part

DOMINATION

ollective acting according

TWO OR MORE OBJECTS (OR TYPE OF

ONGOING SERIES OF INTERACTIONS

THE PATTERNS OF INTERACTION ARE

WHAT MAKE A SYSTEM PREDICTABLE

OVER TIME.

capacity; the construction of increased ability to handle volume of process

ACCUMULATION he build-up of items or periences over time; car ffect system gradually o

once the build-up reaches a hreshold; a memory bank TOLERANCE Permissible variation in precision or accuracy allowing

ontinued operation; ability

A reconfiguration of an object caused by an error or exogenous factor, usually noticed when bestowing an

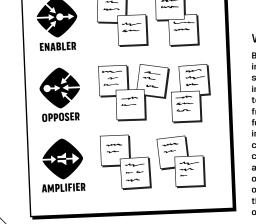
The division of a part into two or more parts; the extraction of constitutive

When an object is copied reproduced, or divided into wo or more analogous

The threshold beyond which

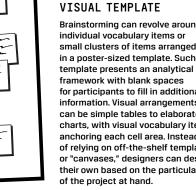
to free-style bricolage.

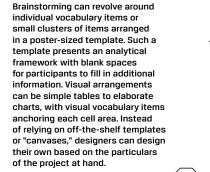
shed new light on difficulties or help to explain how a system works on a deeper level. This applies to any visualization, from technical notation to pictoral map



CHANGE

WHAT FACTORS HELP OR HINDER CHANGE?





distinctions.

of systems that go beyond the simple, complicated. the reverse side relies implicitly on these

TERTIARY

ORGANIZING DEVICE

Analysis can benefit by

looking at different type

loaded at no charge from systemviz.com and can be redistributed

within and diversity between, as well as its significance for systems theory, are fully explained in Scott E. Page Diversity and Complexity (Princeton, NJ: Princeton University Press, 2011). The concept of symmathesy comes