Liberating Our Collective Greatness through Slowification, Simplification, and Amplification

Wiring the Winning Organization

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WIRING THE WINNING ORGANIZATION

From Gene

To the loves of my life: my wife, Margueritte, who allows me to pursue my dreams; and our three sons, Reid, Parker, and Grant, who cheer me on.

To the achievements of the DevOps Enterprise scenius, where so many of the insights that went into this book come from

From Steve

With love and admiration for Miriam, my *b'shert*, without whom none of this would exist. With deep appreciation for the three young adults who've let us share their journeys: Hannah, Eve, and Jesse.

In memory of loved ones who passed away during this book project:

Byung Kim
Vincent Hung Vu

Dr. Angel Tropp z"l
Mrs. Anita Wasserman z"l

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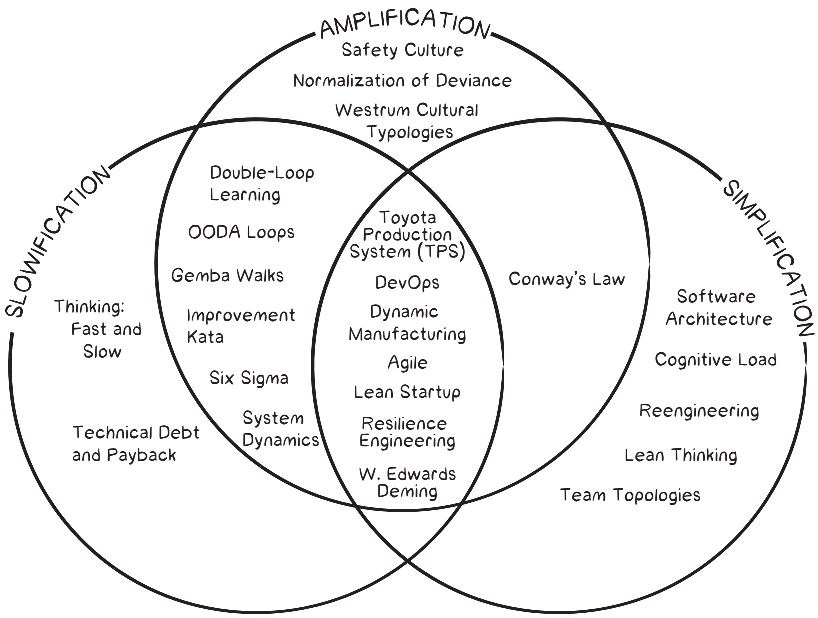


FIGURE 1.2 The Three Layers

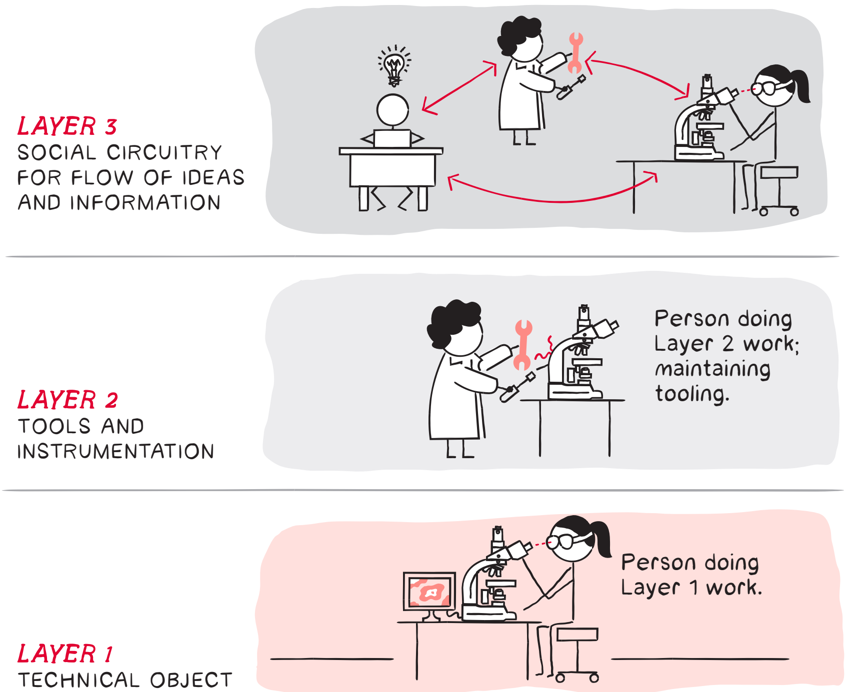
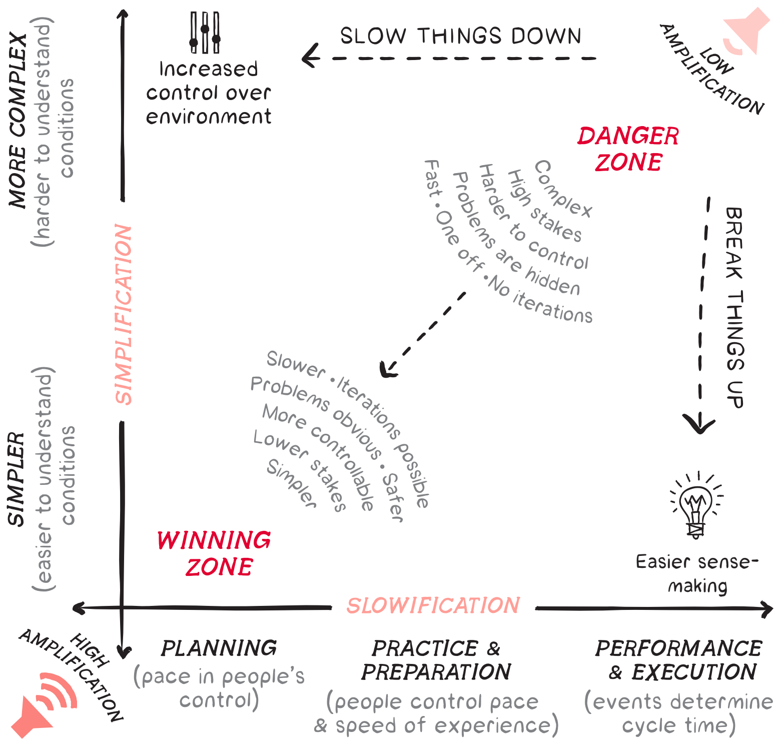
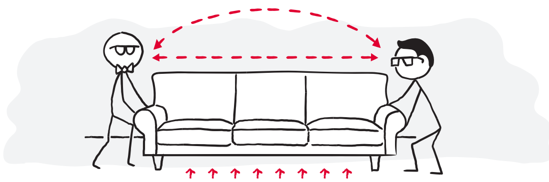


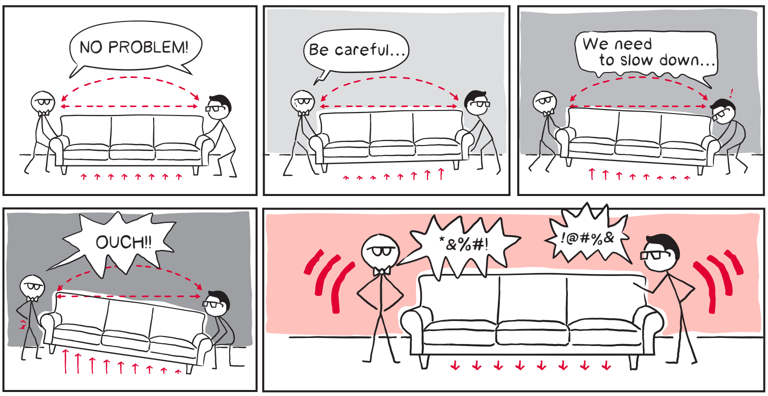
TABLE 1.1 *Danger Zone* vs. *Winning Zone*

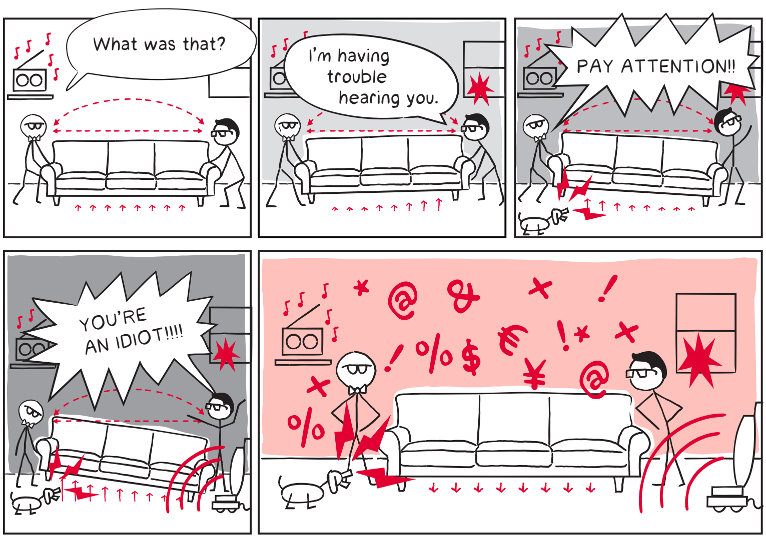
DIMENSIONS	DANGER ZONE	WINNING ZONE
Nature of problems.	⚠ Complex problems with many highly intertwined factors.	✓ Simplified problems that are well bounded, have fewer factors, and can be addressed by smaller teams.
Hazards and risks.	⚠ Dangerous and risky.	✓ Less hazardous and less costly failures.
Speed of environment in which we're trying to solve problems.	⚠ Fast moving and not controllable.	✓ Slower moving with the opportunity to control pace and introduce pauses.
Opportunities to learn by experience or experimentation.	⚠ Experiences are singular or "one-off" so feedback may be missing and learning loops may not exist.	✓ Experiences can be repeated to gain experiential and experimental learning, and knowledge can be captured for recurring use.
Clarity about where and when to focus our problem-solving efforts.	⚠ It is not obvious that problems are even occurring, so they get neither contained nor resolved.	✓ It is obvious when problems are occurring, so attention is given to containing and solving them; and it's obvious whether the problems have been contained and resolved or not.

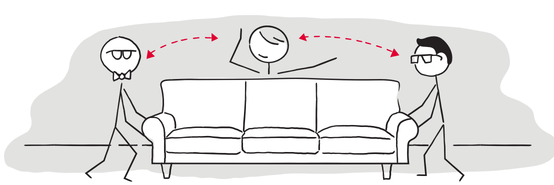
FIGURE 1.3 Moving from the *Danger Zone* to the *Winning Zone* through Slowification, Simplification, and Amplification



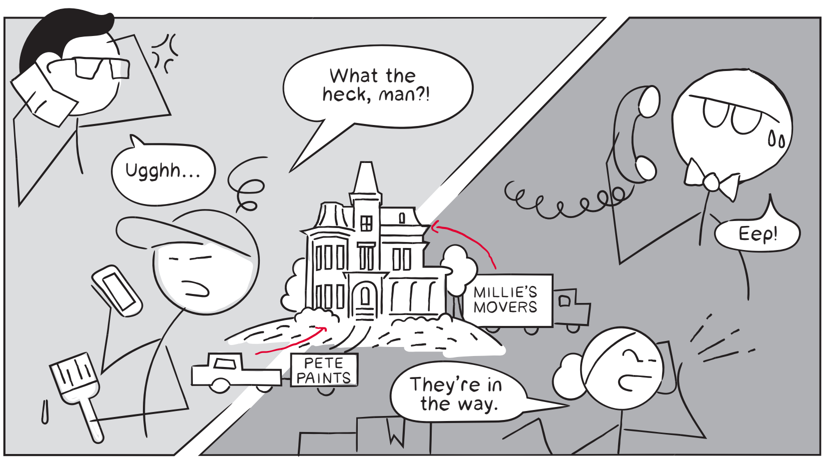



NO PROBLEM!
Be careful...
We need to slow down...
OUCH!!
*&%#!
!@#%&


What was that?
I'm having trouble hearing you.
PAY ATTENTION!!
YOU'RE AN IDIOT!!!!




We're here!
Welcome!


What the heck, man?!
Ugghh...
Eep!
MILLIE'S MOVERS
PETE PAINTS
They're in the way.

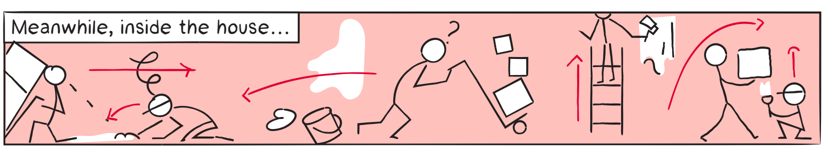

Meanwhile, inside the house...

FIGURE 2.1: Example of Production Control

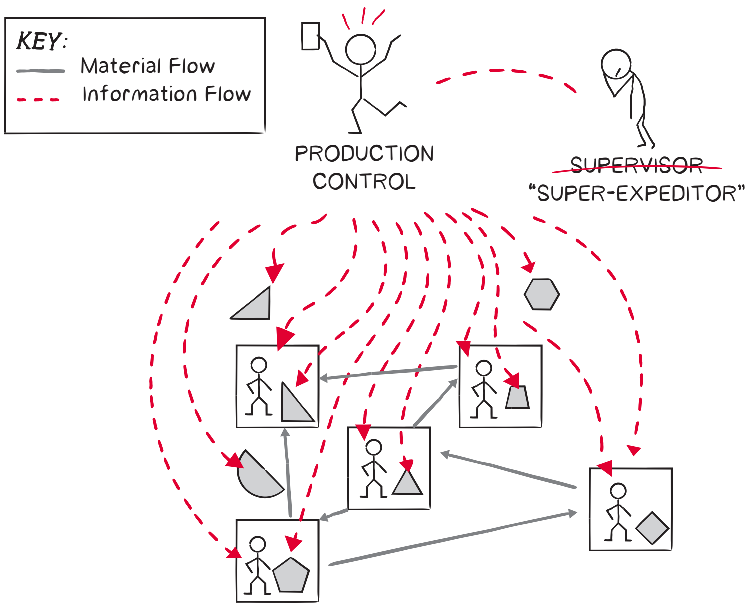


FIGURE 2.2 Partitioning into Room Teams

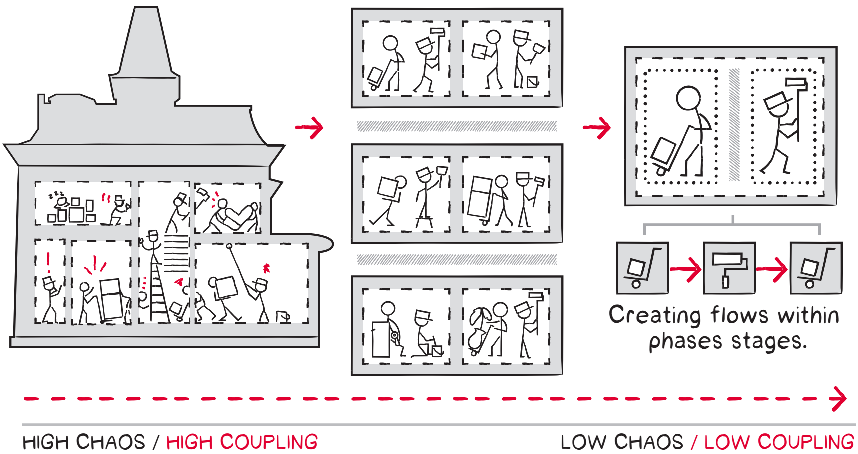
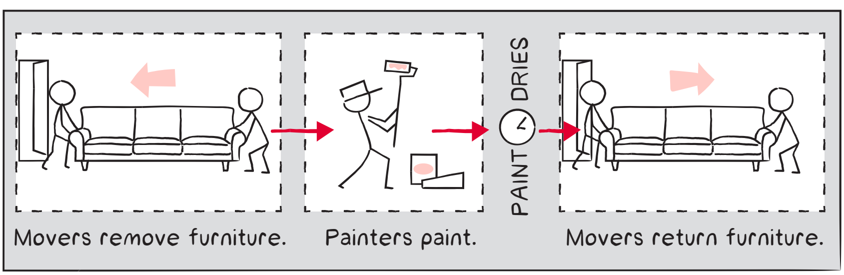


FIGURE 2.3 Further Partitioning within Room Teams



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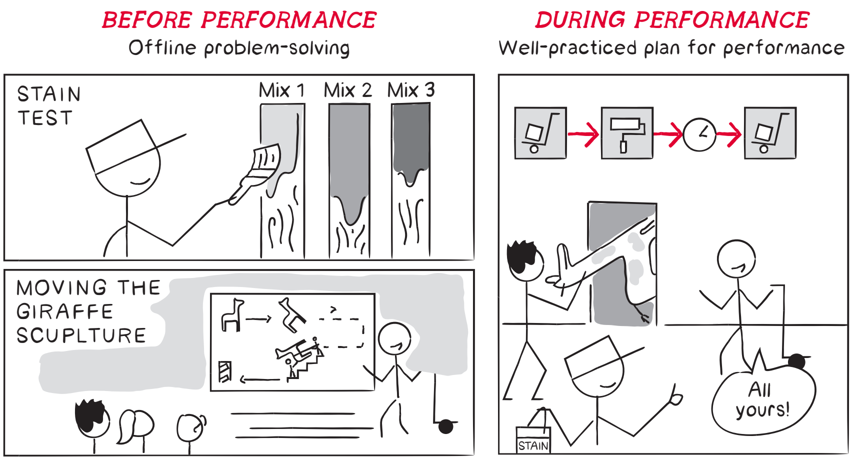

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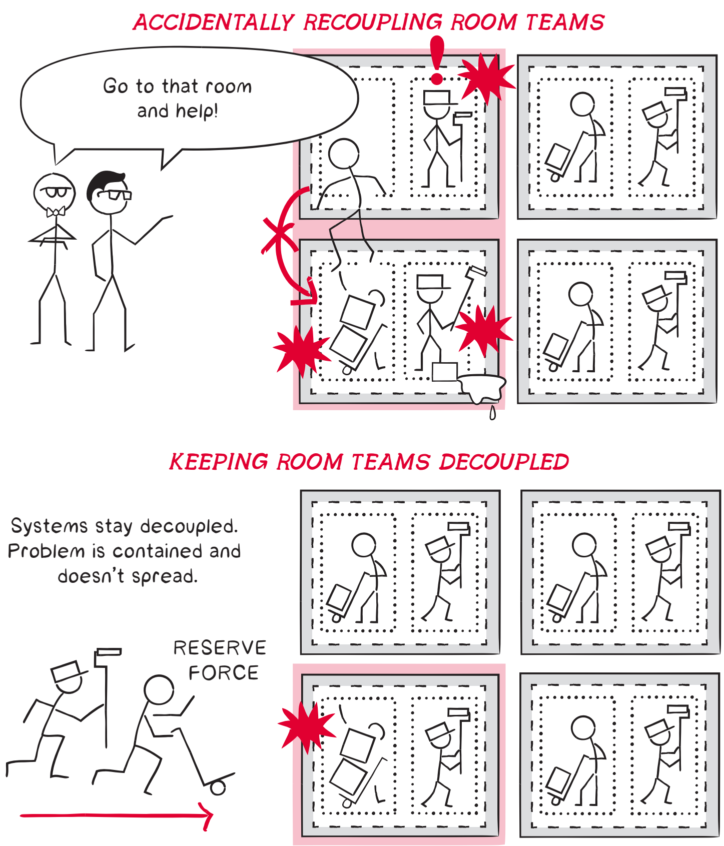


FIGURE 2.6 Self-Synchronized Teams

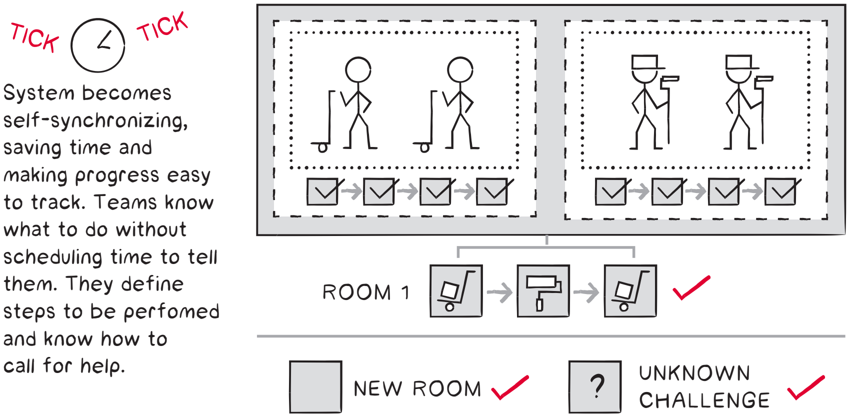


FIGURE 3.1 Moving from the *Danger Zone* to the *Winning Zone* through Slowification, Simplification, and Amplification

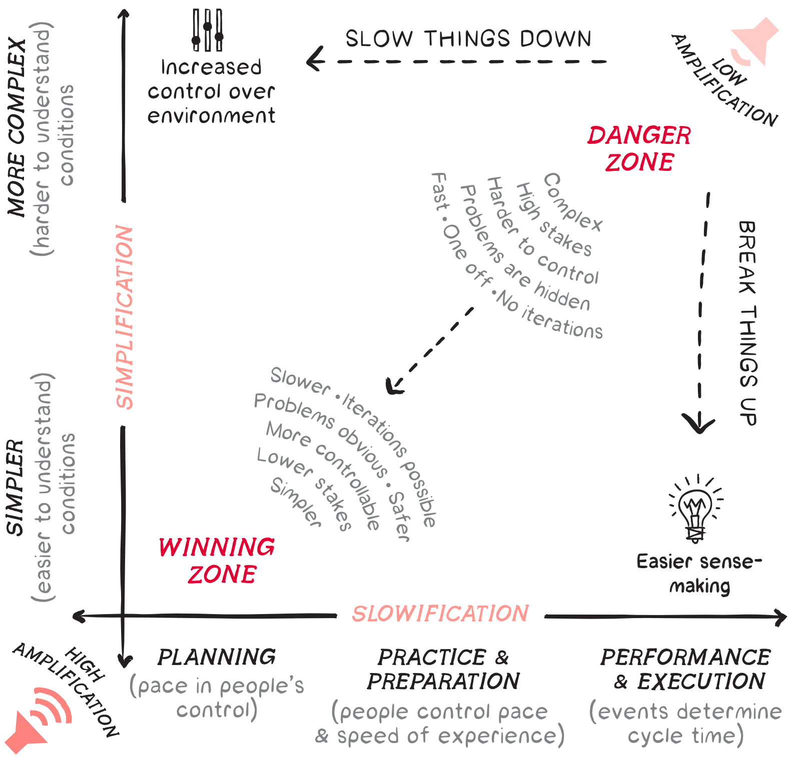
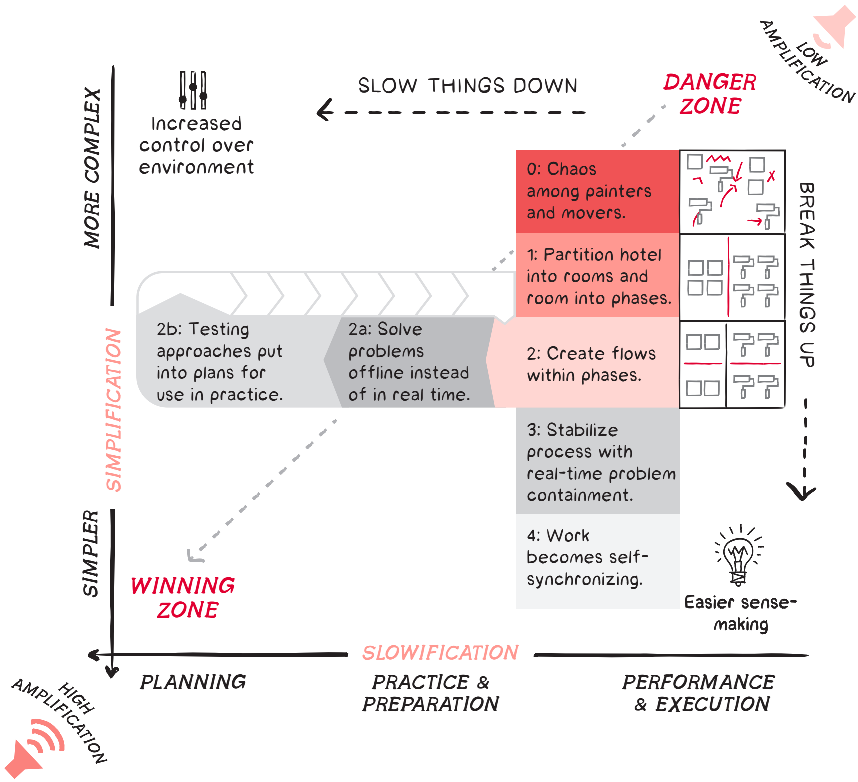


FIGURE 3.2 Hotel Refurbishment: Moving from the *Danger Zone* to the *Winning Zone*



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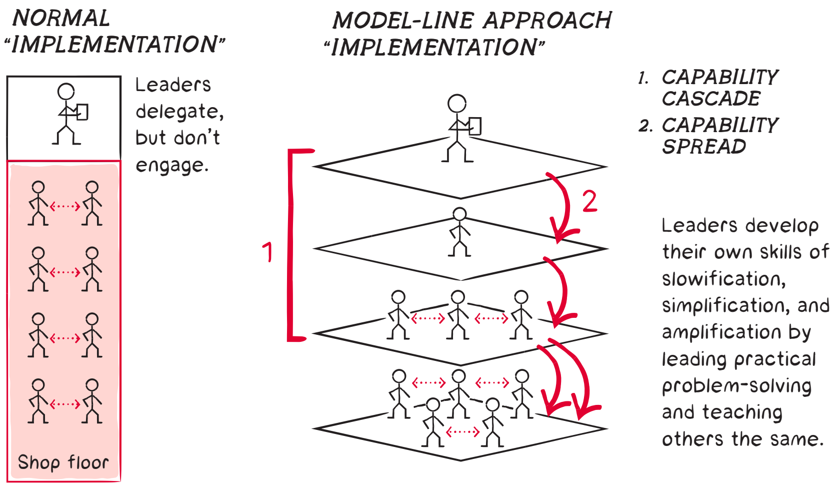


TABLE 4.1 Advantages and Disadvantages of Fast and Slow Thinking

	STRENGTHS	LIMITATIONS
Fast thinking	**Speed:** Heuristics give us quick, reliable answers to familiar problems and situations.	**Inaccuracy:** Heuristics and their attendant biases may give us inaccurate answers to unfamiliar problems or situations that are framed poorly.
Slow thinking	**Flexibility:** Allows us to improve our understanding of familiar situations or add to our understanding of new ones.	**Slowness:** Requires time, patience, and openness of mind that we may be lacking in the moment.

TABLE 4.2 Example of Anchoring Bias

When presented this…	…the typical guess is…
8 x 7 x 6 x 5 x 4 x 3 x 2 x 1	2,250
1 x 2 x 3 x 4 x 5 x 6 x 7 x 8	512

Note: The actual answer is 40,320.

FIGURE 4.1 The Three Ps: Planning, Practice, and Performance

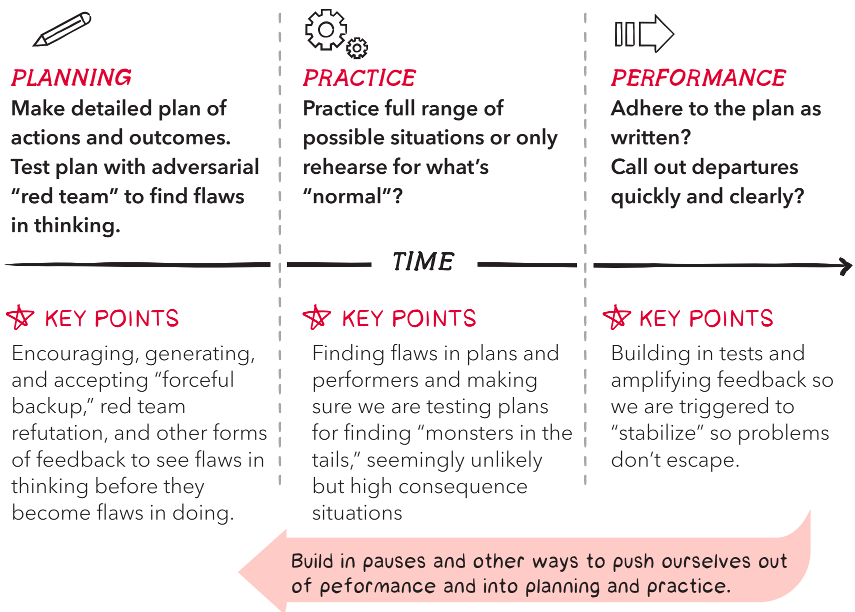


FIGURE 4.2 The Monsters in the Tails

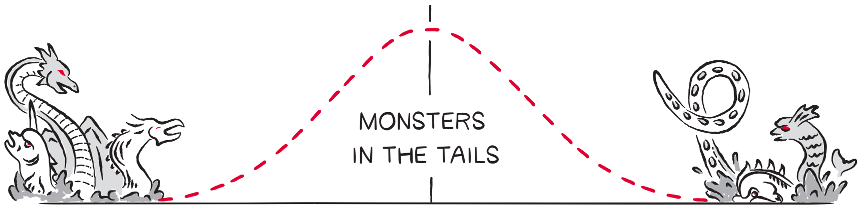


FIGURE 4.3 Using Slowification to Move from the *Danger Zone* to the *Winning Zone*

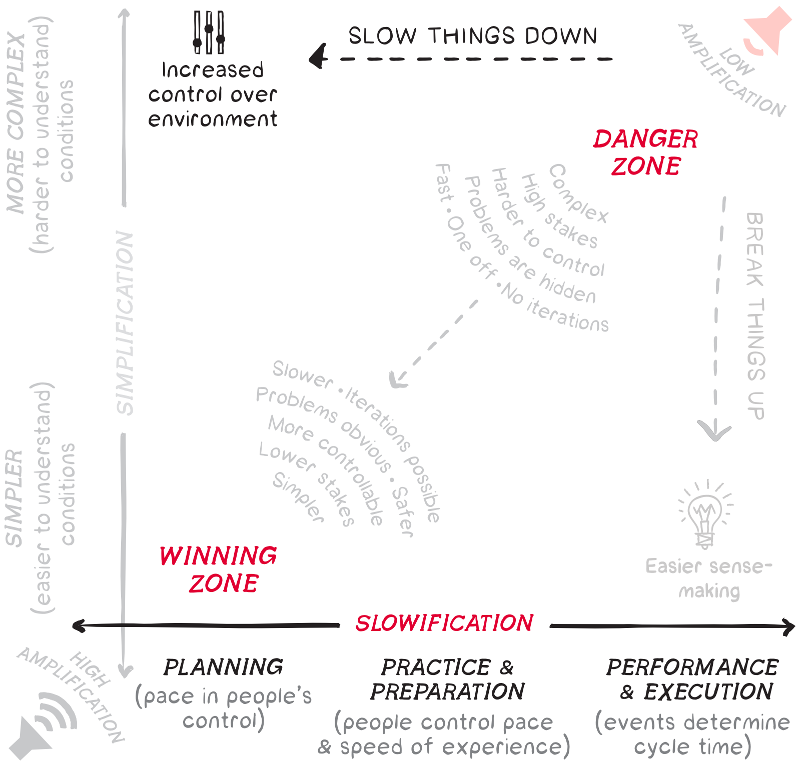
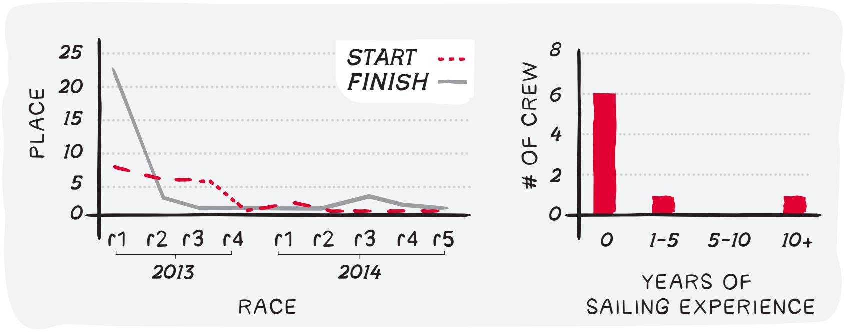


FIGURE 5.1 MIT Sloan Team Results using Slowification



(Left) Chart showing improvement within a race (difference between start and finish) and improvement race to race. (Right) Chart showing experience of crew members.

FIGURE 5.2 Diagram of Wrong Patient Event

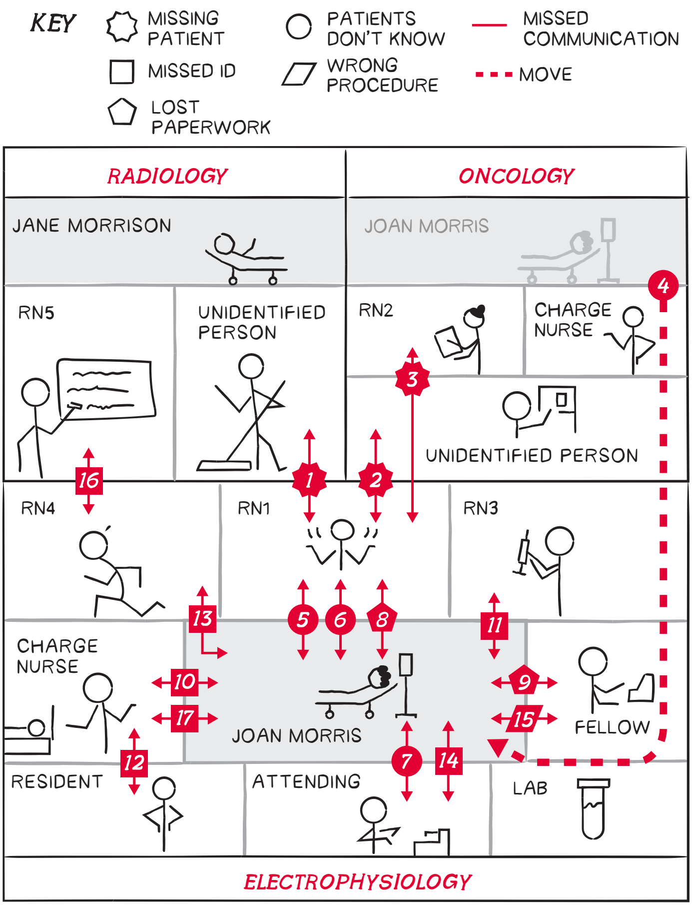


FIGURE 5.3 Stages of Development for Lunar Landing Module

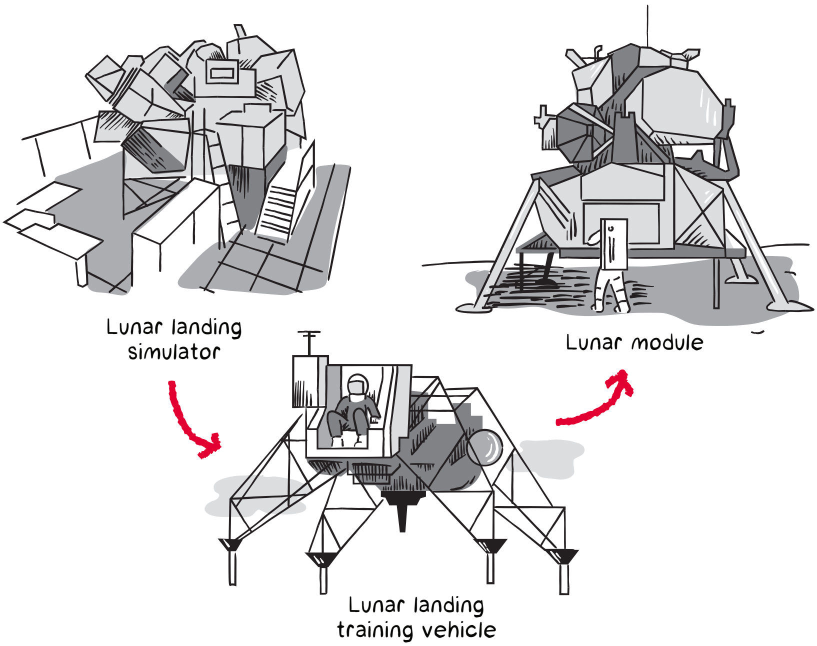


TABLE 5.1: US Navy Fleet Problems during the 1920s and 1930s

YEAR	PROBLEM	EXERCISE
1923	Defend Panama Canal from surprise attack.	I
1924	Advance to the western Pacific, seize an advanced base, and conduct an offensive from it.	II–IV
1925	Explore how best to attack and defend advanced bases.	V
1926	Move across the Pacific to relieve the Philippine garrison before it surrenders.	VI
1927	Simulate an advance across the Pacific and seize an advanced base.	VII
1928	Practice evading the enemy while transiting the Pacific.	VIII
1929	Execute delaying operations against a superior Anglo-Japanese coalition.	IX
1930	Test new tactical fleet dispositions and battle plans.	X
1930	Concentrate a widely dispersed fleet in the face of enemy opposition.	XI
1931	Test an aircraft-heavy force against a more conventional fleet.	XII
1932	Recapture Hawaii from an aggressive Asian power.	XIII
1933	Defend the West Coast from carrier raids.	XIV
1934	Make an opposed advance and explore advanced base operations (attack/defense).	XV
1935	Simulate an offensive Pacific campaign.	XVI
1936	Investigate operational problems associated with an extended Pacific campaign.	XVII
1937	Capture a series of advanced bases in sequence–island hopping.	XVIII
1938	Simulate a protracted Pacific campaign, including advanced base capture.	XIX
1939	Defend the Western Hemisphere from a major European fascist power.	XX
1940	Defend against Japanese attacks while much of the fleet is in the Atlantic.	XXI

TABLE 5.2 Opportunities Taken or Missed for Feedback-Informed Progress during Planning, Practice, and Performance

CASE STUDY	PHASES	
Imperial Japanese Navy vs. US Navy	Planning	Plans issued and compliance expected vs. plans created to generate feedback.
Apollo 11 vs. Space Shuttle Columbia	Practice	Practice phase for finding flaws in technology (Layer 1 and Layer 2 problems) and flaws in coordination (Layer 3 problem). Forceful, aggressive simulations.
Google, Amazon, Netflix	Practice	DiRT, Game Days: rich feedback offline slow; rich feedback offline fast.
	Performance	Netflix Chaos Monkey: rich feedback, drills in performance.
MIT Sailing vs. Mrs. Morris/Ms. Morrison	Performance	Pause during performance.
United Airlines Flight 232 vs. United Airlines Flight 173	Performance	CRM: Slow down thinking even if you can't pause performance.

FIGURE 6.1 Turning Planning, Practice, and Performance into Feedback-Rich Opportunities to Make Progress

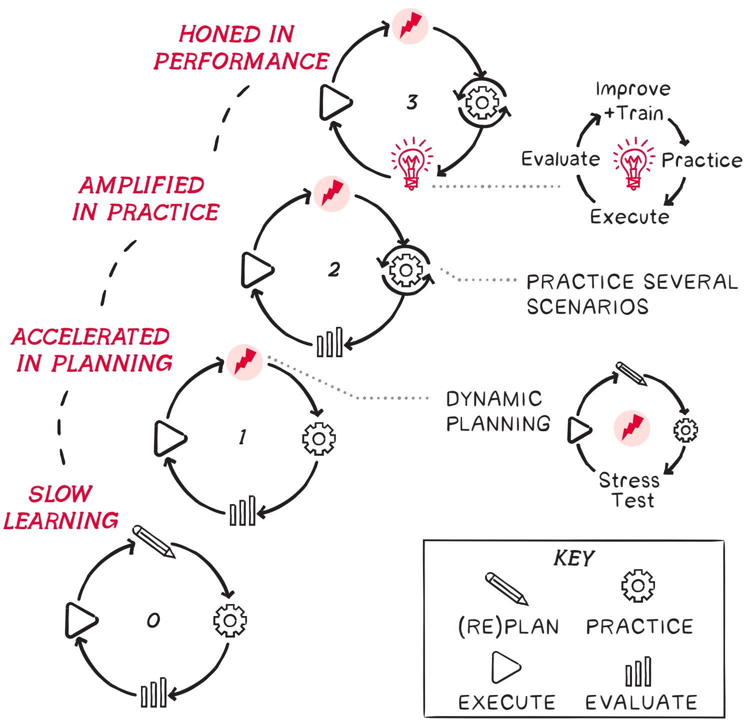


FIGURE 7.1 Shifting from the *Danger Zone* to the *Winning Zone* by Simplification

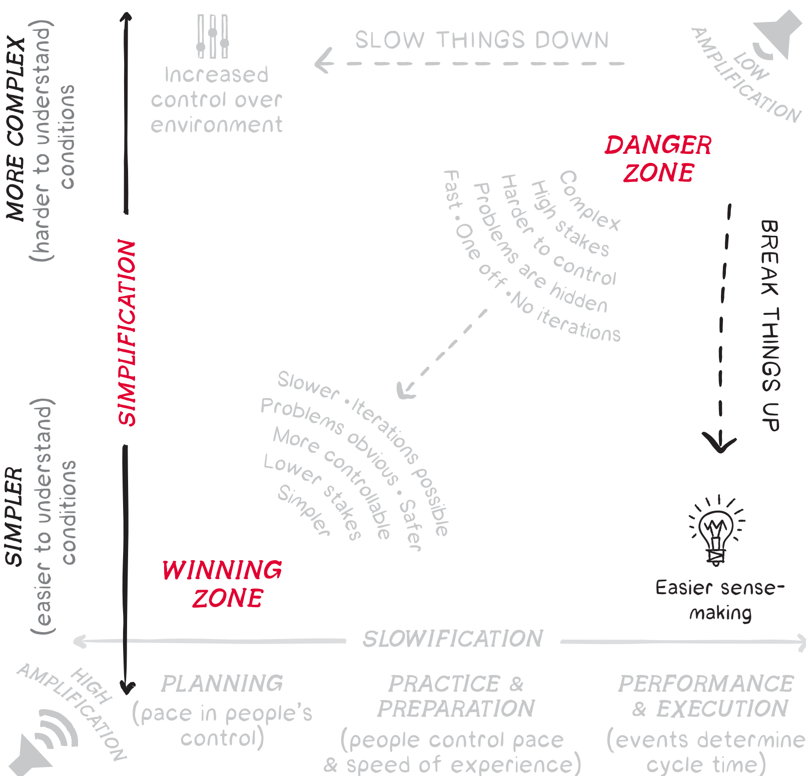


FIGURE 7.2 The Three Techniques of Simplification

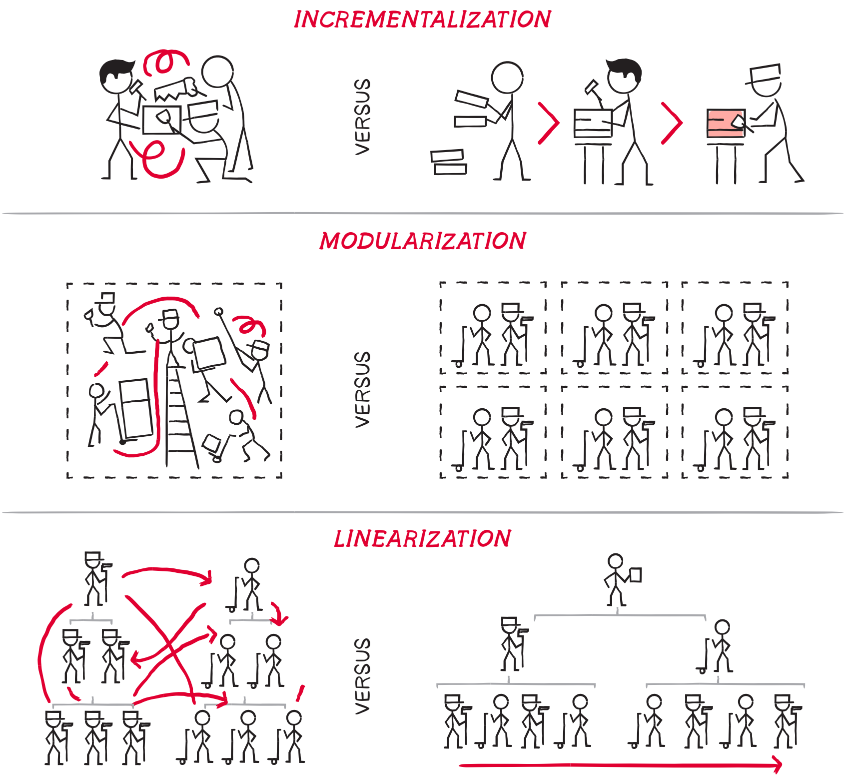


TABLE 7.1 Previous NEO NASA Missions

YEAR	*MISSION*	*DETAIL*
1996	Near Earth Asteroid Rendezvous (NEAR)	*Shoemaker* spacecraft landed on asteroid 433 Eros after traveling for four years and then orbiting around it for an additional year.[6]
1998	Deep Space 1	Mission visited the 9969 Braille asteroid.[7]
2003	*Hayabusa* spacecraft	A NASA partnership with Japan's space agency, collected sample material off the Itokawa asteroid.[8]
2004	Rosetta mission	Flew by the asteroids Steins and Lutetia.[9]
2007	Dawn mission	Visited the asteroids Ceres and Vesta.[10]
2000-2020	Multiple missions	Many other missions to study asteroids were conducted..

FIGURE 7.3 Contrasting Waterfall Approaches with Incremental (Agile) Ones

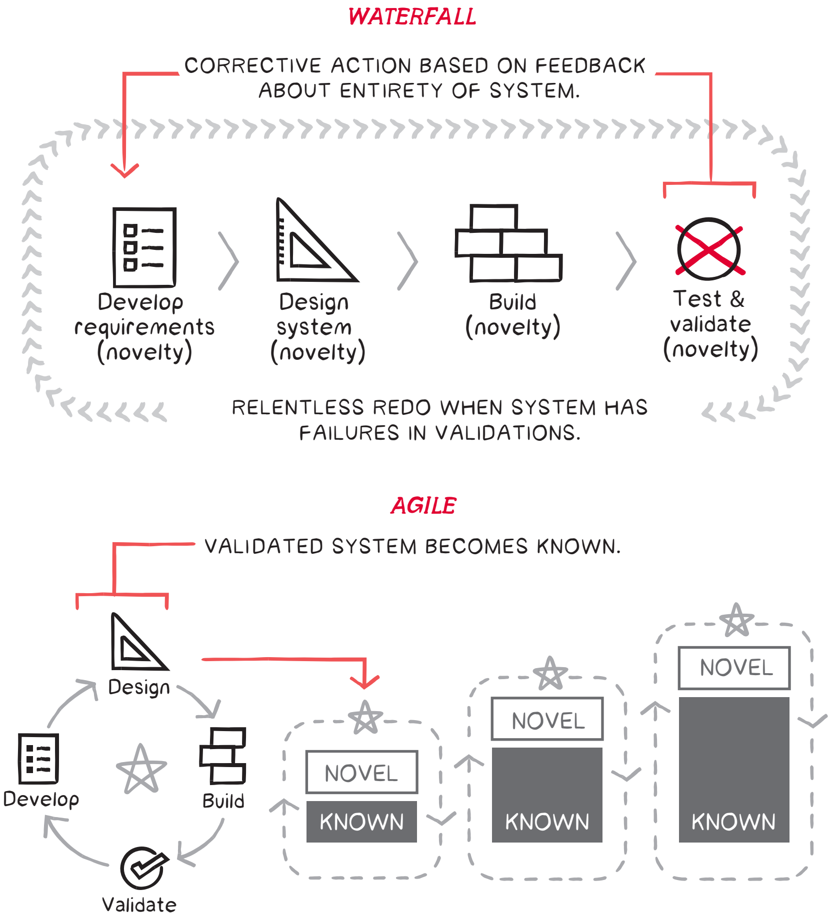


FIGURE 7.4 The Coordination Required in Layer 3 across the Top of the Silo

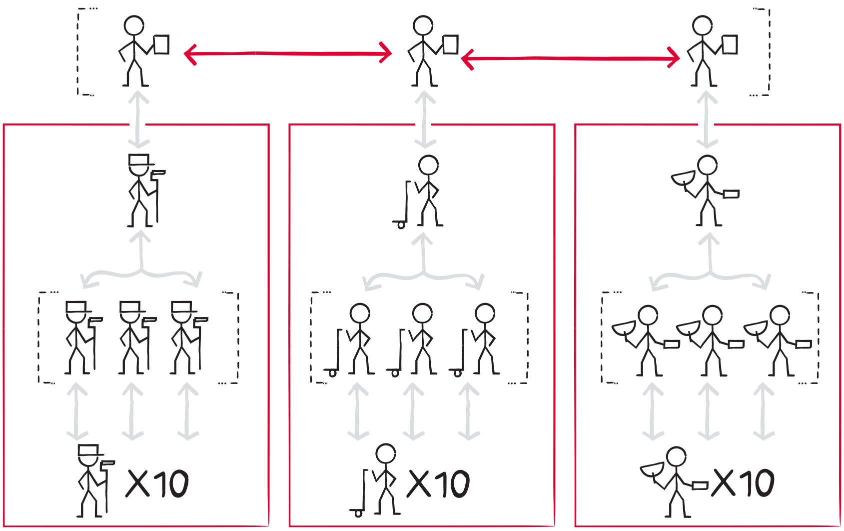


FIGURE 8.1 Comparison of 1903 Flight Trials of the Wright Brothers vs. the Langley Aerodrome

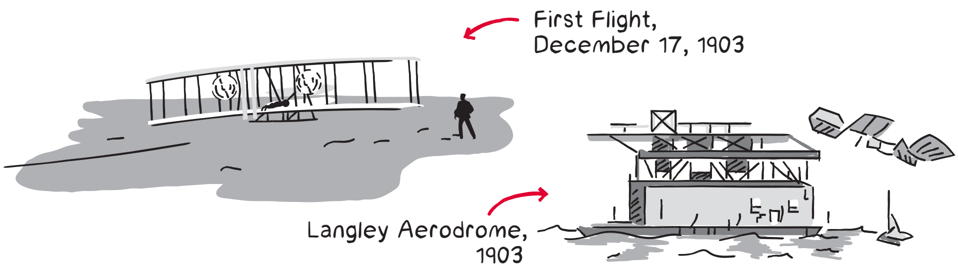


FIGURE 8.2 Comparing Langley's "All at Once" Experiment (left) with the Wright Brothers' Incremental Experimentation (right)

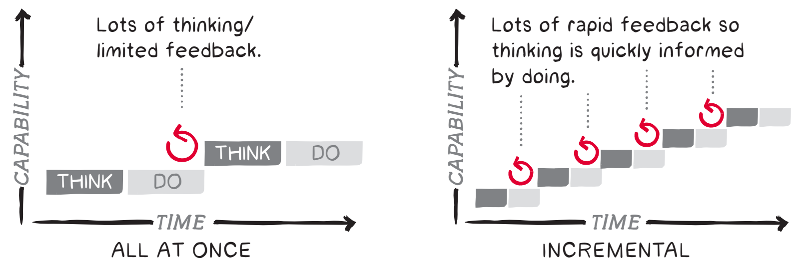


FIGURE 8.3 Incremental Prototypes of the Apple iPhone Keyboard

The leftmost picture shows Kacienda's original prototype; the rightmost, the finished product that shipped with the iPhone.

Adapted from: Ken Kocienda, *Creative Selection: Inside Apple's Design Process During the Golden Age of Steve Jobs* (New York: St. Martin's Press, 2018).

FIGURE 8.4 Top-Down vs. Center-Out vs. Hands-Off Approaches for Leading Distributed Operations

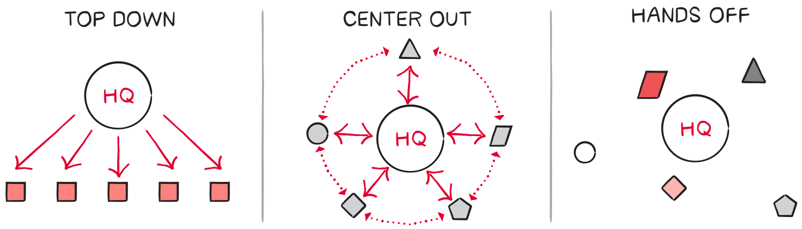


FIGURE 8.5 US Schools vs. Menomonee Falls During COVID-19 Crisis

	USA OVERALL	***MENOMONEE FALLS***
March 2020	Schools close nationwide.	Schools closed on Governor's orders March 13.
March 14 & 15		Menomonee Falls school board is developing remote learning plans.
March 17	Issues of digital inequality take hold. For families with incomes less than $100,000, more than a quarter of students don't have digital resources.[27] Inconsistent internet access, computers, and school ablility to teach remotely.[28]	Virtual learning is in place and running for most kids. Menomonee Falls teachers, staff, administration, and parents running tests and trials to see how to operate in person.
May	Only 80% of teachers report interacting with students daily or weekly.[29]	
Sept.	Approximately 20% of kids are in person.[30]	Menomonee Falls resumes in-person learning for youngest students.
Oct.		All students resume in-person or hybrid (some in-person component) learning.
January 2021	Only approximately a third of students are back to in-person learning.[31]	

FIGURE 8.6 Changes in Naval War Ships Pre- and Post-1900

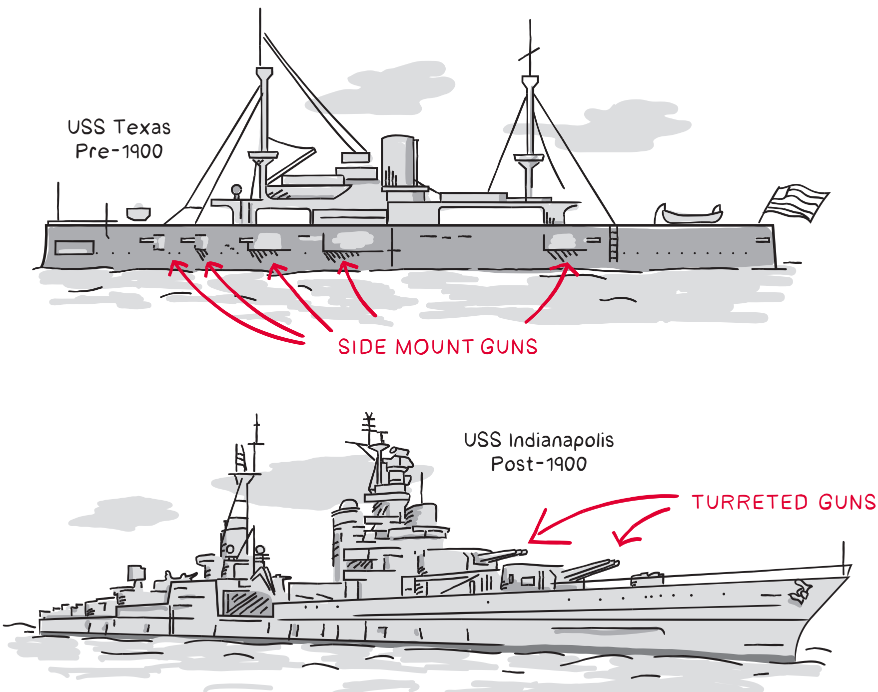


FIGURE 8.7 Communication between Product Category Teams and E-Commerce Teams at Amazon

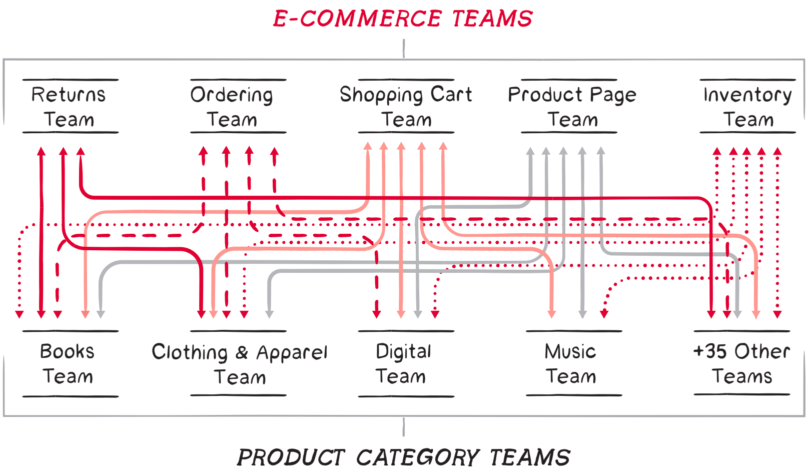


FIGURE 8.8 Amazon.com's Evolution from a Highly Integrated Monolith (on the top) to Modular Architecture (on the bottom)

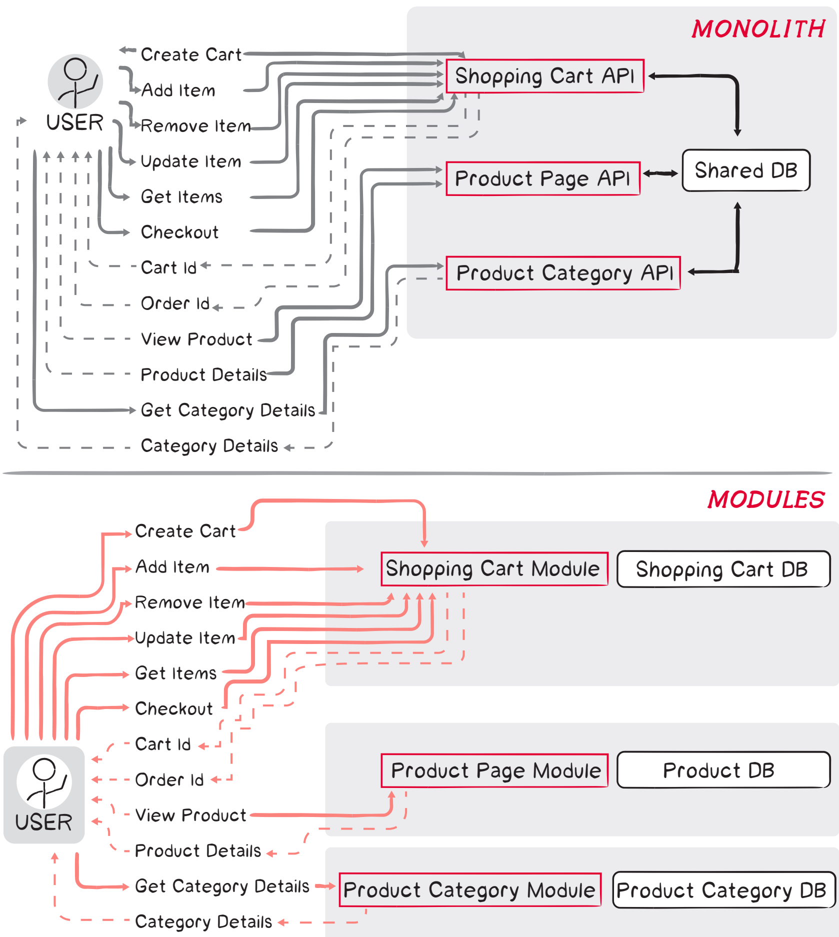


FIGURE 8.9 Design-Make-Test Cycle Connecting Chemistry and Biology Labs with Supporting Services Indicated

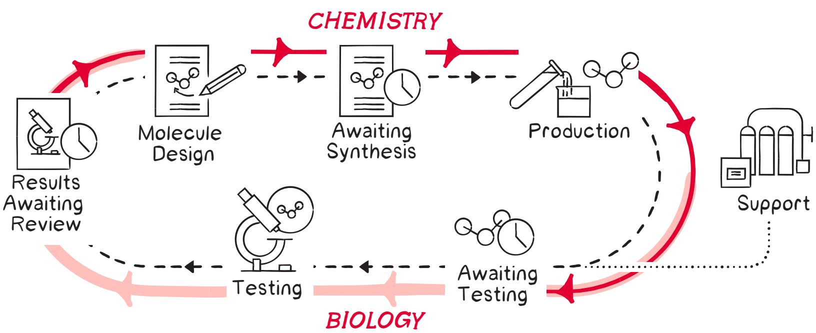


TABLE 8.1 Results of the Model-Line Experiment

	BENCHMARK PROGRAM	*PILOT PROGRAM*	*IMPROVEMENT*
Total time	13 months	6 months	2x faster
Design-make-test cycles	55	19	3x more efficient
Results transmitted to "lead development"	72 qualified hits (< 10 clusters) ~14 internal chemists 5 lead series delivered	340+ qualified hits (100+ clusters) ~16 internal chemists 5+ lead series projected	5x more hits (All achieved with approximately the same size of staff.)

TABLE 8.2 Simplification Techniques in Each of the Case Studies

	KEY *I:* Incrementalization, *M:* Modularization, *L:* Linearization
NASA DART	*I:* Make kinetic collision the novelty on top of validated launch, flight, rendezvous, landing communication, and other technologies and techniques of previous missions.
	M: Separate responsibility for launcher, the probe that collided, the probe that did the surveillance and data capture, etc., among different entities.
ARTISTS AND WRIGHT BROTHERS	*L:* Generate multiple prototypes to test ideas around single problems quickly (like Monet did by using several easels to focus just on lighting in Venice; Wright brothers did this with their high-volume experimentation at Kitty Hawk and elsewhere) or build micro prototypes first, before incrementally building to full-scale model (like Picasso did by having several smaller, rougher test canvases before committing to the masterpiece).
APPLE VS. NOKIA	*I:* Base the iPhone operating system on the Mac operating system, and focus innovation on the novel problems presented with the applications and their user interfaces of keyboard and screen.
SCHOOL REOPENINGS AND NAVY	*M:* Drive data, already-known facts, resources, and authority to act ("independence of action") out to the local operating units; allow experimentation in localized operating units. Have "the center" (headquarters) provide resources and do synthesis of local lessons learned into common, shareable knowledge.
AMAZON AND IBM	*M:* Decompose large, highly integrated systems into coherent pieces, each focused on a small portion of the overall functionality. That way, problem-solving happens within the module without needing to coordinate everything at the system level. This gives independence of action to the teams, reducing the need to coordinate across boundaries with those responsible for other component subsystems.
DRUG DEVELOPMENT, PRATT & WHITNEY, TEAM OF TEAMS	*L:* Link all contributors to a sequential flow of work that progresses from start to finish. That way, what tasks have to be done, by whom, in what sequence, with what exchanges at the boundaries is made obvious. This allows work to flow more easily and for collaboration to occur more easily from one function to the next, as opposed to when integration occurs only at the tops of the functional silos.

FIGURE 9.1 Incrementalization of the Space Race

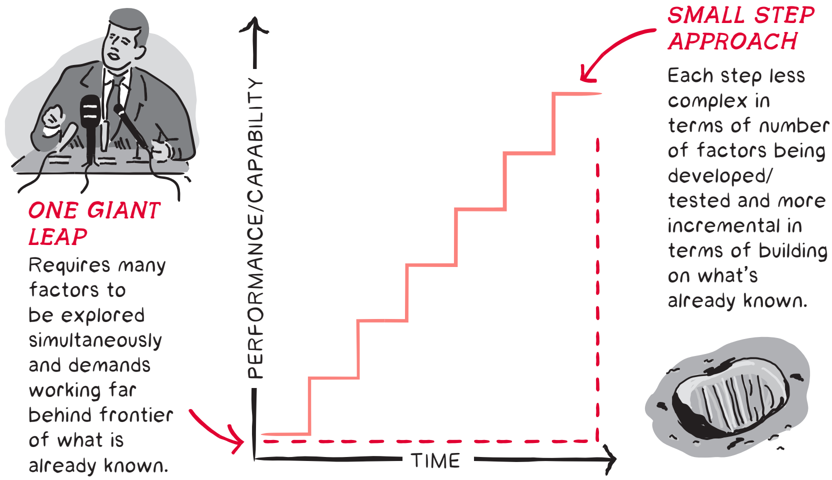


FIGURE 9.2 Incremental Modifications in Mercury Program Flights

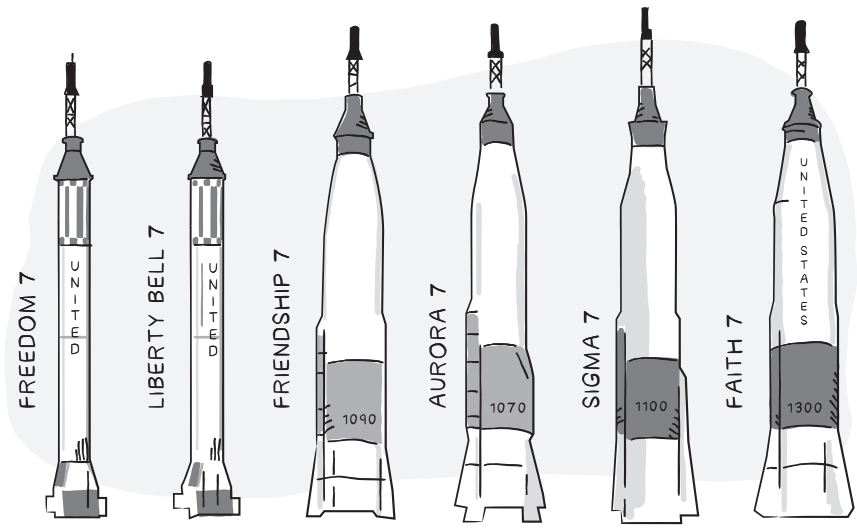


FIGURE 9.3 Size of Rockets across Mercury, Gemini, and Apollo Programs as Metaphor for Accumulated Knowledge

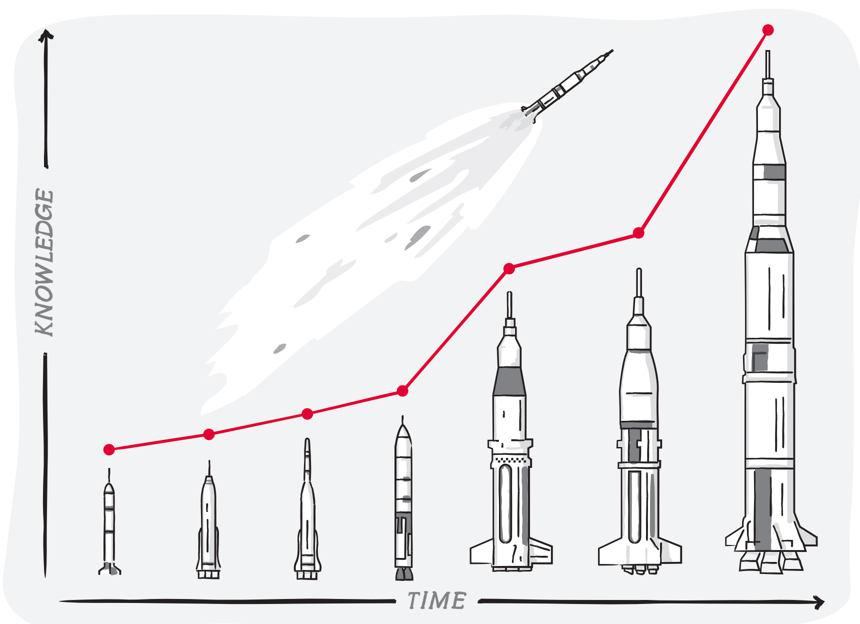
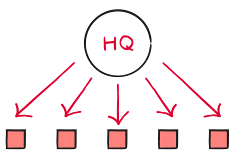


TABLE 9.1 Leadership Challenges with All-At-Once vs. Incremental Approaches

	ALL-AT-ONCE LEADERSHIP	INCREMENTAL LEADERSHIP
Attention	Diffused over many things, simultaneously.	Focused on what is novel but not yet functional or reliable.
Leadership priorities	Giant leap.	Many small steps.
Leadership challenges	Keeping pace with systems scale, scope, complexity, and speed.	Maintaining channels of communication and mechanisms for knowledge sharing and exchange.
Key responsibility	Determining who should be doing what, for what reason, in what fashion. This is by necessity fast-paced, complex, and highly detailed.	Partitioning novel from validated and ensuring experiments are being conducted rigorously and frequently.
Problem-solving	Forced into a few cycles of complex experience and experimentation; difficult sense-making with few learning-loop iterations.	Allowed more cycles of experimentation with easier sense-making and gradual introduction of scale, scope, and complexity.

FIGURE 9.4 Top-Down vs. Center-Out Leadership

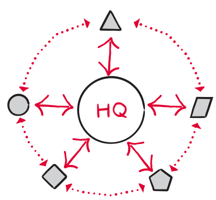
TOP-DOWN
APPROACH (CENTRALIZED)



CENTER
Assume possession of data decisions, expertise, and authority.

EDGES
Either paralyzed and waiting for direction or continuously out of compliance.

CENTER-OUT
APPROACH (DISTRIBUTED)



EDGES
Generating variety of approaches and outcomes.

CENTER
"Mining" across rich data, sythesizing and sharing, evolving best collective known methods.

TABLE 9.2 Comparing Top-Down vs. Center-Out Leadership

	TOP-DOWN LEADERSHIP	*CENTER-OUT LEADERSHIP*
Data	Centralized.	Distributed.
Decision rights	Centralized.	Distributed (but bounded).
Solutions	Homogeneous	Heterogeneous.
Leadership priorities	Coordination and control.	Facilitation, communication, and synthesis.
Leadership challenges	Keeping pace with systems scale, scope, complexity, and speed.	Creating and maintaining channels of communication and mechanisms for knowledge sharing.
Key responsibility	Determining who should be doing what, for what reason, in what fashion. This is by necessity fast-paced, complex, and highly detailed.	Creating mechanisms by which people can arrive at their own solutions and have local discovery synthesized into system solutions.
Mode of problem-solving	Leaders are forced into fast-thinking habits, routines, and impulses to be responsive to demands from operating units.	Leaders are able to maintain deliberative, slow-thinking approaches of designing, assessing, and improving the mechanisms they've created for data sharing and knowledge synthesis.

FIGURE 9.5 Job Shop for Flow Production

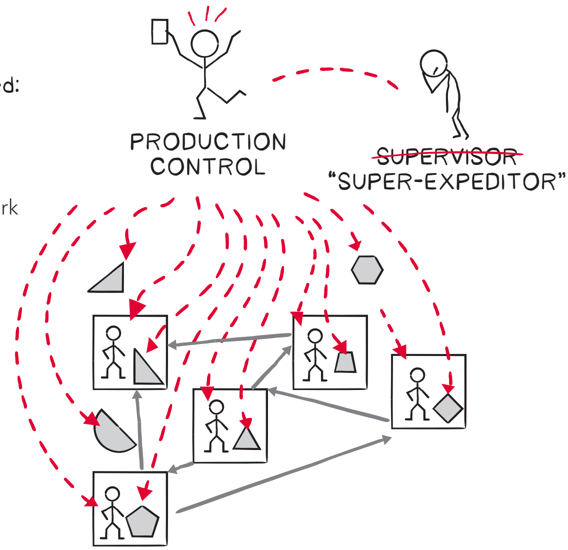
KEY: Material Flow — Information Flow

JOB SHOP

Manager becomes computationally overloaded:

- Tracking parts and people
- Computing next steps based on availability (of resources), stage of work on different jobs, etc.
- Generating schedules and reacting to gaps between reality and scheduled.
- HUGE amount of expediting and hectoring.

Scattershot reactions to persistent problems.



FLOW PRODUCTION

Management becomes cycle-time opportunity.

- People and parts have set location.
- Work has set sequence across all the steps in the flow.
- Scheduling is just on the sequence with which work enters the pipeline.
- Management attention can be refocused on technical, scientific, and engineering challenges.
  - Cycle-time reduction.
  - Reduction in cycle-time variance.
  - Line balancing.
  - Change-over-time reduction.

Persistent solutions to real problems.

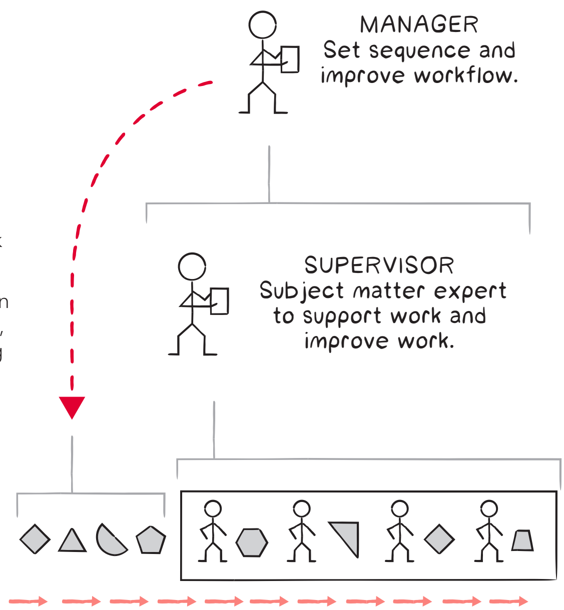


FIGURE 9.6 Flow Production vs. Partitioned Flow Production

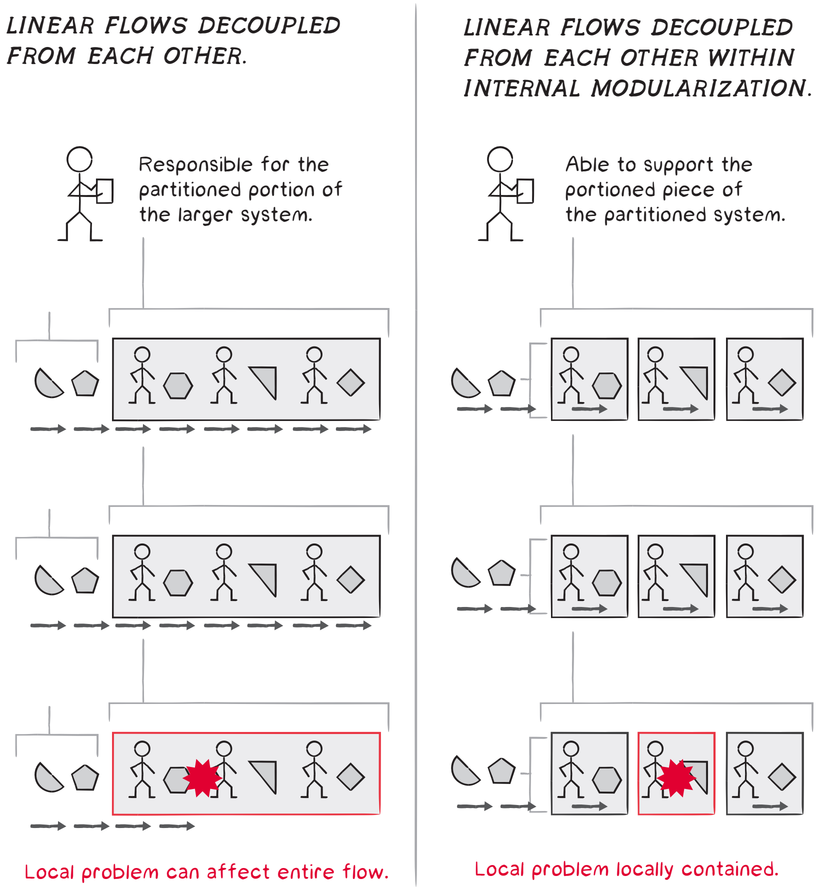


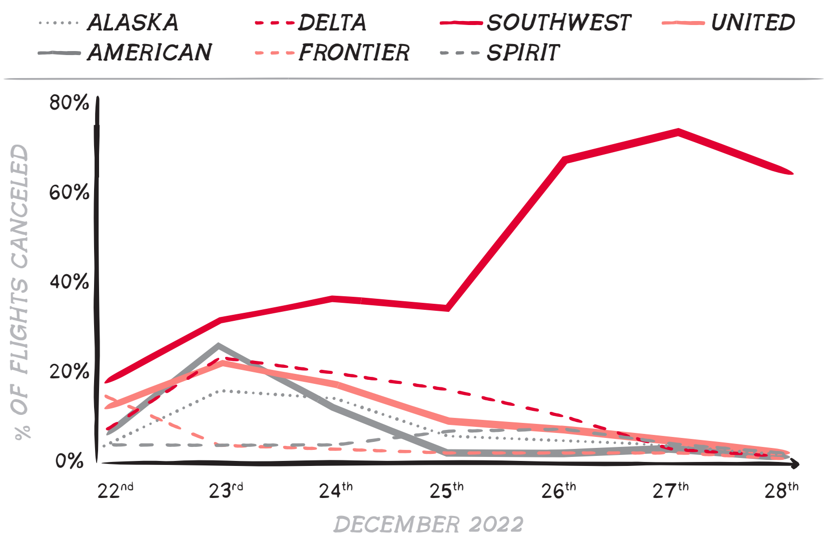
TABLE 9.3 Leadership Challenges with Nonlinear vs. Linear Flows of Work

FLOWS OF MATERIAL	
Job shop	◊ Back and forth from the point of work to some local or central storage.
Flow	◊ From the beginning of the pipeline through the end.
Partitioned flow	◊ Step by step from those who generate an intermediate output directly to those who need it as an input.
FLOWS OF INFORMATION	
Job shop	◊ Up and down from point of work to a production control (scheduling and monitoring) function.
Flow	◊ From those who need an input back to the beginning of the process.
Partitioned flow	◊ From those who need a particular input back to those directly responsible for providing it.
LEADERSHIP PRIORITIES	
Job shop	◊ Data processing: monitoring what work is in what stage of completion, in what location, to what mechanics, and what state of readiness machinery is in, AND determining what has to go where next and who has to do what next based on demand signals as they drop in.
Flow	◊ Identifying and remediating problems related to safety, cycle time, reliability, yield, quality, etc. ◊ In unpartitioned flow (i.e., imprecise standards and inadequate stabilization), there are challenges in resolving where a problem originates and how to contain its spread and correct its causes. ◊ The source is "somewhere in the pipeline" but of indeterminate time and location.
Partitioned flow	◊ Ensuring flows of work are well partitioned. ◊ Depends on assuring supporting mechanisms are in place, e.g., team leads in support of associates, group leads in support of team leads, etc., so there is enough ingenuity available to develop solutions to problems in planning, testing them in practice, and providing help (stabilization) in performance. ◊ Leader periodically gets drawn into solving problems that sprawl across several coherent elements. ◊ That is offset if the leader has developed mechanisms for supporting capability at intermediate levels.

TABLE 9.3 Leadership Challenges with Nonlinear vs. Linear Flows of Work, cont.

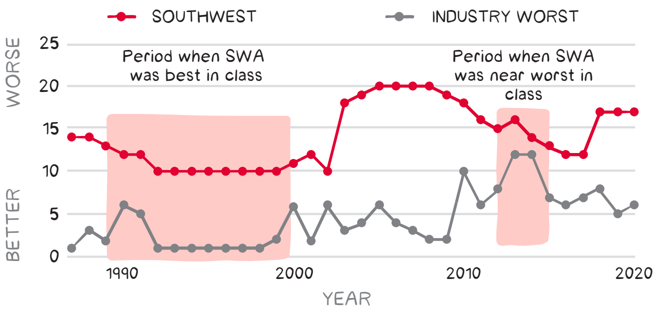
LEADERSHIP CHALLENGES	
Job shop	◊ Tracking everything and everybody all of the time.
Flow	◊ Isolating time and place of problem occurrence and fully engaging the enterprise's distributed wisdom.
Partitioned flow	◊ Creating the partitions by which people can focus on the local issues for which they're uniquely equipped to address and building capability so people can be most fully engaged.
KEY RESPONSIBILITIES	
Job shop	◊ Management as a data-processing problem.
Flow	◊ Management as a search problem of locating symptoms and causes.
Partitioned flow	◊ Management as a system architect and capability development problem.
PRIMARY PROBLEM-SOLVING CHALLENGE	
Job shop	◊ Hard to see their work as part of a larger whole. ◊ Deficiencies in scheduling and material and information handling mean point of work is under-supported in terms of necessary materials, equipment, and information.
Flow	◊ Problem in another part of the system may escape and be disruptive.
Partitioned flow	◊ Doing work according to the standard, recognize (see) problems when they occur, and call attention to problems so they can be contained and resolved so they don't endure or spread.

FIGURE 10.1 Percentage of Flights Cancelled by Airlines



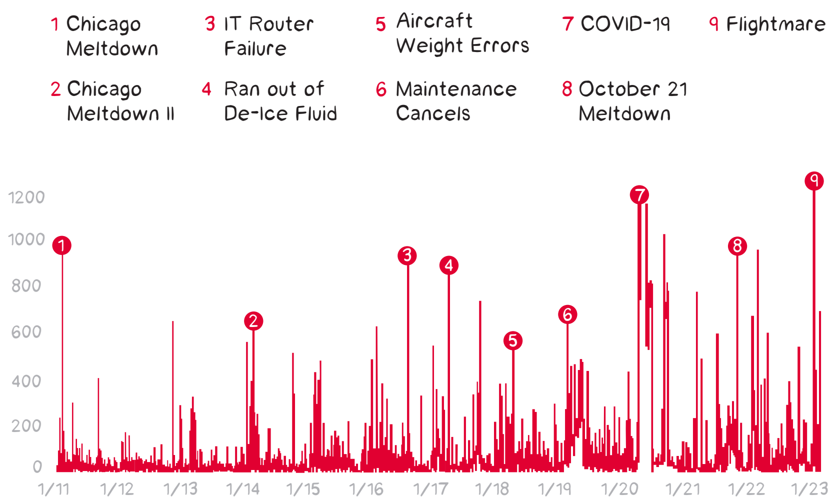
Source: Adapted from Matt Stiles and Christopher Hickey, "How Southwest Failed the Holidays: Four Charts Explaining the Cancellations," CNN.

FIGURE 10.2 Ranking of Southwest On-Time Performance against Worst in Industry (1987–2020)



Source: US Bureau of Transportation Statistics, Department of Transportation.

FIGURE 10.3 Southwest Airlines Meltdown History, 2011–2023



Source: From the Written Testimony of Captain Casey Murray.

TABLE 10.1 Signals of a Problem at Southwest vs. Gene and Steve's Hotel Refurbishment

Generate	Transmit	Receive	React	*KEY* ✸ There was a signal, and it was loud and clear. ✺ There might have been a signal, but it was weak and perhaps ambiguous in its meaning.
				GENE AND STEVE: HOTEL REFURBISHMENT
✸	✸	✸	✸	**Commentary:** Signals from the movers and painters (e.g., complaints, difficulties, scheduling errors) prompted slowification to plan and practice new approaches that included simplification techniques.
				SOUTHWEST
✸	✺			**Commentary:** Signals were either not strong enough or not detailed enough to indicate causes of delays (e.g., baggage handling, crew scheduling) or simply went unheard. Consequently, Southwest did not slowify to upgrade its infrastructure to keep pace with the changes in its operating environment.

FIGURE 10.4 Amplification of Problems through Feedback Loop

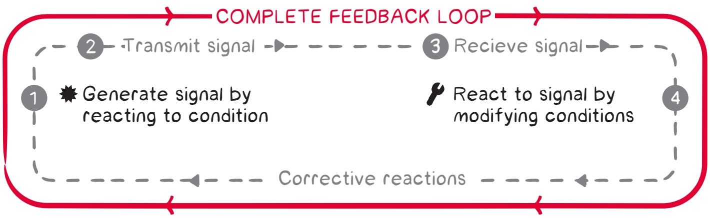


FIGURE 10.5 Using Amplification to Move from the *Danger Zone* to the *Winning Zone*

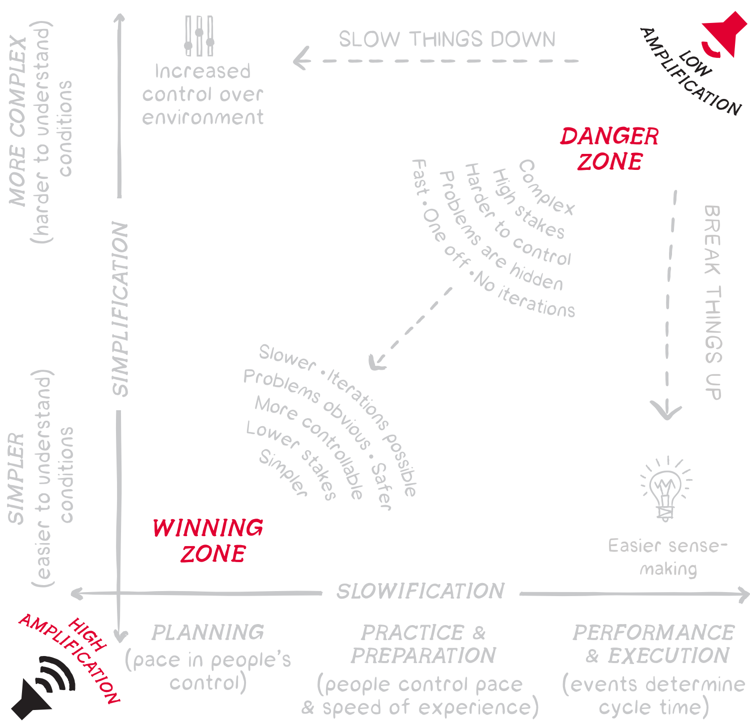


FIGURE 10.6 The Six Steps of the Amplification Feedback Loop

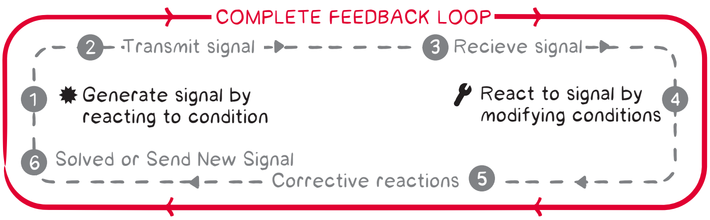
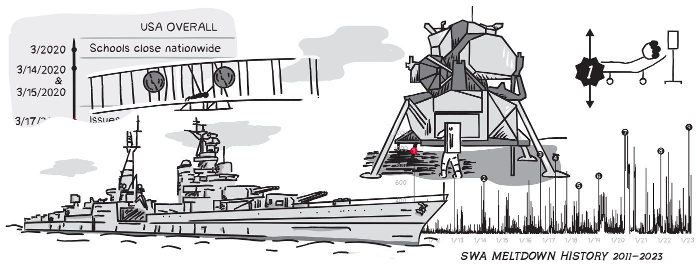


TABLE 10.2 Amplification's Presence or Absence in Cases We've Reviewed



AMPLIFICATION IN SLOWIFICATION

Generate	Transmit	Receive	React	KEY ✸ There was a signal, and it was loud and clear. ✧ There might have been a signal, but it was weak and perhaps ambiguous in its meaning.
				MIT SLOAN SAILING TEAM
✸	✸	✸	✸	Difficulty during performance triggered immediate pause for (re)planning and new practice.
				MORRIS/MORRISON
✸	✧			Confusion ignored ("where's the patient?"). Patient's protests dismissed ("you've got the wrong patient"). No pause to reset and correct the situation or to fix and prevent recurrence.
				APOLLO 11
✸	✸			Steady and relentless feedback from practice to modify plans for lunar landing (e.g., how to respond to a 1201 error code).
				COLUMBIA SPACE SHUTTLE
✸	✧			Evidence that the thermal system didn't perform as designed existed, but it wasn't reacted to (i.e., deviances were normalized).

AMPLIFICATION IN SLOWIFICATION

Generate	Transmit	Receive	React	KEY ✸ There was a signal, and it was loud and clear. ✧ There might have been a signal, but it was weak and perhaps ambiguous in its meaning.
JAPANESE NAVY LEADERSHIP (LEAD-UP TO JUNE 1942 BATTLE)				
✧	✧			Feedback during war games was dismissed as failure by subordinates to execute, rather than recognized as flaws in the battle plan.
US NAVY LEADERSHIP (1923–1940)				
✸	✸	✸	✸	Feedback during Fleet Problems was encouraged, informing development of superior operating concepts for US naval aviation.
UA232				
✸	✸	✸	✸	CRM was the result of feedback from many airline disasters and helped the flight crew slow its thinking, despite fast-moving and catastrophic circumstances. This enabled the crew to engage sound OODA loop feedback, incorporating everyone's efforts and experiences.
UA173				
✧	✧			Lack of CRM meant the crew did not have practiced slow-thinking routines to help them solve their problem, resulting in loss of situational awareness and important signals either not being transmitted or being ignored, resulting in a crash when they ran out of fuel.
GOOGLE AND AMAZON				
✸	✸	✸	✸	Use of stress tests during offline drills (practice) fed lessons learned into performance.
NETFLIX				
✸	✸	✸	✸	Chaos Monkey stress tests during performance (of a modularized system) generated lessons to be fed forward into system redesign and practiced routines.
BOSTON MASS CASUALTY PREPARATION				
✸	✸	✸	✸	Drills, exercises, and previous mass casualty events found flaws in existing procedures and informed improvements.

AMPLIFICATION IN SIMPLIFICATION

Generate	Transmit	Receive	React	*KEY* ✸ There was a signal, and it was loud and clear. ✧ There might have been a signal, but it was weak and perhaps ambiguous in its meaning. *I:* Incrementalization, *M:* Modularization, *L:* Linearization
				DART
✸	✸	✸	✸	Key point: Partitioning makes signals easier to generate, receive, interpret, and react to. *I:* Feed forward lessons from previous missions into the DART mission. *M:* Partition the DART mission into components, which were assigned to different parties.
				WRIGHT BROTHERS
✸	✸	✸	✸	*M:* Break the problem of powered flight into many problems to create feedback around each experiment quicker and clearer to incorporate into the next iteration. *I:* Small, fast, frequent experiments (e.g., wind tunnel, Kitty Hawk) increase speed of feedback to improve understanding.
				MONET AND PICASSO
✸	✸	✸	✸	*M: (Monet)* Isolated single-variable experiments in his various series to get quicker, easier feedback from changes in technique. *I: (Picasso)* Used small-scale "pilots" to get fast feedback on changes in composition.
				MENOMONEE FALLS SCHOOL REOPENINGS
✸	✸	✸	✸	*M:* Partitioned the reopening problem from county-level through district, school, and then classroom. Quicker, easier to learn relevant lessons; apply those locally and incorporate those into collective lessons learned. *I:* Daily trials increased the frequency of seeing and solving problems + weekly sharing of lessons learned.
				NAVY GUNNERY: CDR SIMS
✸	✸	✸	✸	*M:* Partitioning fleet to ships to gun crews made clearer what had been changed to improve or diminish results. *I:* Isolating the novel from the known increased clarity of the signal that a change in an approach was effective or not.

AMPLIFICATION IN SIMPLIFICATION

Generate	Transmit	Receive	React	***KEY*** ✸ There was a signal, and it was loud and clear. ✧ There might have been a signal, but it was weak and perhaps ambiguous in its meaning. *I:* Incrementalization, *M:* Modularization, *L:* Linearization
				IBM SYSTEM/360
✸	✸	✸	✸	*M:* Partitioning behind modular interfaces meant components could be developed with independence of action. Clarity at the interfaces made clear when adjacent designs would create compatibility issues.
				AMAZON E-COMMERCE SOFTWARE before
✧	✧			*M:* The tight coupling of so many functions limited independence of action and impeded understanding the source of problems and the construction and testing of corrective actions. Evidence of problems might be "transmitted," but ability to receive and react is compromised by complexity. *L:* Dev and Ops silos being separate created a slow feedback loop back to developers, and tight coupling further slowed down the pace at which tests of change could be conducted.
				AMAZON E-COMMERCE SOFTWARE after
✸	✸	✸	✸	*M:* Partitioning into modules meant problems could be seen and solved locally with significant independence of action. *L:* Elimination of "Dev vs. Ops" silos meant that every module team was responsible for their entire feedback loop (e.g., running their systems in production and interacting with their customers).
				DRUG DEVELOPMENT before
✧	✧			*L:* Having to integrate work by lab and program leaders left individual contributors disconnected from the whole without the ability to see when and how their work was or was not syncing with larger objectives and efforts.
				DRUG DEVELOPMENT after
✸	✸	✸	✸	*L:* Made clear where individual efforts fit into the larger whole. During planning, collaboration could occur across boundaries about exchanges during performance; content and format of outputs-inputs was clear.

AMPLIFICATION IN SIMPLIFICATION

Generate	Transmit	Receive	React	KEY ★ There was a signal, and it was loud and clear. ☆ There might have been a signal, but it was weak and perhaps ambiguous in its meaning. *I:* Incrementalization, *M:* Modularization, *L:* Linearization
				PRATT & WHITNEY **before**
☆	☆			*L:* Disconnect of individual engineers from a larger situational awareness made it slower and harder to see when and where problems were occurring that needed resolution.
				PRATT & WHITNEY **after**
★	★	★	★	*L:* Working across functions rather than up and down silos fed faster, more frequent feedback on design of components and how they fit into larger systems.
				TEAM OF TEAMS **before**
☆	☆			*L:* Poor integration of individual efforts through collective action toward a common purpose meant that information realized in one function wasn't transmitted or received quickly and clearly enough to trigger a productive reaction to what had been learned.
				TEAM OF TEAMS **after**
★	★	★	★	*L:* Direct linkages across different military, intelligence, and diplomatic units moved information through systems faster and more frequently and allowed greater clarity about what signals meant and how they should be reacted to.
				MANNED MOON MISSIONS
★	★	★	★	*I:* Validate man, machine, and methods on one flight (a signal of an effective approach) and build upon that foundation with novelty (increasing clarity of signal of effectiveness or ineffectiveness). *M:* Partitioning of the entire system into components (e.g., capsule separate from booster in Mercury, command and service module different from landing module in Apollo, simulators assigned to different contractors than operational components) made signals easier to see and react to. *L:* "System engineering" gave clearer definition to the pattern of interdependencies (potential interferences) among component systems, allowing collaboration about interface design and independent design behind interface; ensured that important signals were received by everyone who needed them.

AMPLIFICATION IN SIMPLIFICATION

Generate	Transmit	Receive	React	KEY
				✸ There was a signal, and it was loud and clear. ✸ There might have been a signal, but it was weak and perhaps ambiguous in its meaning. ***I:*** Incrementalization, ***M:*** Modularization, ***L:*** Linearization
				SOUTHWEST
✸	✸			Signals weren't strong enough or detailed enough to indicate causes of delays (e.g., baggage handling, crew scheduling) or simply went unheard. As a result, Southwest did not slowify to upgrade its infrastructure to keep pace with the changes in its operating environment.

FIGURE 10.7 The Six Steps in the Amplification Feedback Loop

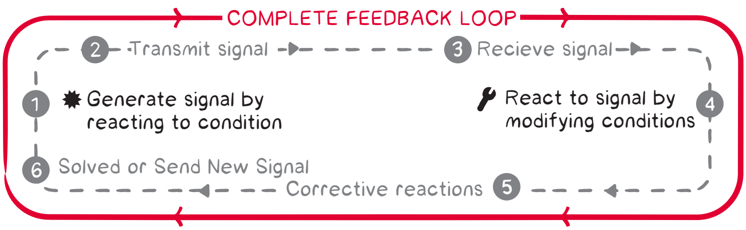


FIGURE 10.8 Leadership to Supporting Ratios at Toyota Plant

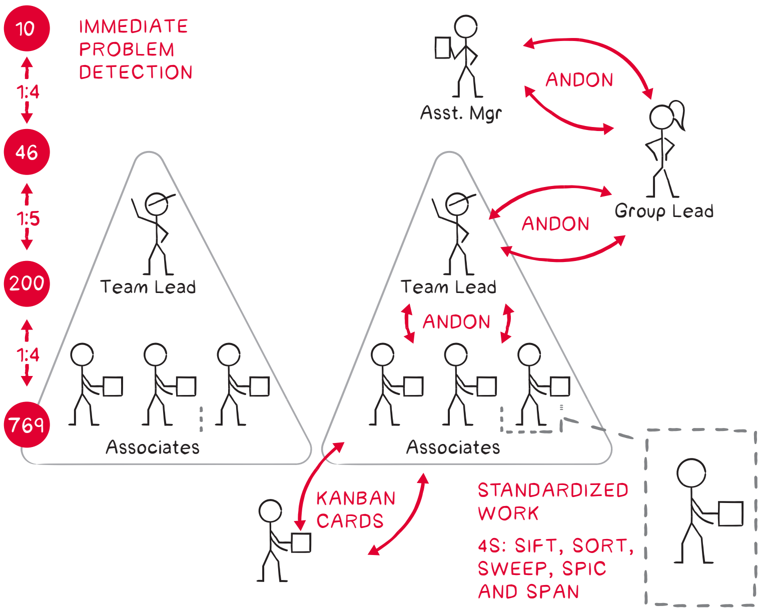


FIGURE C.1 Venn Diagram of How Different Practices Slowify, Simplify, or Amplify

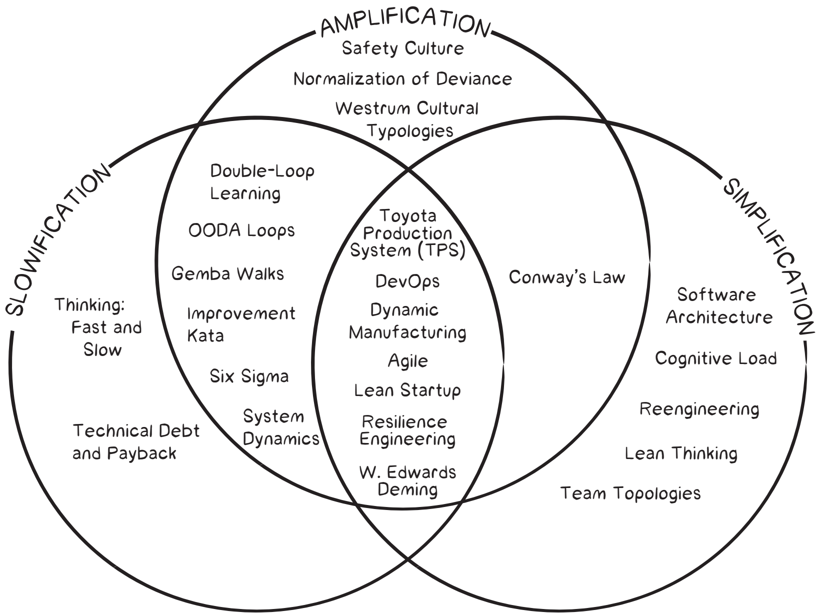


TABLE C.1 Common Practices Compared to Slowification, Simplification, and Amplification

PRACTICE OR THEORY	Slowification	Simplification			Amplification	KEY *I:* Incrementalization, *M:* Modularization, *L:* Linearization
		I	*M*	*L*		***COMMENTS***
Toyota Production System *Ohno, Liker, Spear*	✓	✓	✓	✓	✓	When done at its highest levels, TPS is characterized by flow, linearization, standardization (simplification), and tests built in to work to reveal problems (amplification), which trigger offline, disciplined problem-solving (slowification).
DevOps *Debois, Forsgren, Humble, Kim, Willis*	✓	✓	✓	✓	✓	Set of architectural practices (modularization, linearization), technical practices (incrementalization), and cultural norms (slowification, amplification) that enable software delivery performance and organizational performance.
W. Edwards Deming	✓			✓	✓	Championed a number of approaches for increasing the clarity of feedback in systems. Control charts to make it clearer sooner whether a process was in control or not. Shewhart problem-solving cycles to make clearer what hypotheses are being tested and whether or not they are being refuted. These and other methodologies make possible the steady generation and accumulation of "profound knowledge" that allows for ever better performance.
Agile Software Development	✓	✓			✓	Emerged as an attempt to build through a process of discovery, aiming to deliver higher-quality software more quickly, through small, fast, and frequent iterations. By encouraging developers to interact with users, user feedback was amplified.

PRACTICE OR THEORY	Slowification	Simplification I	Simplification M	Simplification L	Amplification	KEY *I:* Incrementalization, *M:* Modularization, *L:* Linearization COMMENTS
Lean Startup *Blank, Ries*	✓	✓			✓	Feedback-rich cycling of incrementally improved products, sales and marketing processes, etc., so the entirety of the business model is discovered iteratively and dynamically.
Resilience Engineering *Hollnagel, Woods, Leveson, Allspaw*	✓		✓		✓	Studies how systems and organizations can absorb and adapt to shocks and disruptions, recognizing that complex systems are inherently unpredictable and that failure is inevitable, but that systems can be designed and managed to prevent these failures from leading to catastrophic outcomes.
System Dynamics *Forrester, Sterman*	✓				✓	Key point: how systems are structured determines the patterns of feedback in them, and thus determines their dynamic behavior over time.
Double-Loop Learning *Argyris, Schön*	✓				✓	Recognizing that something has gone awry and reacting to that by changing how one understands situations. In contrast to single-loop learning, which doesn't trigger appropriate learning reactions.
Improvement Kata *Rother*	✓				✓	Emphasizes a structured, disciplined approach to problem-solving that makes clear and tests hypotheses (understand direction, set a challenge, grasp the current condition, set the next target condition, and conduct experiments to achieve the target condition).

PRACTICE OR THEORY	Slowification	Simplification *I*	Simplification *M*	Simplification *L*	Amplification	**KEY** *I:* Incrementalization, *M:* Modularization, *L:* Linearization *COMMENTS*
"Gemba Walks," Empowerment, Participative Management	✓				✓	When done faithfully, promotes a culture of openness, collaboration, and continuous learning and active involvement and decision-making authority at all levels of an organization to enhance performance and problem-solving.
Conway's Law			✓	✓		Organizations design and build systems that mirror their communication structure.
Cognitive Load *Sweller, Reason*			✓	✓		Cognitive load is associated with how much information someone needs to know and understand in order to get their work done. High cognitive load can lead to mistakes, slow progress, and poor decision-making.
Team Topologies *Skelton, Pais*	✓		✓	✓		Uses cognitive load to inform team structures and architectures, noting that the organization of teams directly affects the software systems created.
Technical Debt *Cunningham, Cagan*	✓					Term used in software to delay slowification, leading to problems that get increasingly more difficult to fix over time, continually reducing our available options in the future, increasing our cost of change over time.
Software Architecture *Brooks, Parnas*			✓			Described properties of encapsulation (the ability to make changes to one module without changing other modules), high cohesion, low coupling, interchangeability, and reuse.

PRACTICE OR THEORY	Slowification	Simplification			Amplification	KEY *I:* Incrementalization, *M:* Modularization, *L:* Linearization COMMENTS
		I	*M*	*L*		
Normalization of Deviance *Vaughan*					✓	What were once considered defects and errors become accepted as normal, so feedback diminishes (weaker generation and transmission) that problems exist, and even if they are called out, they are less acknowledged as being worthy of attention (weakened reception and reaction).
Lean Thinking *Womack, Jones*				✓		Emphasis on value stream, flow, and pull as actions to improve efficiency (remove waste) and improve quality.
Psychological Safety *Edmondson*					✓	Social, psychological, and professional impediments to calling out problems (squelching of generation and transmission of useful feedback) diminishes the ability of individuals and groups to learn and improve.
Cultural Typologies *Westrum*					✓	Described information flow as a prime variable in creating safety, but also an indicator of organizational functioning. Defined three categories of organizations: pathological, bureaucratic, and generative.

APPENDIX A

Influences: Authors, Thinkers, and Leaders

We want to take a moment to explain the substantial number of influences and theories that inform this book, which draws on management, engineering, and mathematics. For the avid reader and thoughtful practitioner (and academics) who have spent time studying these areas, you may find the lineage of ideas interesting and surprising.

§

What is novel about our theory is that it directly addresses the mechanisms of the social circuitry that enables organizations to achieve these performance advantages. And it recognizes that coordinating and synchronizing various specialties is an information problem to support creative collaboration. The concept of *circuitry* will be familiar to those concerned with how machines connect to and communicate with other machines. We apply it here to how people and groups communicate and coordinate with each other.

Wiring the Winning Organization asserts that outsized performance doesn't come merely from reorganizing the shop floor or from adjusting how materials pass through machines (literally or figuratively). Doing so still leaves people spending time and energy on heroics to get things they need to succeed (e.g., information, approvals, requirements, time), navigating often bewildering and byzantine work conditions, processes, procedures, policies, politics, rules, and regulations in their daily work (what we call the *danger zone*).

Instead, the most successful organizations are those that create conditions in which people can fully focus their intellects on solving difficult problems collaboratively and toward a common purpose, delivering solutions that have great societal value (conditions that we call the *winning zone*).

Creating such conditions requires developing and engaging three mechanisms to get out of an operating *danger zone* and into a contemplative *winning zone*:

1. **slowification** of the environment in which the problem-solving occurs to make problem-solving easier;
2. **simplification** of products, processes, and systems through the use of modularization, incrementalization, and linearization to make the problems themselves easier; and
3. **amplification** to make it more obvious that problems are occurring so they can be seen and solved.

This book explored each of these concepts at length. These insights build on and are informed by streams of research in management theory and adjacent areas that are worth breaking down briefly. We'll start with *slowification*.

There are distinctions between fast and slow thinking, as explained by Dr. Daniel Kahneman and Dr. Amos Tversky, that we lean heavily into throughout Part II of the book. Their work distinguishes between slower conditions (in which people can be deliberate, reflective, and creative) versus faster-moving, higher-stakes conditions (in which people must depend upon the "muscle memory" of practiced habits and routines because there is neither sufficient time nor emotional or psychological safety to consider if new approaches might be warranted).[1]

Slowification expands upon this concept by placing an emphasis on creating opportunities to absorb feedback that fosters self-reflection and self-correction. This connects to the literature on organizational learning from systems scientist Dr. Peter Senge's *The Fifth Discipline*, business theorist Dr. Chris Argyris's *Organizational Learning*, and work by philosopher Dr. Donald Schön.

Simplification may be the most difficult of the three mechanisms because there are three distinct techniques to engage it—modularization, incrementalization, and linearization.

- **Modularization** simplifies problems by partitioning *large, complex systems* (the elements of which have highly intertwined interdependencies) into systems that are more modular in structure, with each module having clearly defined boundaries and established conventions for interactions with other modules. Clarity around modularization was influenced by Dr. Steve Eppinger's design structure matrix concepts, Dr. Carliss Baldwin and Dr. Kim Clark's book *Design Rules*, Dr. Charles Perrow's ideas around complexity and coupling in *Normal Accidents*, and the wealth of architectural practices around APIs, containers, domain-driven design, and so forth.
- **Incrementalization** simplifies problem-solving by converting a *few, complex experiments* (in which many factors are being tested simultaneously) into *many smaller, faster, simpler experiments* (in which fewer factors are being tested individually). It does this by partitioning what is already known and validated from what is novel and new, and by adding to the novelty in many small bits rather than in a few large bites. This simplification method is informed by agile processes for product development, and, for the enterprise more generally, by work about the "lean launchpad," as explained by Steve Blank's *The Four Steps to the Epiphany* and by Eric Ries in *The Lean Startup*.
- **Linearization** *sequences* tasks associated with completing a larger set of work so that they flow successively, like a baton being passed from one person to the next. What follows is *standardization* for those sequences, for exchanges at partition boundaries, and for how individual tasks are performed. This creates opportunities to introduce *stabilization*, so that when a problem occurs, it triggers a reaction that contains the problem and prevents it from enduring and from its effects from spreading. This allows for *self-synchronization*, so the system is self-pacing without top-down monitoring and

direction. Linearization (as well as amplification and slowification) draws from the teachings of the Toyota Production System and Taiichi Ohno; Hammer and Champy's book *Reengineering the Corporation* (which championed a process view for organizing enterprises in lieu of an overly functionalized approach); Dr. Bob Hayes, Dr. Steve Wheelwright, and Dr. Kim Clark's *Dynamic Manufacturing* (which also speaks to a process view of organizing versus a functional, metric-driven approach); Dr. Eliyahu Goldratt and Jeff Cox's *The Goal*; Dr. James Womack, Dr. Daniel Jones, and Dr. Daniel Roos's *The Machine that Changed the World*; and, of course, Dr. Jeffrey Liker's monumental *The Toyota Way*.

The science around the *amplification* (or suppression) of small problems includes "normalization of deviance," as explained by Dr. Diane Vaughan in *The Challenger Launch Decision*, and feedback as critical for stability and progress, as explained by Dr. Jay Forrester and the systems dynamics community. The common link is that in the absence of fast, frequent, and useful feedback, systems of any type—technological, biological, social, psychological—will experience instability and even collapse. Systems with reliable feedback that triggers appropriate reactions are stable, resilient, and agile in even the most arduous situations. In the long term, systems that have adequate feedback and are capable of adaptation will improve, sometimes in dramatic ways, both by direction and magnitude.

Amplification also draws heavily on the work about control systems of Dr. Harry Nyquist and Dr. Claude Shannon in "Communication in the Presence of Noise," and Shannon and Dr. Warren Weaver's 1948 book *The Mathematical Theory of Communication*.

There's a meta-acknowledgment necessary here, and that is from Steve to mentors Dr. Clay Christensen and Dr. H. Kent Bowen for pushing so hard on developing a bona fide theory that explains competitive success. Both emphasized, supported, and coached the "inductive" element of theory building—observation, description, categorization, classification, and finally, declaration of causality. They were both wildly supportive of the "deductive" element of theory testing by creating hypotheses that could be refuted or not in practice. Neither Gene nor Steve would have been so obsessive in creating a "simple" theory of learning-based operational excellence without having this thinking in mind.

Last, we don't want to understate how strongly we argue against the static transactional notions of management and leadership that have so relentlessly gripped theory and practice. Decades ago, economist Dr. Michael Porter compared industrial sectors. He found that those in which competition was less perfect—due to the firms' ability to lock in customers and suppliers and lock out rivals—offered higher returns than those in which competition was more perfect—due to the ruthlessness of challenge and the greater difficulty of differentiating one's own offerings from those of rivals.[2]

However, by having the "unit of analysis" of the industrial sector, Porter's theory of differentiation by positioning couldn't explain the sustained heterogeneity of outcomes, even within highly competitive sectors. In other words, competitive advantage alone couldn't explain Toyota's outlandish successes, overcoming whatever barriers to entry existed to newcomers and beating rivals in an otherwise level playing field, once it was established in the sector.

Yet, obsessiveness about grand strategic vision has, it seems, blinded too many manager/leaders to the opportunity to take a developmental approach, as we saw throughout the book. That developmental approach is not one of incessantly figuring out what transactions will yield the highest reward from existing resources in already established ways. While the transactions may be many, the mindset is not sufficiently dynamic. Rather, the developmental approach requires designing and improving the social circuitry by which people can best apply their creative energies to find new and better things to do with their time and the resources they have, and by developing new and better ways to do so.

Similarly, agency theory, as credited to economists Dr. Michael Jensen and Dr. William Meckling, takes the general notion that people respond to incentives in motivating their actions and creates a reductionist view of characterizing enterprises as primarily a collection of contractual relationships.[3] Get the metrics and incentives right, it would suggest, and people will behave accordingly. Again, this is a rather transactional notion of people's efforts, one that leaves little consideration for collaboration or coordination.

The problem is, of course, that the right metrics vary by degree of aggregation, phase, type of value creation, and so forth. How one measures performance in pharmaceutical research and development is different from measuring performance in clinical trials or production. So, you'd either have to measure everything by the same standards (so measure everything poorly) or you'd have to create metrics and rewards that are too impossibly diverse to monitor effectively.

And, of course, there's an implied assumption that you know well enough about what needs to be done individually and collectively, and you know well enough about how to get it done that contracts can be well written. So, organizations trying to create metrics, accountability, and incentives to drive performance—rather than designing systems that are able to harness the investment people are already willing to make in achieving great things together—miss the developmental opportunities that create the chance for greatness.

In contrast, we present slowification, simplification, and amplification as the mechanisms by which a developmental approach of creating new and better things in new and better ways can be most fully expressed.

APPENDIX B

Transactional vs. Developmental Leadership

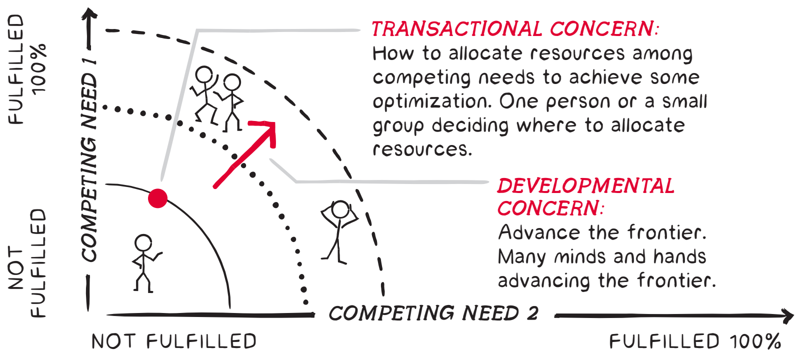
To better see the contrast between transactional and developmental leadership mindsets, let's revisit NASA's experience with the *Apollo 11* landing (and the missions that preceded it) and that of Boston's medical community on the day of the marathon bombing.

When asked about what limitations hinder their ability to create and deliver value, transactional leaders will likely be concerned about constraints (row *a* in Table A.1). They will point out that they have limited resources, which restrict the alternatives available to which those resources can be put to use. For them, the corrective action is to improve resource allocation, either by transactions in a market to get more or better people and more or better resources or by some algorithm (e.g., assign them better for more productive uses), (row *c*), to achieve some "optimal" outcome as measured by productivity, efficiency, profitability, utility, and so forth, (row *d* in Table A.1).

The result is that they are stuck operating within a frontier, constantly weighing what to do with what they have, and why to do it, based on costs and benefits. That is also reflected in Figure A.1. Those with a transactional mindset are constantly doing cost-benefit analysis, trying to determine how much of Need 1 to satisfy at the expense of not meeting all of Need 2, and vice versa. For transactional leaders, their only relief is to add more resources.

We must acknowledge that almost everyone, at some point, is forced into transactional cost-benefit analyses. However, those with a developmental mindset are able to create much better alternatives to choose from than they would have had otherwise. In contrast to transactional leaders, developmental leaders constantly expand the frontier to expand the possibilities (i.e., possible choices) available to them and their colleagues.

FIGURE A.1 Transactional vs. Developmental Attitudes



Optimizing on the frontier or advancing it (collaboratively).

Consider how developmental leaders responded to the following *danger zone* situations of fast-moving, unforgiving, uncontrollable, high-stakes, and nonrepeatable conditions in which they simply had to do the best that they could with the resources that were immediately available. On July 20, 1969, Neil Armstrong and Buzz Aldrin had a limited set of backup alternatives from which to choose (including aborting their mission) when they discovered that the designated lunar landing zone was strewn with boulders. On Patriots' Day 2013, Boston-area hospitals had limited alternatives as to what to do with patients already in their emergency departments when they found that trauma patients from the marathon bombing were on the way, who would need half or more of the capacity typically available.[1]

1 Escort commanders had to make terrible choices during the early months of 1943, when the Battle of the Atlantic was in full fury. German U-boat submarine "wolf packs" were exacting huge tolls on convoys crossing from East Coast ports to bolster Britain with men and materials. They could scout ahead for the enemy, head back to protect the flocks of slower-moving cargo ships, or stay even farther back to pick up survivors of ships that had already been torpedoed. The resources were few, the demands were many, and the choices were terrible.

In those situations, developmental leaders were able to create far better choices in those *danger zone* situations. Aldrin and Armstrong had an alternative landing spot and a way to land safely because NASA had invested so heavily in preparatory, feedback-rich planning and practice that tested people, systems, and processes. NASA had created *winning zone* conditions of greater simplicity, lower risk, more controllability, and repeatability to build a repertoire of possibilities. NASA invested in building the skills to solve the difficult problems that might have imperiled the successful lunar landing of *Apollo 11*'s crew and expanded the number of possible alternatives available to the crew. In doing so, they were using the same developmental mindset that characterized NASA's management of itself and its university and corporate partners from the early days of the Mercury program, through the Gemini missions, and those Apollo flights that had preceded *Apollo 11*.

On the day of the marathon bombing, Boston-area emergency departments had routines they could employ to get patients already in the emergency department admitted into other units of the hospital (or quickly discharged) to clear space and allow attention to the trauma casualties. This was because they'd done so many drills and other rehearsals to expand their set of alternatives.

Similarly, leaders at Amazon were faced with thousands of software engineers with little independence of action, having increasing difficulties making changes within a tightly coupled software system, often resulting in global outages. Instead of hiring more managers to coordinate the work being done on Layer 1 and Layer 2 problems, Amazon focused instead on creating *winning zone* conditions by re-architecting their Layer 3 wiring, which brought back independence of action to software teams. This enabled them to push the frontiers of performance, from twenty risky software deployments per year in 2011 to doing 136,000 routine deployments per day in 2015.

Those specific examples highlight the mindset that distinguishes developmental leaders from ones who are always transactional. For developmental leaders, the limitations are not resources but useful knowledge about what to do with the resources that are available and how and why to get it done. In other words, the limitation is lack of knowledge (ignorance), (row *a* in Table A.1), for which the corrective action is creating and utilizing conditions in which it's far easier for people individually and collaboratively to solve difficult problems quicker, easier, and better (row *b*).

The objective for them is not finding an optimal solution along a fixed frontier. It is advancing the frontier of what solutions are possible (row *c*). And that leads them in the direction of creating systems in which people can succeed, so that they can generate great solutions to difficult problems, and then bring those ideas into action (row *d*). In the longer term, the developmental leader is not constantly lobbying for more resources, which would otherwise be used in much the same fashion for the same purposes as the resources that are already available. Instead, developmental leaders are always trying to figure out how to improve the problem-solving capabilities of the people for whom they are responsible.[2]

Therefore, as shown in the Figure A.1, developmental leaders' concerns are different from transactional ones. They are not constantly recalculating how much of Need 1 to satisfy at the expense of Need 2 or how much of Need 2 to satisfy in trade-off with Need 1. Rather, they're trying to figure out how to engage the minds of more people pushing together to advance the frontier of what is possible.

We've seen distinctions between the transactional and developmental mindset throughout the various cases. The developmental mindset is one of relentless and iterative experimentation. That is why designers in any field, who have such a developmental mindset, are always looking to increase the number and speed of iterations from which we might learn. Their desks will be covered by (the equivalent of) drawings and they are marked by mock-ups and prototypes. Then they will construct scale models and increasingly realistic models before committing to the final design, which can be constructed and released.

2 In the book *Engineers of Victory*, it is shown that while in the short term, commanders had to make terrible transactional decisions for every convoy, the good fortune was that, in parallel, a developmental effort was also occurring: development of better code breaking to anticipate where U-boats might be lurking, development of better sonar to detect U-boats, and better long-range aircraft to destroy the U-boats once they'd been detected. Yes, in the short term, leaders were limited to short-term, transactional decisions. But the developmental engine behind them meant that the frontier of possibilities was being pushed out and the set of alternatives was improving.

TABLE A.1 Contrasting Transactional and Developmental Leadership

		TRANSACTIONAL ORIENTATION	DEVELOPMENTAL ORIENTATION
a	What limits our ability to create and deliver value?	Scarce resources and the limited alternatives for which they can be used.	Useful understanding of resources' best possible use: the range of alternatives that might be pursued and how to use the resources most effectively in pursuit of those possibilities.
b	What actions can we take to meet our goals?	"Optimization": allocation of scarce resources to best possible use (by transaction [in a market] or reassignment [by algorithm]).	Slowification, simplification, and amplification make it quicker and easier to solve difficult problems better.
c	What are we trying to achieve?	Achieve some optimal point on the frontier of what is achievable, given the resources available.	Advance the frontier of what is achievable by bringing new and useful knowledge into practice.
d	What is primary and what has to adapt?	The system is primary, and people have to adapt to it.	The people are primary, and the system has to be adapted to fit people and the work they have to do individually and collaboratively, so more value is created quicker and easier.
e	What is needed to increase output?	More resources.	Better problem-solving.

Literally or figuratively, projects for them are crumpled-up sketches overflowing from a wastebasket, foam-core models scattered on a desk, and drawing sets that are numbered by their double-digit revisions. Of course, if not for those iterations, subject to strong (self-)critical review, code wouldn't run, medications wouldn't work, planes wouldn't fly, cars would underperform, articles and books would be unreadable, and buildings would leak and be poorly lit.

Transactional vs. Developmental Mindset in Improving Layer 3 Processes

We see such a developmental mindset come into play when it comes to designing new or improving existing processes. Transactional leaders focus on the process itself. They believe that by carefully calculating and developing a solution, they can effectively impose it on the individuals responsible for executing it. This approach stems from the belief that limited resources are the primary constraint and the appropriate course of action is to allocate them optimally.

Contrast that to leaders with a developmental mindset. Their starting assumption is that their limitation is insufficient understanding about how to use the resources available to them; that better understanding has to be discovered. So, they don't try to fix everything all at once. They partition a microcosm model line from the larger whole of the enterprise.

This presents an opportunity for individuals to collaborate with their colleagues, identify areas that are not functioning effectively, propose new approaches, rapidly test them in real-world scenarios, learn from the outcomes, and iterate for further discoveries. In practice, the model line serves as the practical equivalent of sketches and scale models used by designers, who are focused on continuous development.

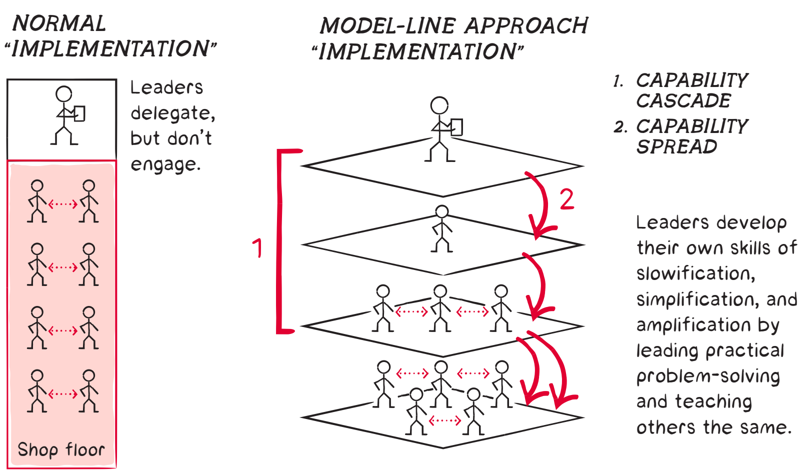
How We Teach Layer 3 Skills: Model Lines and Developmental Leadership

The model line can be used to build Layer 3 skills in much the same way that it can be used for problems in Layers 1 and 2. It facilitates a rapid comprehension of processes, but it also becomes a platform in which more people can build the skills for being great Layer 3 designers, operators, and improvers. The model line is a small piece of the larger whole. It is more controllable; fewer people are involved, so coordination is easier, less disruptive, and less costly; and the consequences of it not working are manageable. Furthermore, there's more opportunity to pause, plan again, and practice anew.

When learning how to solve problems in Layers 1 and 2, professionals are first trained to understand the underlying principles and science of their domains. As first principles are being introduced, small problems are being offered—preferably with feedback and coaching—and work is often completed on paper. Then they explore and iterate to solve increasingly larger problems. As skill is demonstrated, less work is on paper and more is practical problem-solving with small projects. If successful, they then become responsible for increasingly larger, more complex, and more consequential projects that might require more collaboration.

So too with building great Layer 3 skills. The model line can not only serve as the platform for piloting and validating new ideas of social circuitry, but it can also be the training ground for those who need exposure to, practice with, and mastery of the mechanisms of slowification, simplification, and amplification.

FIGURE A.2 Transactional vs. Developmental Mindsets: Improving Processes Directly or through the Minds and Hands of Colleagues



The model line yields multiple outputs. It generates lessons learned about problems in Layers 1 and 2. It identifies how to better use the technical and administrative apparatuses available to create the products and services for which the enterprise is responsible. It yields insights into better Layer 3 designs for processes, procedures, and routines. And, model lines increase the number of people creating better conditions for themselves and for those for whom they are directly responsible.

In organizations, we are all likely, at some point, to be responsible for teaching someone something that is important. The transactional mindset is to focus on grading the learner, whereas the developmental mindset will be focused on building capability.

Transactional and developmental mindsets are also found throughout education, from primary school through professional training. For instance, we can see this with how a high school teacher might handle a quiz. A transactional teacher might focus on the graded outcomes without allowing for opportunities to learn from the wrong answers. A developmental teacher might focus on the opportunity wrong answers give for more practice and learning.

Those wrong answers might be recognized as amplification of what students didn't yet know and what they still needed to learn. The response to those signals would be to focus on teaching students how to correctly do problems of the types that each had gotten wrong.

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Many people had a direct impact on the content and form of this book. First, it wouldn't exist without lessons learned from my wife, Miriam. Our offices adjoin, so I get to vicariously learn from her work as an architect. Ideas into plans are only part of that work, which I've come to appreciate. Designing great community buildings that help build great communities (the Layer 1 object in our parlance and the focus of Miriam's work) depends on creating an outstanding Layer 3 social circuitry to draw on and synthesize toward common purpose the contributions of clients, consultants, builders, sub-contractors, inspectors, and suppliers. Seeing how this happens every day helped model each of the mechanisms about which we write.

Several mentors passed while this book was gestating, each of whom left us with unfinished homework.

Clayton Christensen taught that "disruptive innovation" isn't a technological issue; it is a behavioral one. Incumbents get so entwined in their existing mental models of what to sell, to whom, and with what value proposition, that they stop looking for answered problems because they'd lost their empathy for and concerns about the problems of people they didn't know well.

Clay's homework: Go find someone about whom you've given no consideration, learn what their concerns are, and try to develop solutions that fit them and their circumstances.

Hajime Ohba was General Manager for Toyota's supplier support center in North America. Ohba-san taught how tightly aligned the experiences of people doing work were directly with the metrics of the enterprise, showing how to use shop-floor observations to test if the social circuitry that conveyed material, information, tools, skills, and support helped associates to succeed. If not, that was a critique of the conditions leaders had created and premonition of competing poorly.

Ohba's homework: Find someone who is struggling to be consistently creative. Commit time and create the program to build their skills as a problem-solver and create conditions in which they can succeed.

Paul O'Neill led Alcoa, created and championed the Pittsburgh Regional Healthcare Initiative, and was Secretary of the Treasury. Paul led Alcoa during an extraordinary transformation. High-hazard worksites had been high risk, with injuries occurring at rates you would associate with mining, refining, smelting, forging, extrusion, and other heavy industrial processes. Paul championed a dynamic of amplifying little problems so they would be seen and solved before they became big ones. This wasn't just a technical solution of amplifying glitches. It was a social revolution, giving voice to people who'd badged in or punched into work to call out risks they faced, with the expectation that those "higher up than them" would respond immediately by swarming and solving immediate problems and quickly sharing what had been discovered. By this, Alcoa had achieved near-perfect workplace safety, best in the USA, while also improving on quality, yield, time to market, and so forth. He then showed the local healthcare community how the same dynamic would improve patient safety and quality of care while also improving the workforce's experiences too.

Paul's homework: Find people for whom you are responsible and ask them: Are you treated with dignity and respect? Are you given whatever you need to succeed, and does this bring value to your life? Are you recognized for what you do by someone whose opinion matters? Conditions that generate a "no" to any of these merit correction.

Who knows where our understanding of industrial competitiveness would be without Norman Bodek. When American political and corporate leaders were responding to Japanese competitiveness as a Cold War-like nation-state contest, Norman went to Japan, found the expert teachers there, as was his regular practice of finding great teachers for anything that interested him, and created a publisher, Productivity Press, to share their wisdom with English speaking practitioners. It is because of Norman that English readers first knew of Taichi Ohno and Shigeo Shingo. Later in life, Norman shared his own well-earned wisdom, authoring numerous books to remind leaders to focus on the human experience, with machines and materials as supportive of that, rather than getting lost in the costs and quantity of inanimate objects and forgetting those exist only so people can create value for other people.

Norman's homework: Find something you know nothing about. Study it. Teach others what you have learned.

For nearly a hundred years, the Feuerstein family operated Malden Mills, pioneering Polartec, fleece fabrics more generally, and other textile innovations. This is a significant accomplishment. Given their fabrics' performance in unforgiving environments, one can imagine that the company's products did more than make people comfortable. For some, they helped prevent terrible harm in adverse conditions. That the Feuerstein's did this as a New England-based manufacturer, when the industry as a whole was seeking low wages, is also remarkable enough.

However, in December 1995, a catastrophic fire erupted, destroying the factory. Owner Aaron Feuerstein could have done the "normal" thing: collect the insurance money and move on to other things. Instead, he committed to rebuilding, promised to keep the workforce on the payroll in the meantime, and was able to restore employment to nearly the entire workforce, thereby earning the sobriquet "the Mensch of Malden."

Aaron's homework: Ask yourself, with the authority and opportunities you've been given, for whom do you have responsibility?

Many have been unusually generous in letting me see the nitty-gritty of what they do, exposing the difficulty, the detail, and the necessary skill in every creative act. Others have repeatedly shaped and reshaped my thinking by telling me what was wrong. Their contributions are throughout this book.

This includes but is not limited to: Stephen Ashman, John Baldoni, Carliss Baldwin, Joe Barto, Eric Bergamen, Lorraine Bittner, Steve Blank, Chuck Blackledge, Jamie Bonini, Kent Bowen, Rick Breckenridge, Scott Brown, Christopher Brunett, John Carrier, Ellen Chang, BJ Cloutier, Darrell Cook, Ross Csaszer, Karen Davis, Eric Dickson, Christina Dixon, Brian Donnell, Gadi Dvir, Steve Eppinger, Steve Fahey, Alice Fakre, Roberto Fernandez, Jeff Gallimore, Corey Gallo, Brad Garber, Daniel Gordon, Patricia Greco, Bill Green, Jeff Gross, Berto Guerra, Christian Guerra, Bruce Hamilton, Scott Harvey, Peter Hirst, Lucy Holt, Trent Hone, Susann Kazunas, Jeff Jablon, Joel Jergeson, Tami Johnson, Allison Kakmar Richards, Michael Kavanaugh, Steve King, Beth Knapp Read, Tom LaBatt, David Lane, Bill Lescher, Steve Levisohn, David Lewis, Stan McChrystal, Paul McClay, Patricia McDonald, Maria Mentzer, Nicole Morlinaro, Pete Newell, Anna Noak, Jose Olivero, Sam Paparo, Jason Paragas, Vickie Pisowicz, Keith Reitel, John Richardson, Kevin Schilling, Lorin Selby, Dale Shaver, David Silverman, Ezra Sivan Zuckerman, Doug Small, Jason Stack, John Sterman, Michael Stewart, Patrick Stoy, Scott Swift, Michael Tamasi, Keith Terhune, Jeff Trussler, Tim Tyler, Kevin Voelkel, Martin Wallace, Des Walker, Matt Welborne, Steven Wheelwright, Ken Whitesell, Mark Whitney, James Wolfe, Tony Wood, and Ron Wyatt.

In terms of details and nitty-gritty, authors get credit for their work, with editors as the hidden figures. That's just not fair. A book is the Layer 1 "technical object" being created; the authors are working at Layer 2; and the editor works through them by managing Layer 3's processes of text generation, editing, and so forth. We are indebted to and appreciative of Anna Noak, Leah Brown, and their team through this process.

Lastly, in terms of generation to generation, I'm a fourth-generation American whose time is spent in factories, shipyards, laboratories, clinics, and with members of the armed forces, hopefully learning a lot from everyone and sharing back what I can. By coincidence or by design, that continues the family tradition. There, great-grandparents Izzy and Helen Spielman, who had a shoe factory in Punxsutawney, creating good jobs for good people to make good products. My other great-grandparents, Jack and Bessie Wasserman, also immigrants, who'd gone into the clothing business. My one grandfather, Sol Spear, worked in the Brooklyn shipyards during the war, while his wife, Gussie, was raising two boys amidst war-time scarcity and all the anxiety about what was befalling their families, in Europe. My other grandfather, Gene Wasserman, served overseas as did his brother, Bunny, and two brothers-in-law, Len Zoref and Seymour Hirsch, while their wives Anita, Rita, Selma, and Muriel held down the homefront in their absence. There are countless educators, healers, and community servants in the family—my parents, Bernie and Laurie; my brother Jonathan and his wife Lisa; Miriam's parents, Dr. Angel and Matilde Tropp; Miriam's brother Daniel, and many others. Hopefully, this book and the work it represents help continue and sustain the next generations, in at least a small way, such family commitments.

ABOUT THE AUTHORS

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Spear once worked in finance, at a Congressional agency, and at the University of Tokyo. He has a doctorate from Harvard, a masters degrees in mechanical engineering and management from MIT, and a bachelor's degree in economics from Princeton. He and his wife, Miriam, an architect, live in Brookline, Massachusetts, where they volunteer for several community organizations.

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