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GUIDELINES FOR DRAWING CAUSAL LOOP DIAGRAMS

The old adage "if the only tool you have is a hammer, everything begins to look like a nail" can also apply to language. If our language is linear and static, we will tend to view and interact with our world as if it were linear and static. Taking a complex, dynamic, and circular world and linearizing it into a set of snapshots may make things seem simpler, but we may totally misread the very reality we were seeking to understand. Making such inappropriate simplifications "is like putting on your brakes and then looking at your speedometer to see how fast you were going," says author Bill Isaacs.

Articulating Reality

Causal loop diagrams provide a language for articulating our understanding of the dynamic, interconnected nature of our world. We can think of them as sentences that are constructed by linking together key variables and indicating the causal relationships between them. By stringing together several loops, we can create a coherent story about a particular problem or issue.

Following are some more general guidelines that should help lead you through the process:

- **Theme selection.** Creating causal loop diagrams is not an end unto itself, but part of a process of articulating and communicating deeper insights about complex issues. It is pointless to begin creating a causal loop diagram without having selected a theme or issue that you wish to understand better. "To understand the implications of changing from a technology-driven to a marketing-oriented strategy," for example, is a better theme than "To better understand our strategic planning process."

- **Time horizon.** It is also helpful to determine an appropriate time horizon for the issue—one long enough to see the dynamics play out. For a change in corporate strategy, the time horizon may span several years, while a change in advertising campaigns may be on the order of months.

Time itself should not be included as a causal agent, however. After a heavy rainfall, a river level steadily rises over time, but we would not attribute it to the passage of time. You need to identify what is actually driving the change. In computer chips, $/MIPS (million instructions per second) decreased in a straight line in the 1990s. It would be incorrect, however, to draw a causal connection between time and $/MIPS. Instead, increasing investments and learning curve effects were likely causal forces.

- **Behavior over time charts.** Identifying and drawing out the behavior over time of key variables is an important first step toward articulating the current understanding of the system. Drawing out future behavior means taking a risk—the risk of being wrong. The fact is, any projection of the future will be wrong, but by making it explicit, we can test our assumptions and uncover inconsistencies that may otherwise never get surfaced. For example, drawing projections of steady productivity growth while training dollars are shrinking raises the question, "If training is not driving our growth, what will?" The behavior over time diagram also points out key variables that should be included, such as Training Budget and Productivity. Your diagram should try to capture the structure that will produce the projected behavior.

- **Boundary issue.** How do you know when to stop adding to your diagram? If you don't stay focused on the issue, you may quickly find yourself overwhelmed by the number of connections possible. Remember, you are not trying to draw out the whole system—only what is critical to the theme being addressed. When in doubt, ask, "If I were to double or halve this variable, would it have a significant effect on the issue I am mapping?" If not, it probably can be omitted.

- **Level of aggregation.** How detailed should the diagram be? Again, the level should be determined by the issue itself. The time horizon also can help determine how detailed the variables need to be. If the time horizon is on the order of weeks (fluctuations on the production line), variables that change slowly over a period of many years may be assumed

TEAM TIP

Create causal loop diagrams together as part of a process of gaining insights into complex issues.

to be constant (such as building new factories). As a rule of thumb, the variables should not describe specific events (a broken pump); they should represent patterns of behavior (pump breakdowns throughout the plant).

- **Significant delays.** Make sure to identify which (if any) links have significant delays relative to the rest of the diagram. Delays are important because they are often the source of imbalances that accumulate in the system. It may help to visualize pressures building up in the system by viewing the delay connection as a relief valve that either opens slowly as pressure builds or opens abruptly when the pressure hits a critical value. An example of this might be a delay between long work hours and burnout: After sustained periods of working 60+ hours per week, a sudden collapse might occur in the form of burnout.

Causal loop diagrams provide a language for articulating our understanding of the dynamic, interconnected nature of our world.

See page 7 for detailed guidelines for drawing causal loop diagrams.

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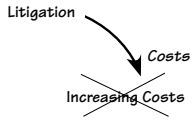
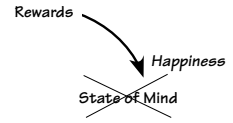
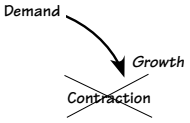
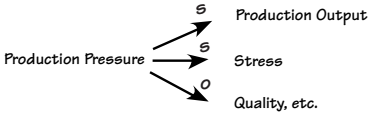
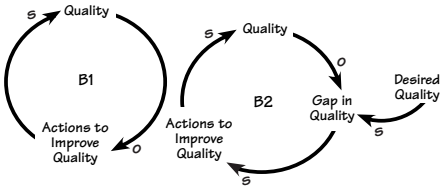
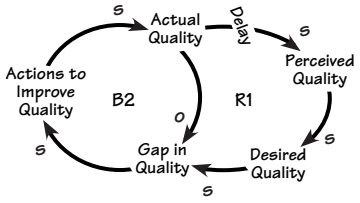
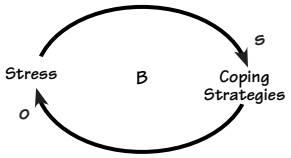
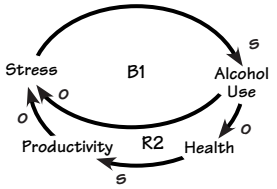
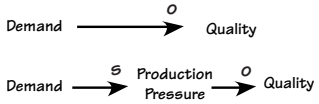
	GUIDELINE	EXAMPLE
SELECTING VARIABLE NAMES	**1** Use nouns when choosing a variable name. Avoid verbs and action phrases, because the action is conveyed in the loop's arrows. For example, "Costs" is better than "Increasing Costs," because a decrease in Increasing Costs is confusing. The sign of the arrow ("s" for same or "o" for opposite) indicates whether Costs increase or decrease relative to the other variable.	
	2 Use variables that represent quantities that can vary over time. It does not make sense to say that "State of Mind" increases or decreases. A term like "Happiness," on the other hand, can vary.	
	3 Whenever possible, choose the more "positive" sense of a variable name. For example, the concept of "Growth" increasing or decreasing is clearer than an increase or decrease in "Contraction."	
LOOP CONSTRUCTION	**4** Think of the possible unintended consequences as well as the expected outcomes for every course of action included in the diagram. For example, an increase in "Production Pressure" may increase "Production Output," but it may also increase "Stress" and decrease "Quality."	
	5 All balancing loops are goal-seeking processes. Try to make explicit the goals driving the loop. For example, Loop B1 may raise questions as to why increasing "Quality" would lead to a decrease in "Actions to Improve Quality." By explicitly identifying "Desired Quality" as the goal in Loop B2, we see that the "Gap in Quality" is really driving improvement actions.	
	6 Distinguishing between perceived and actual states, such as "Perceived Quality" versus "Actual Quality," is important. Perceptions often change slower than reality does, and mistaking the perceived status for current reality can be misleading and create undesirable results.	
	7 If a variable has multiple consequences, start by lumping them into one term while completing the rest of the loop. For example, "Coping Strategies" can represent many different ways we respond to stress (exercise, meditation, alcohol use, etc.).	
	8 Actions almost always have different long-term and short-term consequences. Draw larger loops as they progress from short- to long-term processes. Loop B1 shows the short-term behavior of using alcohol to combat stress. Loop R2, however, draws out the long-term consequences of this behavior, showing that it actually *increases* stress.	
GENERAL TIPS	**9** If a link between two terms requires a lot of explanation to be clear, redefine the variables or insert an intermediate term. Thus, the relationship between "Demand" and "Quality" may be more obvious when "Production Pressure" is inserted between them.	
	10 A shortcut to determining whether a loop is balancing or reinforcing is to count the number of "o's" in the loop. An odd number of "o's" indicates a balancing loop (i.e., an odd number of U-turns keeps you headed in the opposite direction); an even number or no "o's" means it is a reinforcing loop. CAUTION: After labeling the loop, you should always read through it to make sure the story agrees with your R or B label.