Chapter 5

The Improvement Kata - Planning Phase

Step 2: GRASP THE CURRENT CONDITION

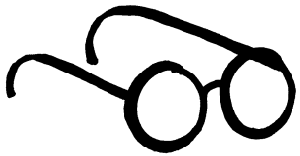
A Simple Process-Analysis Kata

Practice this Routine

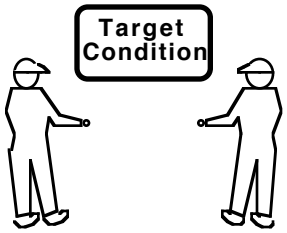
ORIENTATION

Understand the Direction

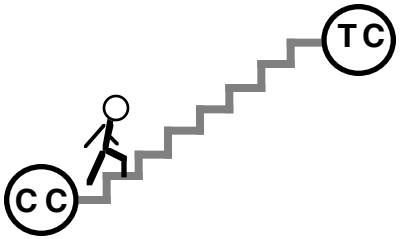
Grasp the Current Condition



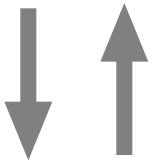
Establish the Next Target Condition



Iterate Toward the Target Condition

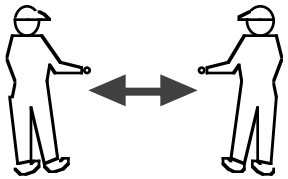


What is the current performance and working pattern?



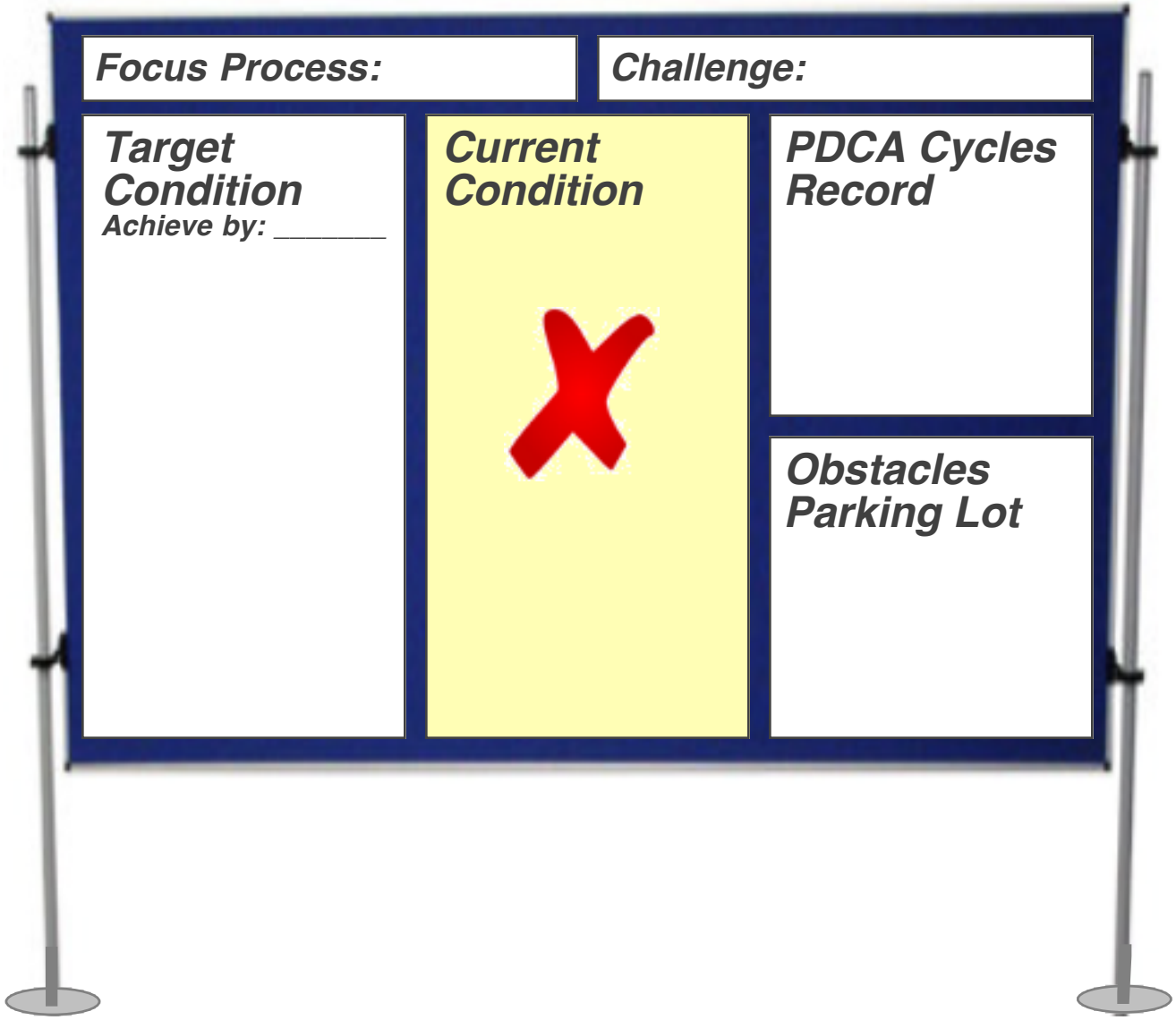
'Planning' Coaching Cycles

'Executing' Coaching Cycles



LEARNER'S STORYBOARD

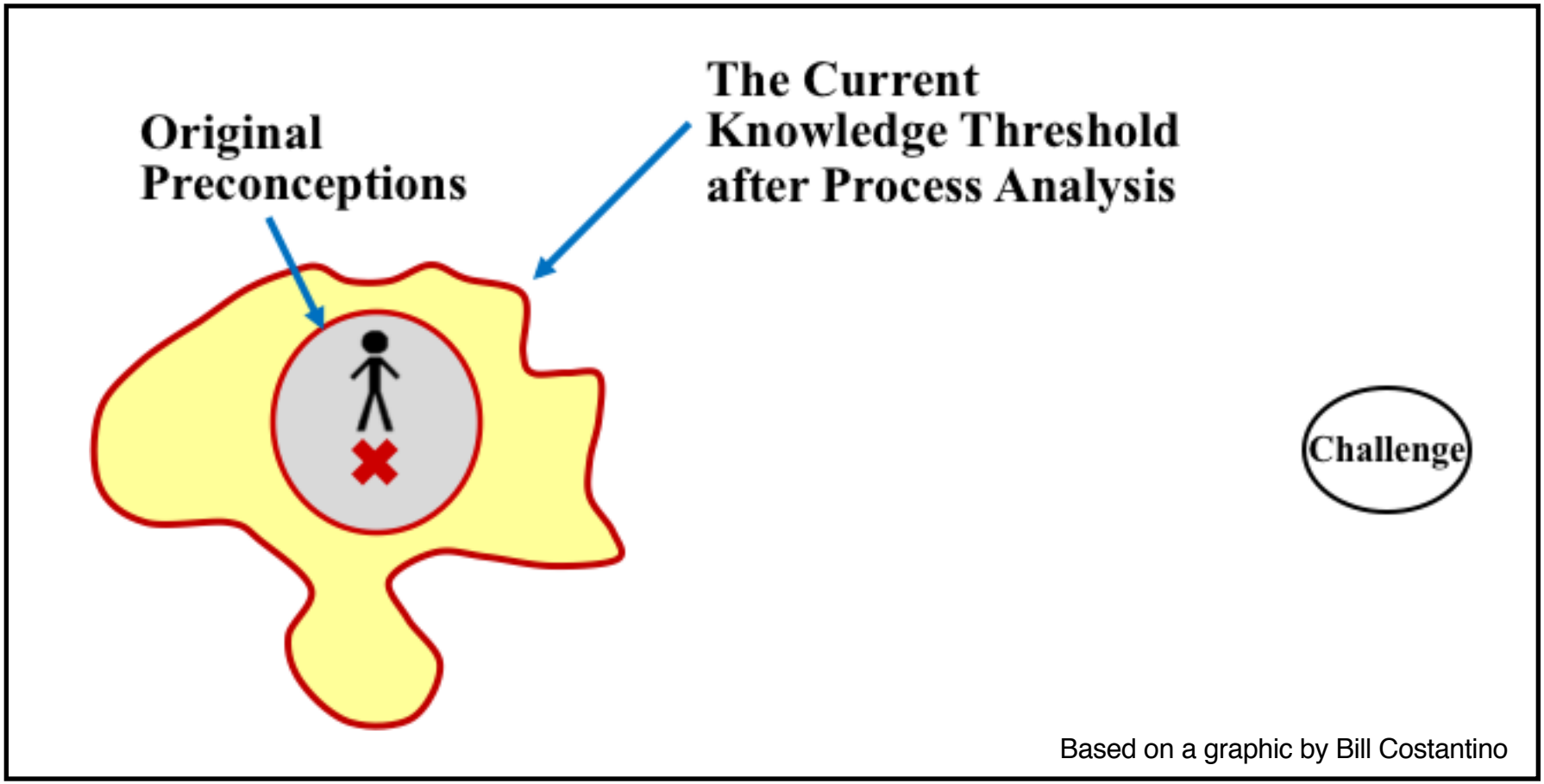
Learner and Coach are now concentrating on this field



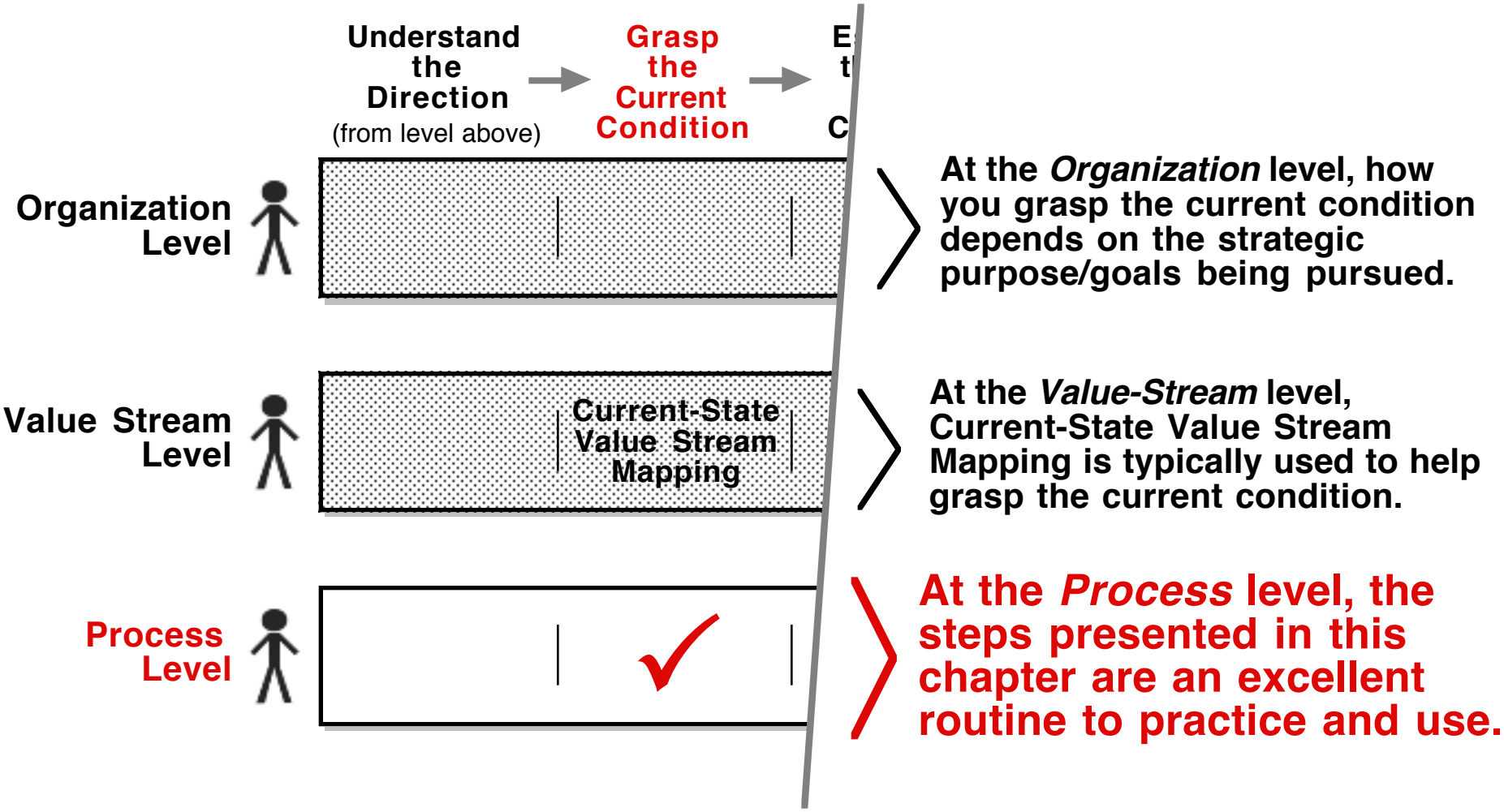
Concept Overview

WHAT IS *GRASPING THE CURRENT CONDITION*?

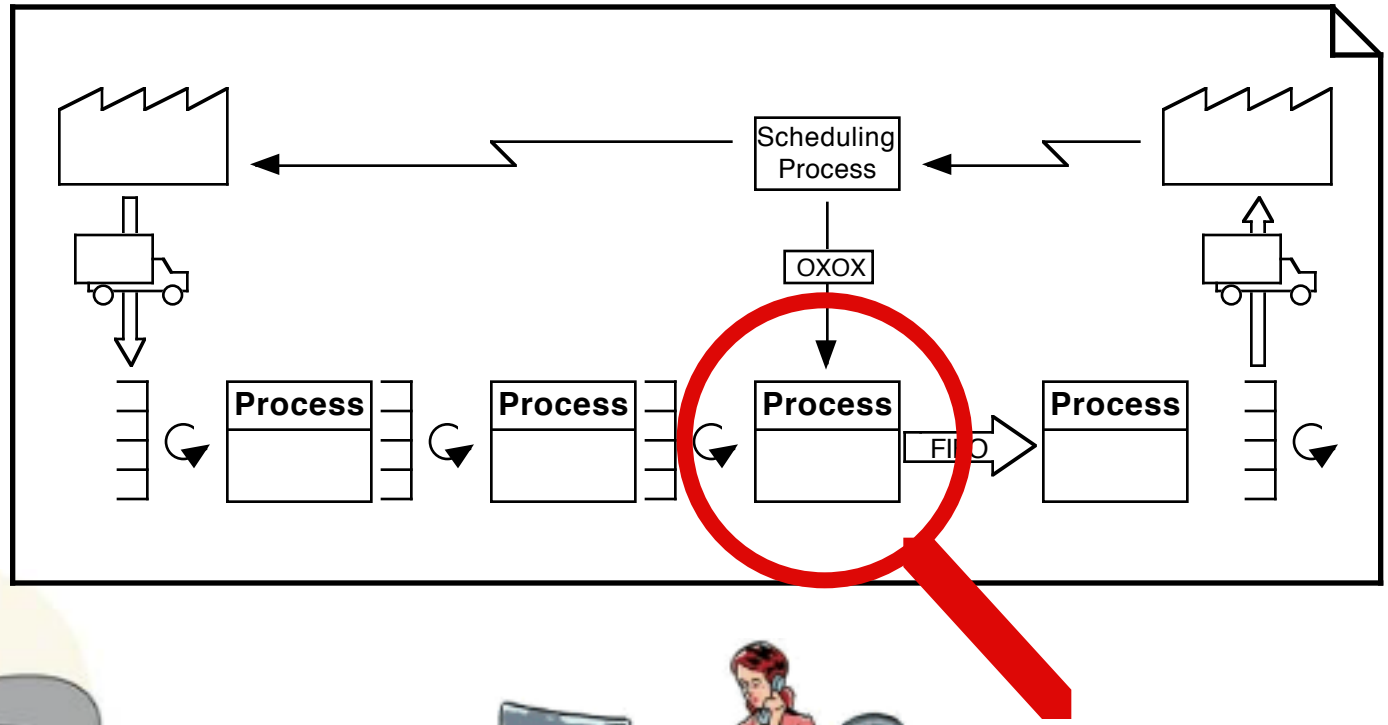
Grasping the current condition here means immersing yourself in a focus process to analyze and understand how it currently performs and operates. This chapter provides you with a structured practice routine (a Kata) for doing that with any work process.



THIS CHAPTER PRESENTS A FUNDAMENTAL ROUTINE FOR GRASPING THE CURRENT CONDITION AT THE PROCESS LEVEL



THIS PROCESS ANALYSIS IS TYPICALLY DONE AT AN INDIVIDUAL WORK PROCESS



A PROCESS is the work that a *person* or a *group of persons* do as they interact with objects such as routines, schedules, materials and equipment.

PURPOSE

The purpose of this process analysis Kata is to get a baseline understanding of the focus process. That's all.

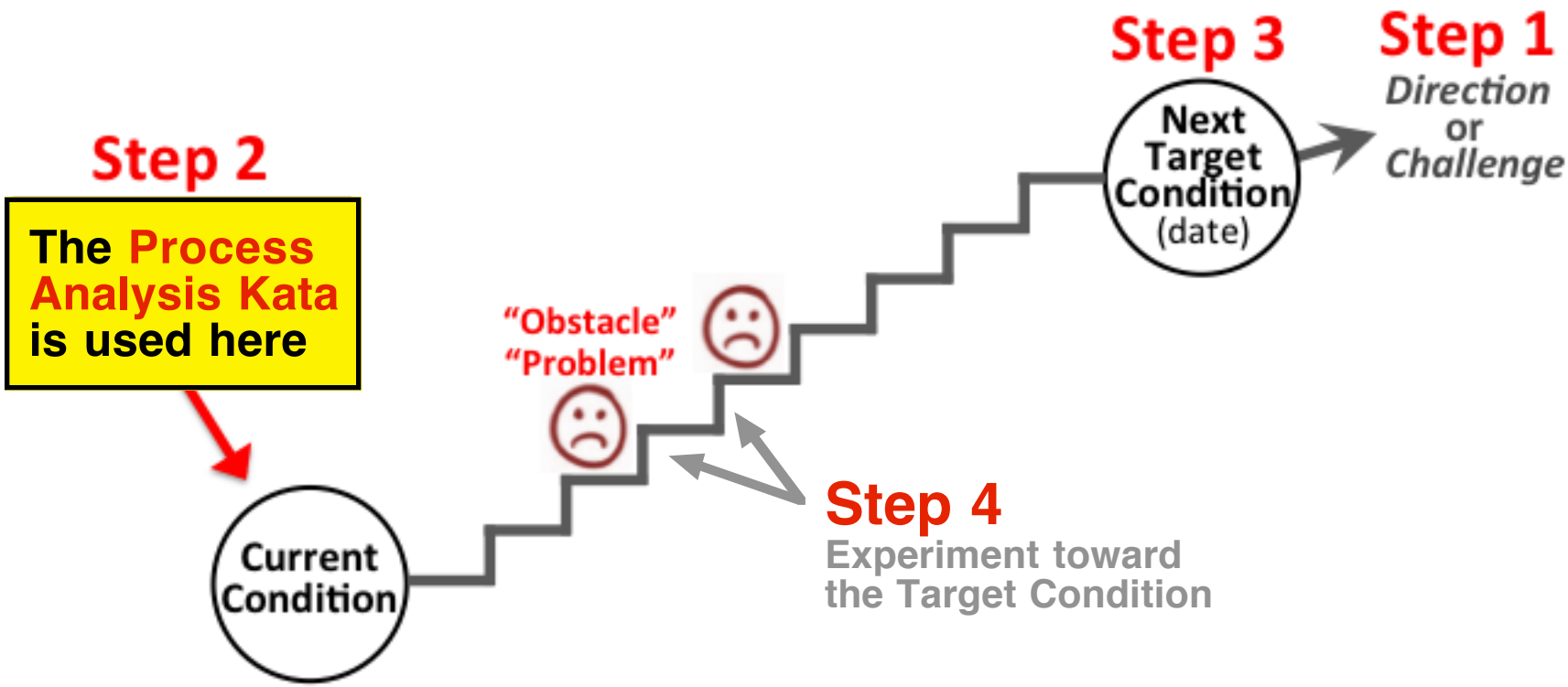
Process Analysis (or "Grasping the Current Condition") is about getting an understanding of the current outcome performance and operating characteristics/patterns of the focus process, so you can then define an appropriate next "Target Condition."

Process Analysis is a prerequisite for establishing a Target Condition. Analyzing the current condition is done to obtain facts & data about what's really going on, which you then use to describe an appropriate next target condition.

Caution! The purpose of this process analysis is <u>not</u> to uncover problems, wastes or potential improvements. Process Analysis is *not* about identifying issues to work on. Once you have established a target condition and strive to move toward it, then you'll discover the obstacles that you *need* to work on.

Grasping the <u>initial</u> current condition is a step toward establishing a <u>first</u> Target Condition. When you are ready to establish a second Target Condition for the same process you'll have learned a lot about that process through the experimenting in the *Executing* phase of the Improvement Kata. The process analysis for the second Target Condition may therefore procede more quickly, since you are not starting over.

WHERE THIS PROCESS ANALYSIS FITS INTO THE IMPROVEMENT KATA STEPS



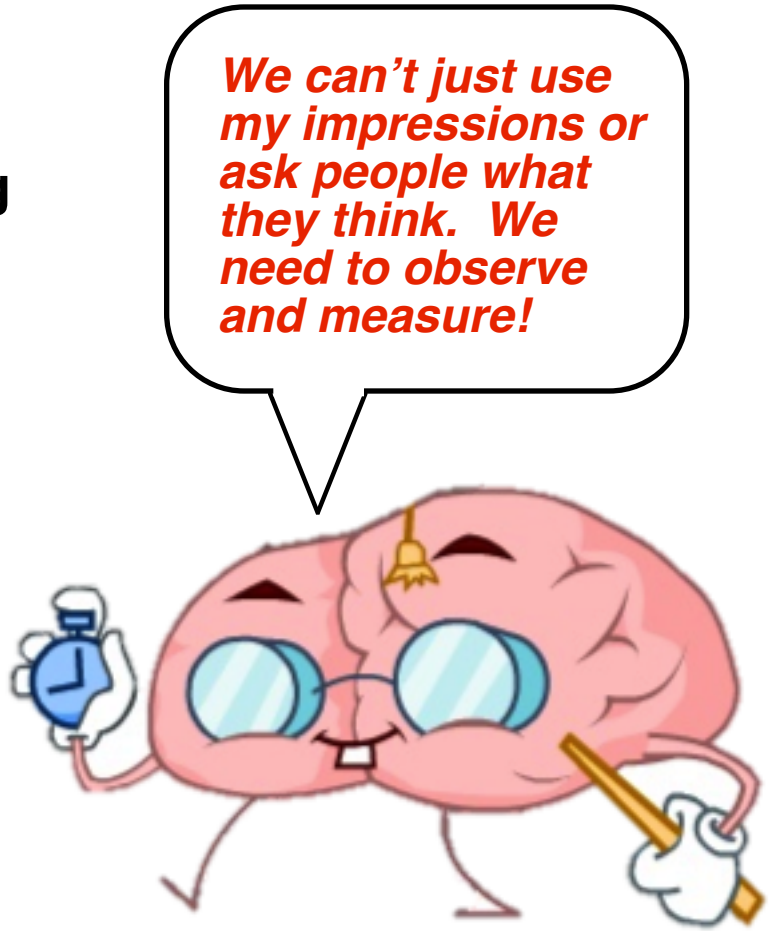
REALITY IS NOT OBVIOUS

We can't depend on our brain's intuition for an accurate assessment of the current situation, no matter how well we think we already know the focus process.

It would be unscientific to start discussing goals and steps to take based on our impressions and intuitions, before objectively analyzing the current operating patterns of the focus process.

Practicing the pattern of the process analysis kata helps you develop an open-minded way of looking. It's a procedure to follow in order to see and understand non-obvious characteristics of a work process.

This is a step toward increasing our comfort in crossing the threshold of knowledge and iteratively discovering the path to the next target condition through the grey zone.



WHY PRACTICE THIS KATA?

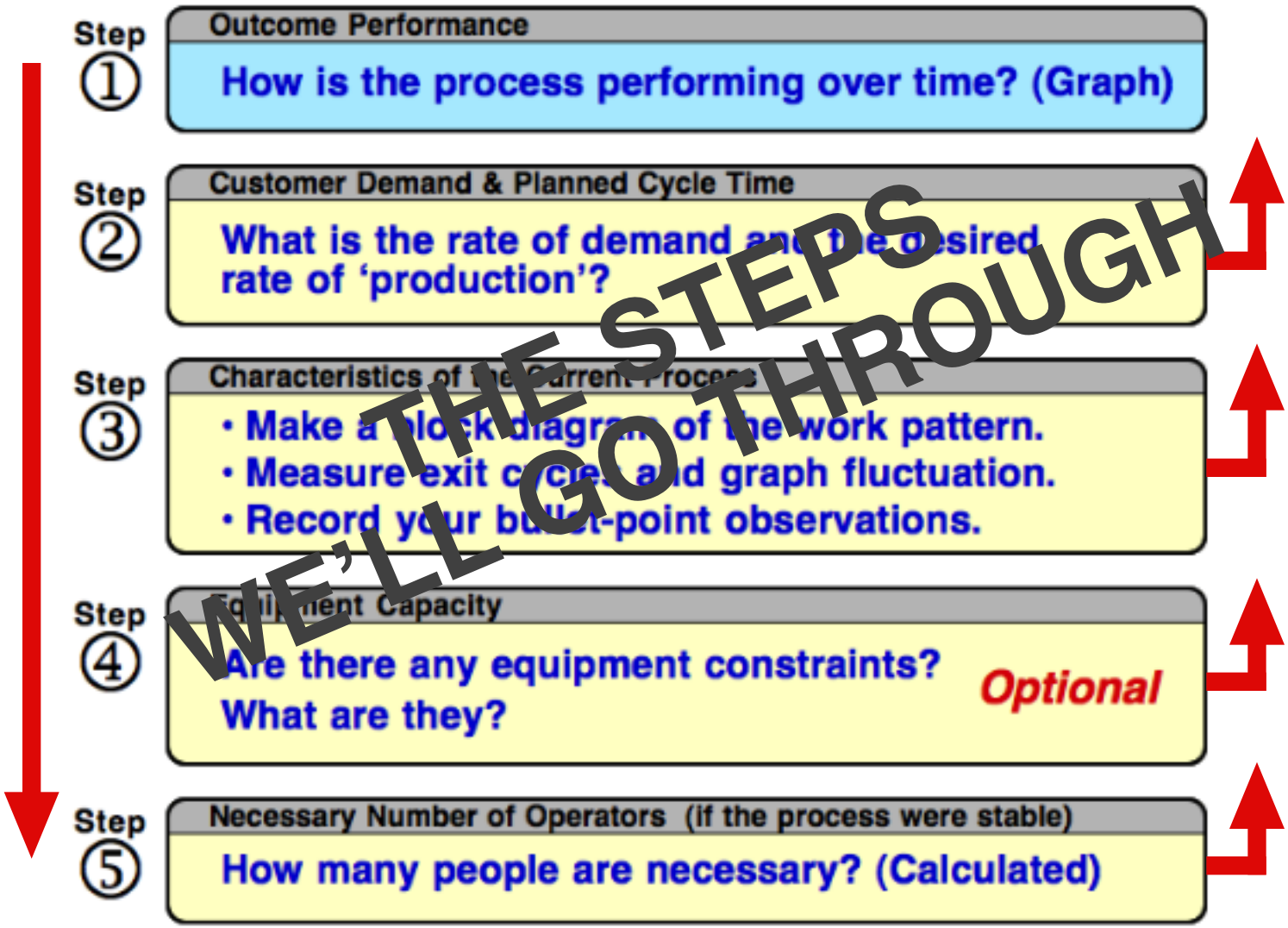
Being able to grasp the current condition is a foundational skill. This process analysis Kata is a structured way to observe & analyze a current process condition. Benefits of practicing it are:

- **Prevents skipping Step 2 in the Improvement Kata model, i.e., jumping to conclusions based on an insufficient understanding of the actual current condition.**
- **Makes process analysis teachable and transferrable across your organization.**
- **Communication and coaching are more effective because you have a fundamental & shared way of looking at and talking about work processes.**

This process-analysis Kata can be adapted to almost any work process. Begin by practicing the steps of process analysis as they are described here. As you become proficient and understand the principles behind this Kata you can evolve it into a process-analysis Kata more specific to your organization and processes... as long as the basic principles remain.

THIS PROCESS ANALYSIS IS LINEAR BUT RECURSIVE

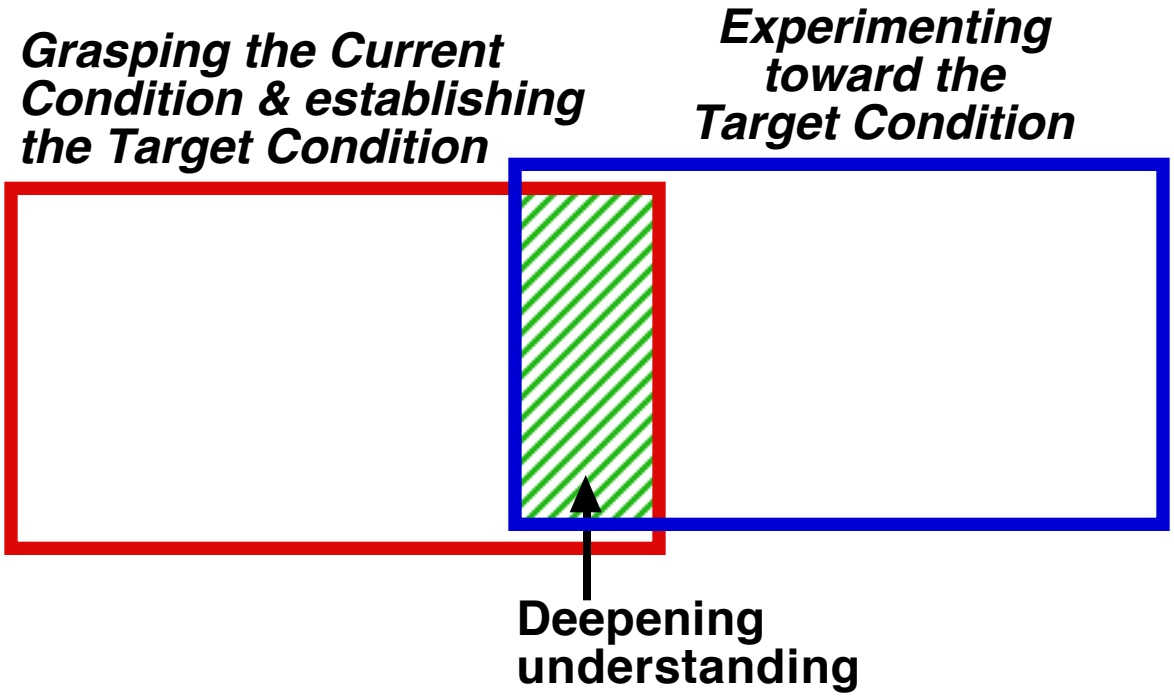
What you learn in one step of the process analysis may lead you to go back and adjust a prior step. That's normal.



YOU DON'T HAVE TO GET A PERFECT UNDERSTANDING OF THE CURRENT CONDITION BEFORE PROCEEDING TO THE NEXT STEP

Analysis is important, but it's a balance between that and experimenting. You won't be able to understand everything about the focus process before you establish a first Target Condition and get going with experimenting toward that Target Condition.

Those experiments will deepen your understanding of the process.



SOME PROCESS ANALYSIS TERMINOLOGY

FACTS ***Something you observe.***

Example: The actual occurrence of scrap.

DATA ***Something you measure.***

Example: The scrap rate.

OUTCOME METRIC

This metric is a 'result' that indicates how a process or system has performed over a past time period. An outcome metric cannot be directly affected because it summarizes the effects of multiple variables.

Examples: Lead time, Output / hour, Cost, Labor cost, Productivity.

PROCESS METRIC

This is a metric that occurs at approximately the same time as the conditions it signifies, and can be measured in real time to assess how a process is operating now. A process metric can be directly affected.

Example: The time each work cycle takes.

GUIDELINES FOR THE COACH: TEACHING PROCESS ANALYSIS

- As discussed in the 'Roles & Structure' Chapter, for beginner Learners choose a process that is easy to understand and analyze. The first goal in Step 2 of the IK is to internalize the routine of process analysis, not to tackle the most important process to improve. Once the Learner has developed competency they can apply this process analysis to more difficult processes.

- Have the Learner follow the process analysis steps as closely as possible. Don't let the Learner jump ahead, because you're trying to imprint a pattern. Competent-level learners can vary the process analysis and its sequence according to the situation at hand.

- As the Learner moves through the analysis steps in order s/he will often have to go back to review or recalculate an earlier step based on what they are learning. That's normal. You can't get each step right the first time.

- Break the practicing into 'chunks':
  - Have the Learner complete one process analysis step at a time.
  - After each step have the Learner summarize on a flipchart & present to you.
  - The Learner should present information in the order shown in the steps table on page 11. Each time the Learner presents, have him or her begin the presentation at Step 1.

- The Coach must go along during the process analysis, and should also analyze the process <u>at the same time</u>, not in advance. This way the Coach will be in a good position to evaluate and correct what the beginner Learner is doing.

- At the beginning a process analysis can easily take a couple of days. As one gains experience you can often do it in a few hours. For practice it can be fun to set an increasingly shorter time to do a process analysis. Pick another process and do it again. Can you get to two hours?

PROCESS ANALYSIS WITH OFFICE AND SERVICE PROCESSES

Find the *pattern of working*

<u>Pattern</u> is a good word to use when you seek to understand *any* process.

In office and service processes the work content often varies, takes a long time and/or is even invisible. However, there is a "pattern" in nearly all work that humans do. Even if the work content varies, the people carrying out the task will have certain ways (repetitive patterns) of doing it. That's a key part of what you're trying to see and measure in process analysis.

It can takes longer to observe, track and measure the current work pattern in office and service processes. But once you see and can measure the basic pattern of working you'll then be able to define the next target pattern to aim for.

WHAT ABOUT HIGHLY AUTOMATED PROCESSES?

The question of how to handle highly-automated processes comes up regularly. Here's an answer...

Start by creating a run chart of output-cycles for the machine, with a *target* line that indicates the output cycles you expect from this automated process's operation.

You may think you should then apply the steps of the Improvement Kata directly to the automated machine itself, but even in highly-automated processes, the process is still dependent on things that people do. The focus in applying the steps of the Improvement Kata to an automated process is often *on the human-centered processes around the machine that influence how the machine operates*. These are processes such as:

- **Machine tending (incl. monitoring, stocking, loading, adjusting, etc.)**
- **Changeovers**
- **Logistics (moving material in and out)**
- **Reacting to problems**
- **Maintenance**

Apply the steps of the IK to *these* work processes as they become obstacles to the target machine output cycles, with one storyboard per process:

- **Carefully study the work process to sketch, measure and understand its current pattern of operating using this chapter's process analysis.**
- **Based on that understanding of the current operating pattern, define the next desired operating pattern (target condition) for the process.**
- **Then experiment iteratively to move toward that target condition.**

Practice Routines

EQUIPMENT YOU'LL NEED

- Stopwatch that measures in seconds
- Graph paper
- Pencil, eraser & ruler
- Calculator

COURTESY AT THE PROCESS

- Approach the process via the Manager
- Introduce yourself to the people there
- Explain what you are doing
- Do not interrupt people while they're working
- Explain that you are watching the work, not the person
- Show any notes you've taken
- Say *thank you* before you leave
- Hands out of pockets, because we're all working here

STEPS OF THE PROCESS ANALYSIS KATA

Step ①

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Step ②

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Step ③

Characteristics of the Current Process

- Make a block diagram of the work pattern.
- Measure exit cycles and graph fluctuation.
- Record your bullet-point observations.

Step ④

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

Step ⑤

Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

Process metrics and characteristics

THE BASIC PROCESS ANALYSIS SEQUENCE

Keep this two-part sequence in mind when you study any work process

(1) RESULTS

The first step is taking a look at the process's outcomes over a period of time. This gives you a sense for what the process is creating and provides a frame for the rest of your process analysis.

(2) PATTERN OF WORKING

In the rest of the process analysis you turn you attention to understanding the process's characteristics and operating pattern, which are what generate the outcomes.

The process's characteristics and operating pattern are what you can actually work on (in later steps of the Improvement Kata pattern) to influence and change the outcomes.

The Process Analysis Kata Step-by-Step

- STEP ONE -

Step ①

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Characteristics of the Current Process

- Make a block diagram of the work pattern.
- Measure exit cycles and graph fluctuation.
- Record your bullet-point observations.

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

Process metrics and characteristics

PROCESS OUTCOME PERFORMANCE

How is the process performing over time?

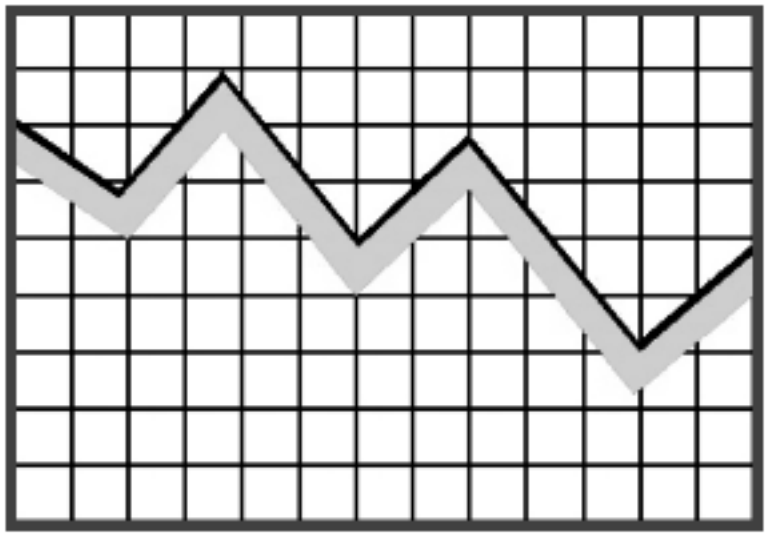
Once the focus process has been selected, begin your process analysis by looking at data on how the process has been delivering/performing over time. Examples of such outcome metrics include quantity, productivity, quality, cost, etc.

It may be possible for you to measure and collect this data, and you should set up a system to do so, but you'll probably also be relying on historical data. Keep in mind that you cannot tell how accurate historical data is.

Be sure to make a graph of the outcome-metric data that you decide to focus on, so you have a visual representation of the focus process's current performance. For example...

Output per Shift

Overtime



- STEP TWO -

Step ②

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Characteristics of the Current Process

- Make a block diagram of the work pattern.
- Measure exit cycles and graph fluctuation.
- Record your bullet-point observations.

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

Process metrics and characteristics

CUSTOMER DEMAND & PLANNED CYCLE TIME

What is the rate of demand and the desired rate of 'production'?

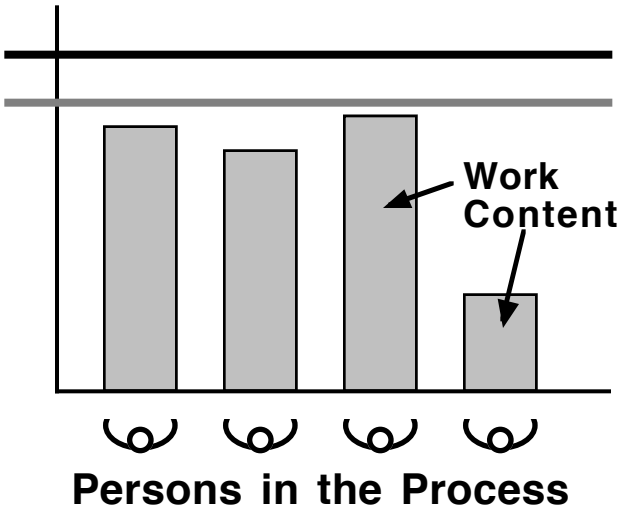
In this step of process analysis you're trying to figure out (A) the rate of customer demand and (B) the target pace at which the focus process should be cycling. This provides a frame for the rest of the process analysis.

Key questions are:

What is the 'product'?
How often does the customer want one?
How often do we want to produce one?

Remember, you can come back and fine-tune these numbers as you move forward and learn more.

Two Numbers from the Manufacturing World: "TAKT TIME" & "PLANNED CYCLE TIME"



Ⓐ **Takt Time (TT)**

The actual customer demand rate

Ⓑ **Planned Cycle Time (Pc/t)**

The desired production rate

Usually faster than TT, as it accommodates changeover time and perhaps some downtime

Ⓐ TAKT TIME

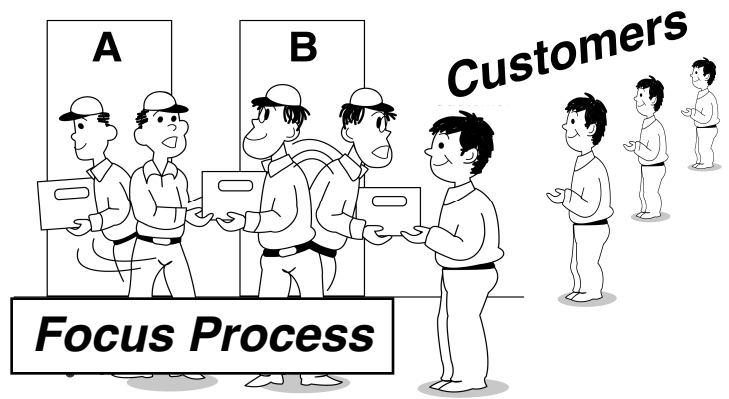
The rate of customer demand

$$\text{Takt Time} = \frac{\text{your effective operating time / shift or day}}{\text{quantity customer requires per shift or day}}$$

Example

$$\frac{26{,}100 \text{ seconds available time}}{450 \text{ pieces required}} = 58 \text{ seconds Takt Time}$$

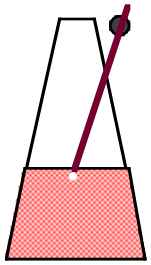
This is the current rate of customer demand



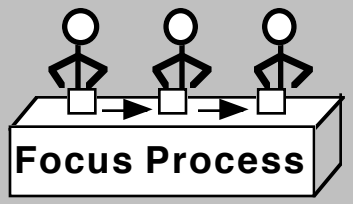
Notes:

Customer demand changes! Recalculate Takt Time regularly.

It is not always possible calculate a Takt Time. In such cases simply start with a desired rate of production, called "Planned Cycle Time."



Example:
HOW TO CALCULATE TAKT TIME



- 1840 pieces/day total
- 2 Shifts, 8 hours each
- 2 x 10 min break/shift
- 10 changeovers / day
- C/O Time = 15 min per c/o
- Unplanned Downtime = 10%

TAKT = 30 seconds/piece

This is the current rate of customer demand

1) Determine the Numerator (available time to produce):

16 hours = 960 minutes / day
960 min - 40 min (breaks) = 920 minutes available / day

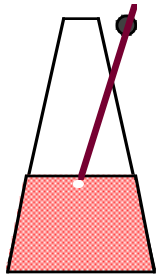
2) Takt Time Calculation:

$$\frac{\text{920 minutes available}}{\text{1840 pieces required}} = \text{30 seconds per piece}$$

Do not include your losses in the Takt Time calculation, because you first want a picture of the actual customer demand!

Ⓑ PLANNED CYCLE TIME

The actual rate at which you want the focus process to operate



Once you have calculated Takt Time (demand), now you can subtract <u>changeover time</u> and <u>other losses</u> such as unplanned downtime and scrap & rework rates from the available time in order to arrive at the *planned cycle time* (Pc/t). This is the actual speed at which the process should be running.

(A) <u>Changeover time</u>. Make your first Pc/t calculation simply using the number of changeovers currently done per day, and their current times. You can also calculate again with other numbers of changeovers and different changeover times, in order to explore what might be reasonable possibilities.

(B) <u>Downtime</u>. There are two kinds of downtime: Short stoppages throughout the day that add up, and rarer but catastrophic failures. In calculating Pc/t we are concerned with the small stoppages. You cannot cover for catastrophe with a faster Pc/t.

-15% One tactic is to simply set Pc/t at 15% faster than Takt, and strive to fit changeovers and other losses within that 15%. Of course, if your losses greatly exceed 15% then this number will not work at the start.

The Planned Cycle Time (Pc/t) or desired rate is a target, and it may seem strange to have a 'target' in mind when you are analyzing the current condition. However, to grasp the current condition of a work process you should understand what is required of the work process.

- STEP THREE -

Step ③

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Characteristics of the Current Process

- **Make a block diagram of the work pattern.**
- **Measure exit cycles and graph fluctuation.**
- **Record your bullet-point observations.**

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

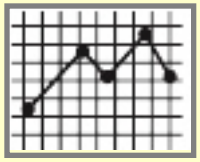
Process metrics and characteristics

CHARACTERISTICS OF THE CURRENT PROCESS

These 3 tasks are the heart of the Process Analysis Kata

1) Get to know the work pattern by sketching a block diagram

- Define the start & end points of the process.
- What are batch sizes at the processing steps?
- Where does WIP accumulate?



2) Time exit cycles & graph how much the process fluctuates

- Time & run-chart 20-30 exit cycles for each operator.
- Are each operators' work steps the same from cycle to cycle?

3) Record your bullet-point observations

- These are not problems, issues or *good* or *bad*.
- Record and describe other characteristics of the current work pattern that you notice.

Analyzing how the focus process functions helps you understand the current patterns of working. The better you understand how the process operates, the better you can develop an appropriate Target Condition.

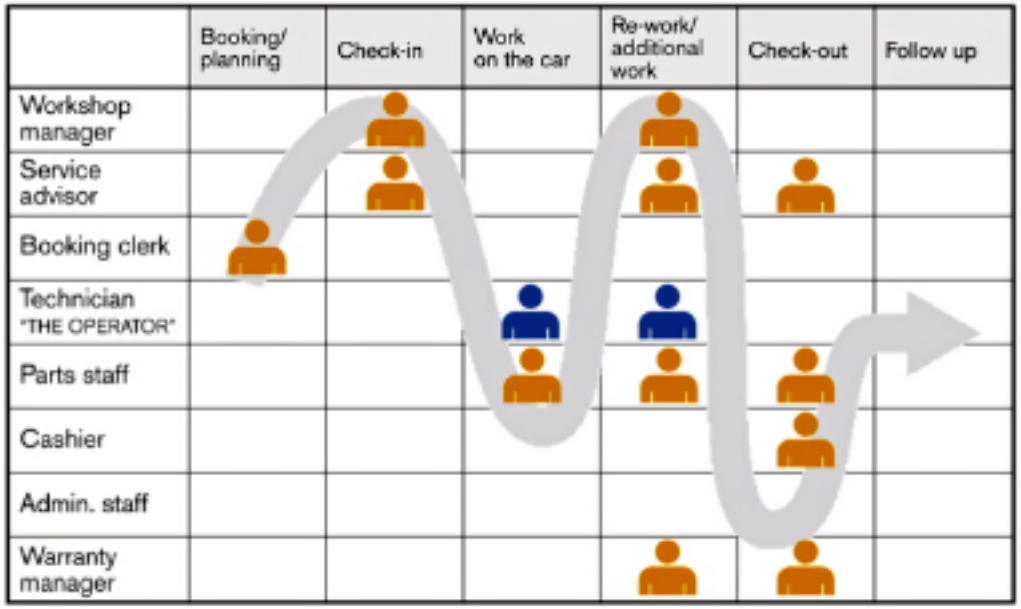
In this step you may ask others about process details, but do not interview or ask people about process problems or improvement ideas. Study the actual work and learn to see and understand for yourself.

1) GET TO KNOW THE WORK PATTERN BY SKETCHING A BLOCK DIAGRAM

Visually portray the steps and sequence of how the work is done

--> **For Physical Processes** sketching a "Block Diagram" is highly useful. This tool is described on the next two pages.

--> **For Office/Service Processes** a "Swim-Lane Diagram" (example below) can be useful. There are many resources that describe this tool, so we won't discuss it further here.

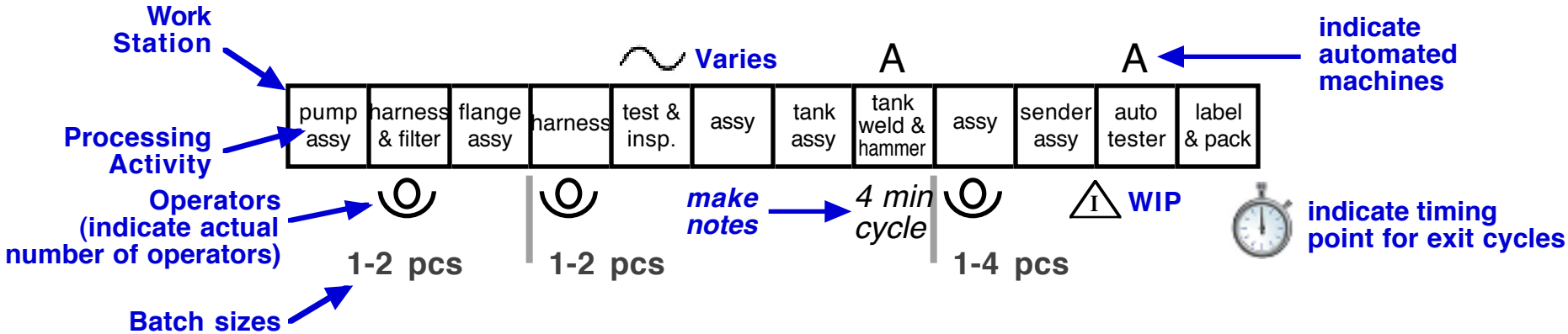


BLOCK DIAGRAM OF THE CURRENT WORK PATTERN

A block diagram is simply a row of squares to which you add data

At this stage you're trying to figure out the <u>current work pattern and flow</u>, *not* the physical layout. To do this draw a straight-line sketch of the workstations in the process as squares. The drawing does not resemble the actual layout. It shows the work flow. Each square simply = a workstation, table, fixture or machine.

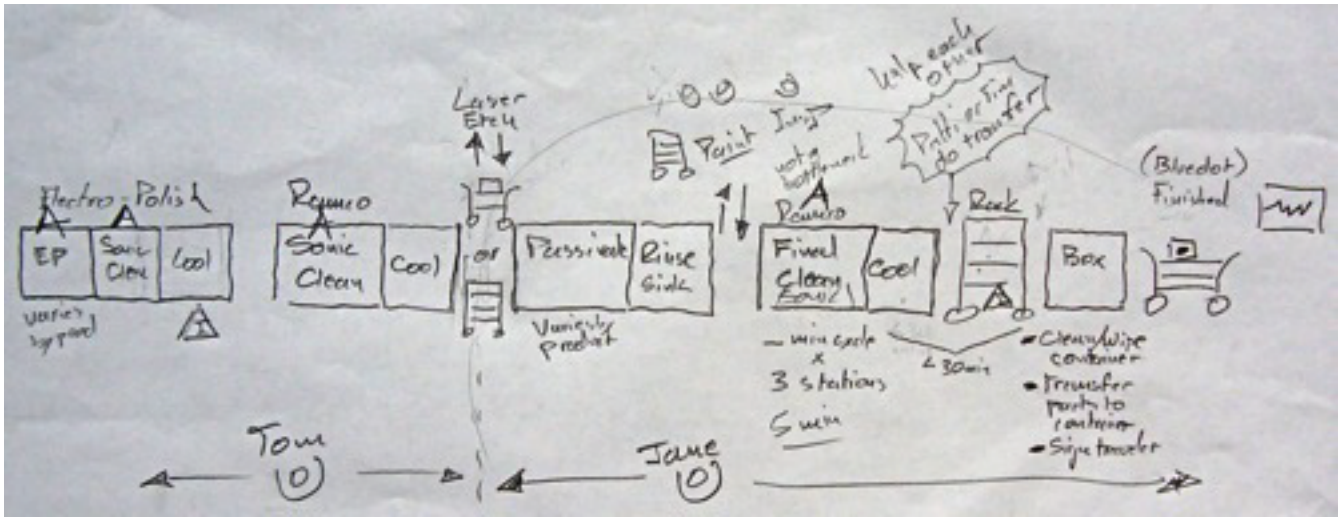
Do not draw to scale or worry about the actual shape, ie. layout, of the line. Simply make each box the same size. Begin by defining the start and end points of the process you are observing, which you may need to to adjust as you get to know the process better.



You can of course keep adding detail to your block diagram as you go through the further steps of process analysis

THE BLOCK DIAGRAM GETS MESSY

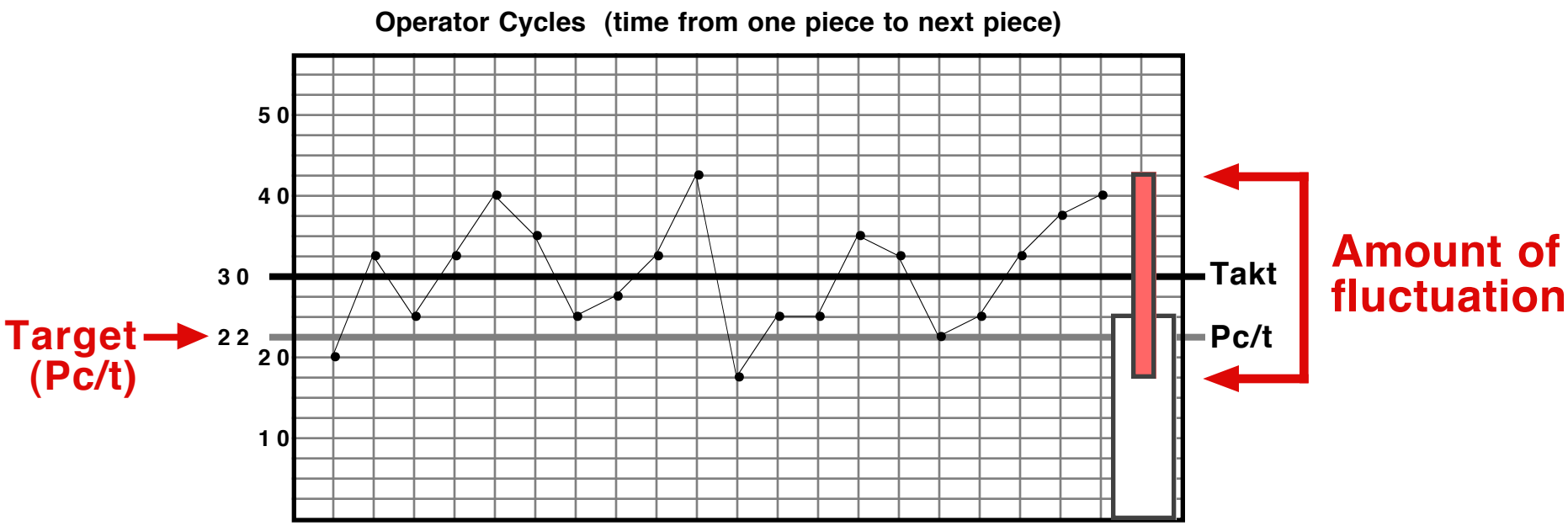
That's normal



NOTE that the block diagram is a process-level diagram, *not* a value-stream map

2) MEASURE EXIT CYCLES AND GRAPH HOW MUCH THE PROCESS FLUCTUATES

You'll be making run charts like this one:



Understanding the amount of fluctuation in a process is important because it can affect so many other aspects of the process

START BY TIMING 20-30 EXIT CYCLES FOR EACH OPERATOR IN THE PROCESS

- **An 'exit cycle' is how often an operator's work cycle occurs.**
- **Select a reference point in the operator's work pattern.**

  Start your stopwatch when the operator gets to this point and let the stopwatch run until the operator returns to this point, no matter what takes place. You are timing "full cycles."
- **Record these cycle times on the worksheet provided. Do not skip or discard any cycles.**
- **For each cycle, write down any operator wait time you see, and the reason for it, in the "notes" area of the worksheet. You will use this wait-time information later, in Step 5 of the process analysis.**
- **Remember... you're actually timing *process characteristics*, not the operator.**

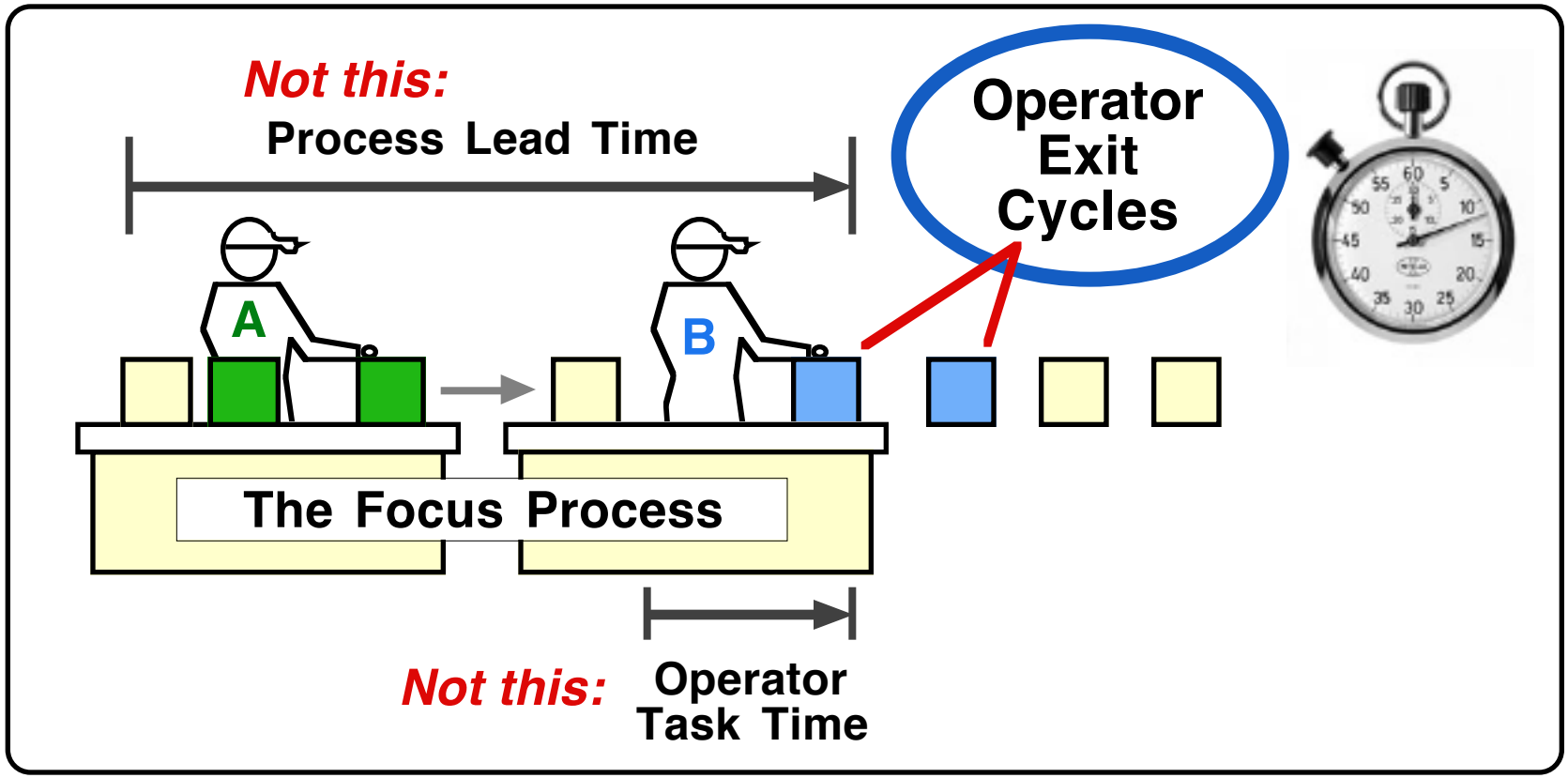
Operator Exit Cycles

Start and stop your stopwatch at the <u>same</u> point, to get the total operator cycle

WHAT IS AN "EXIT CYCLE"?

An Exit Cycle is the actual time between completed units of whatever is the product or service coming off the end of one operator's segment of the process. It's not how long, but *how often*.

The exit cycles of the *last operator* in the process often also represent the output fluctuation for the overall process. Check the box on the timing worksheet if you are timing the operator exit cycles that represent overall process output. The run chart from this data will tell you how the overall process is fluctuating.



TIMING WORKSHEET

Process	Metric
Date	Operator ☐

Cycle	Observed Times (Data)	Observations about the current operating pattern (Facts)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

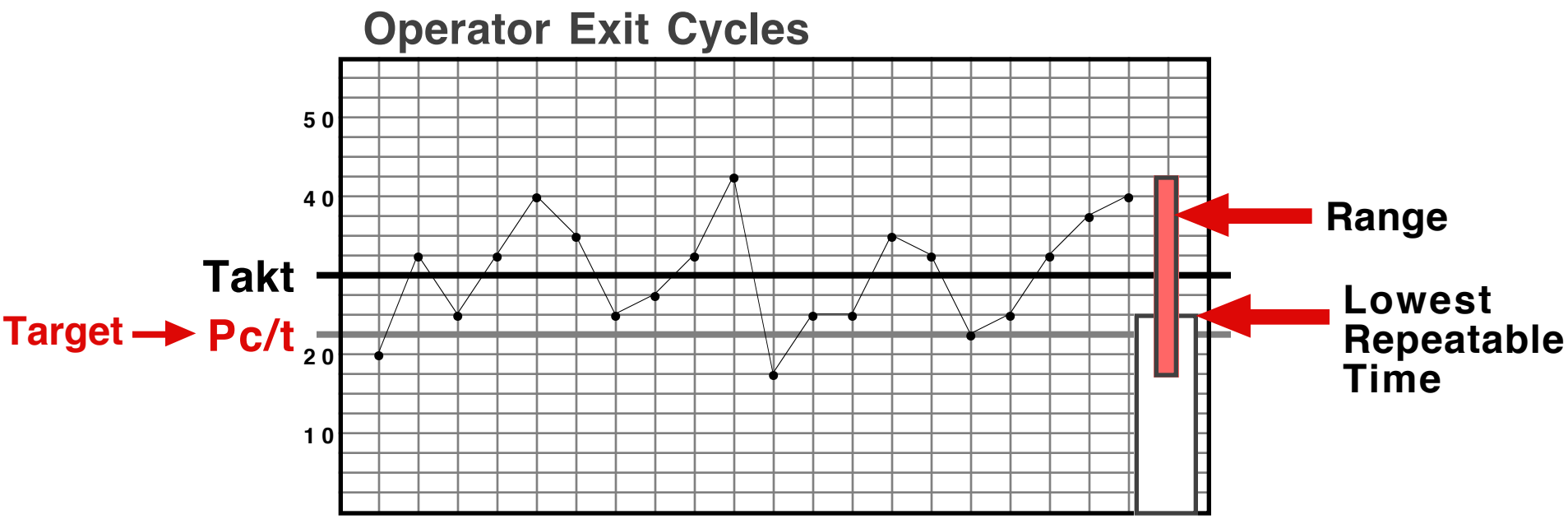
Check box if this is **process output**

Note wait times here

DRAW A RUN CHART OF THE DATA POINTS, ONE RUN CHART FOR EACH OPERATOR

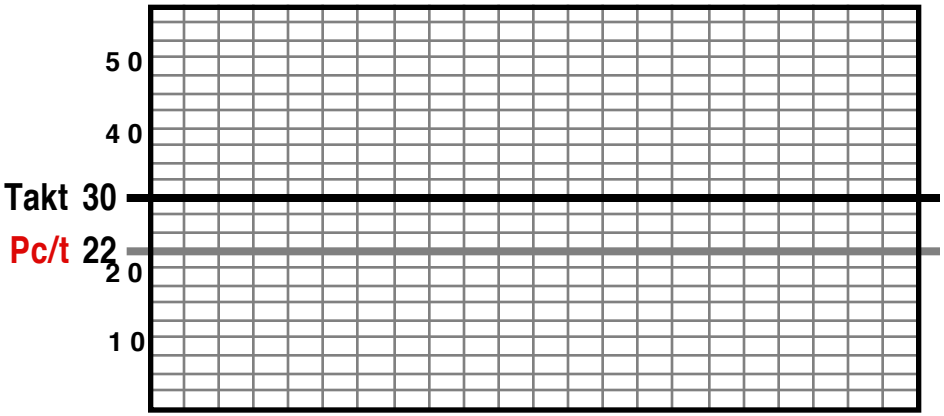
Run charts help you see and understand process variation

A run chart is a graph that illustrates process variation over time. Run charts are an excellent way to gather and communicate current-state information.



MAKING A RUN CHART - Step by Step

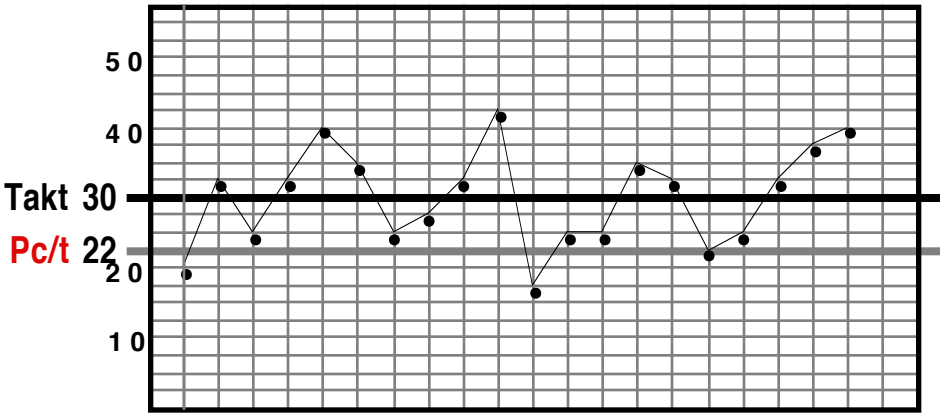
Step 1



1) **If you have a Takt Time and/or Planned Cycle Time for the process, draw horizontal lines for them on the chart.**

   If you don't have a TT or Pc/t, draw a line for the exit cycle time/rate you'd like to have.

Step 2

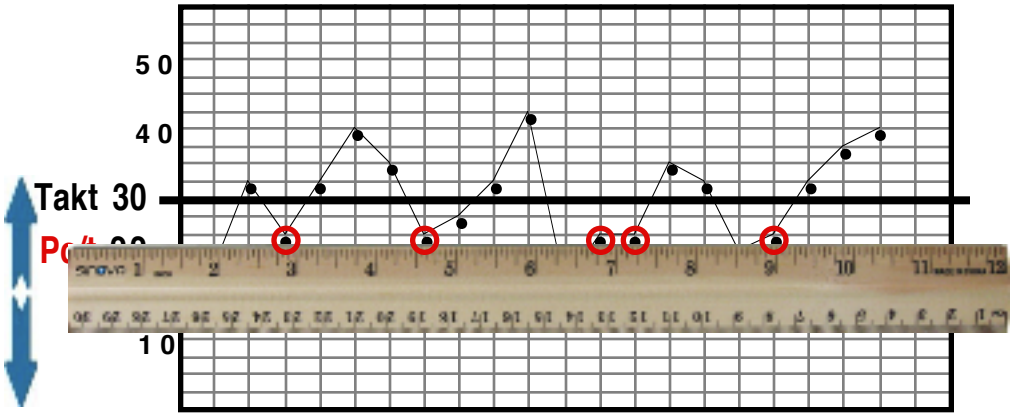


2) **Plot & connect the data points**

   Note:
   - **Do not use averages because they obscure variation**
   - **Include all data points**

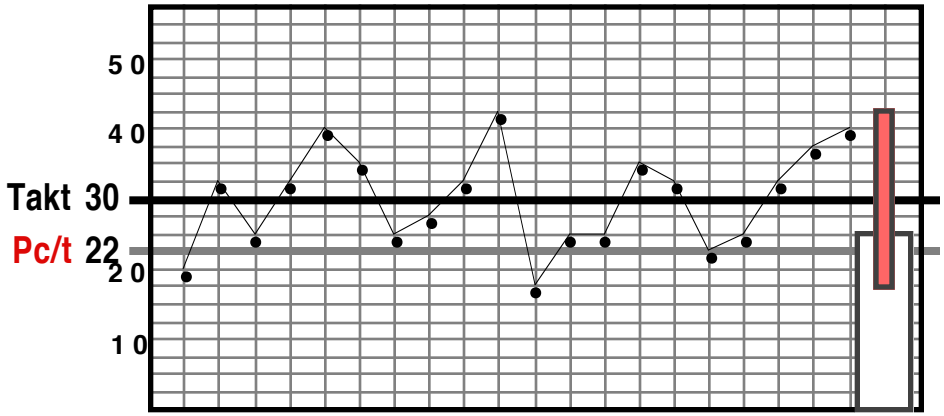
RUN CHART - Step by Step

Step 3



3) Find the lowest repeatable time by moving a ruler up from the bottom until data points start repeating.

Steps 4 & 5



4) Draw a wide bar to show the lowest repeatable time.

   Draw a thin bar to show the range of fluctuation (highest point to lowest point).

5) Calculate current +/- % variation

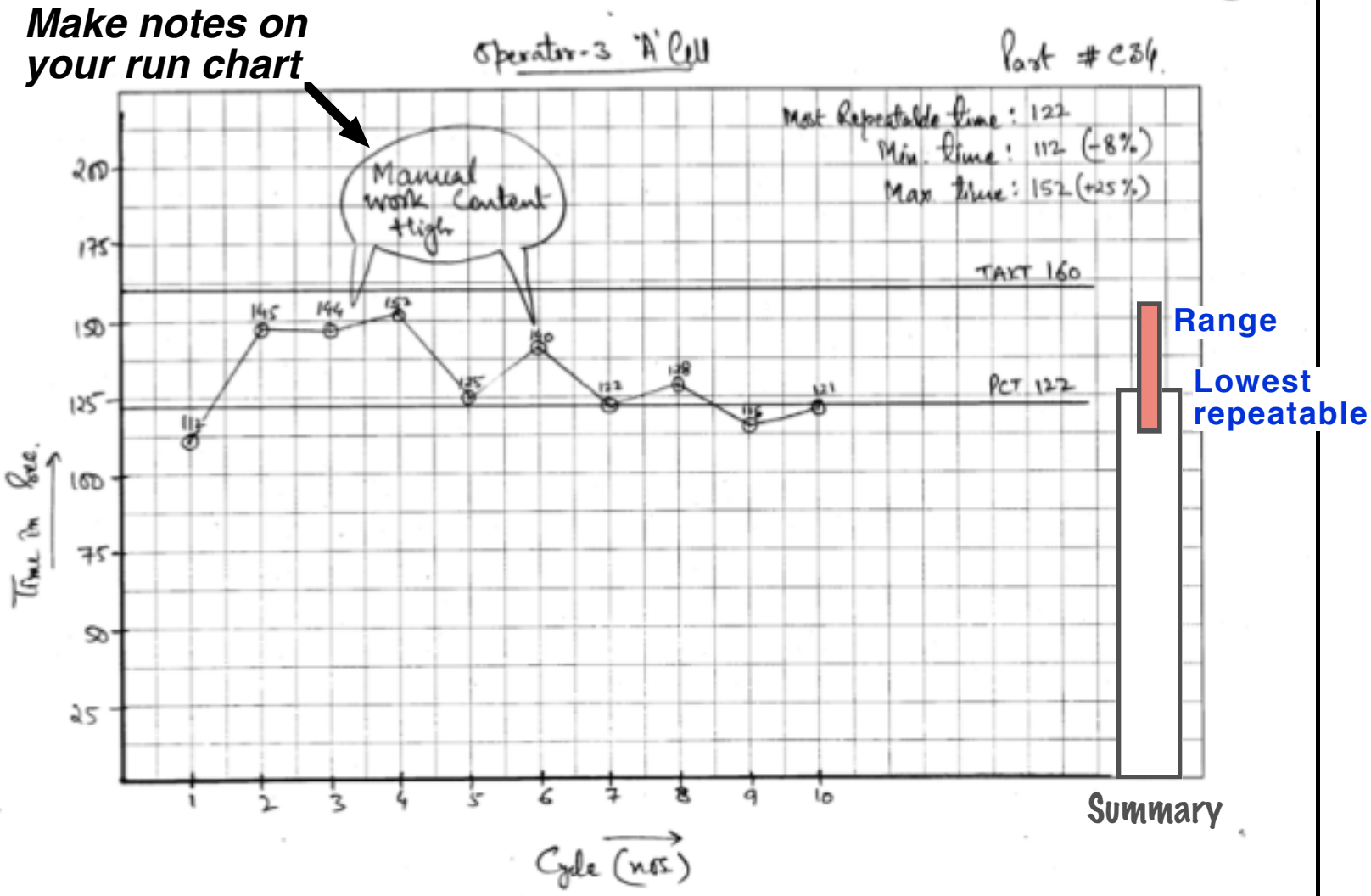
   %+ Var:
   (Highest point - Pc/t) ÷ Pc/t

   %- Var:
   (Lowest point - Pc/t) ÷ Pc/t

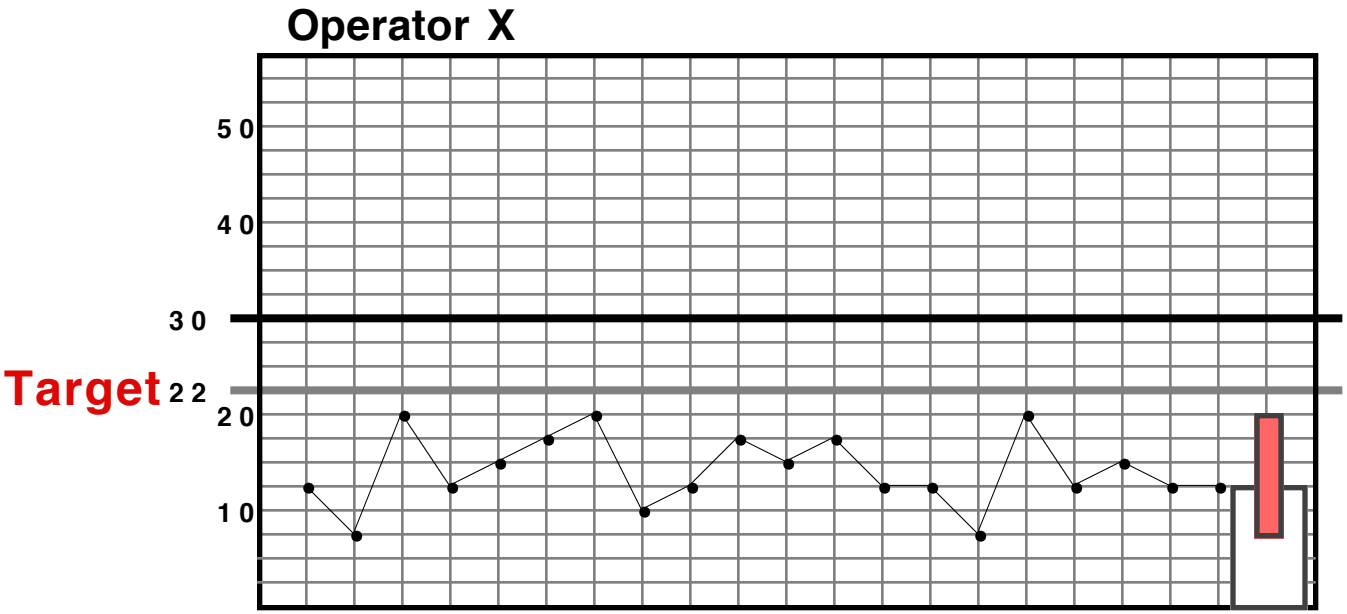
EXAMPLE RUN CHART OF EXIT CYCLES

Operator 3 = last workstation

Make notes on your run chart



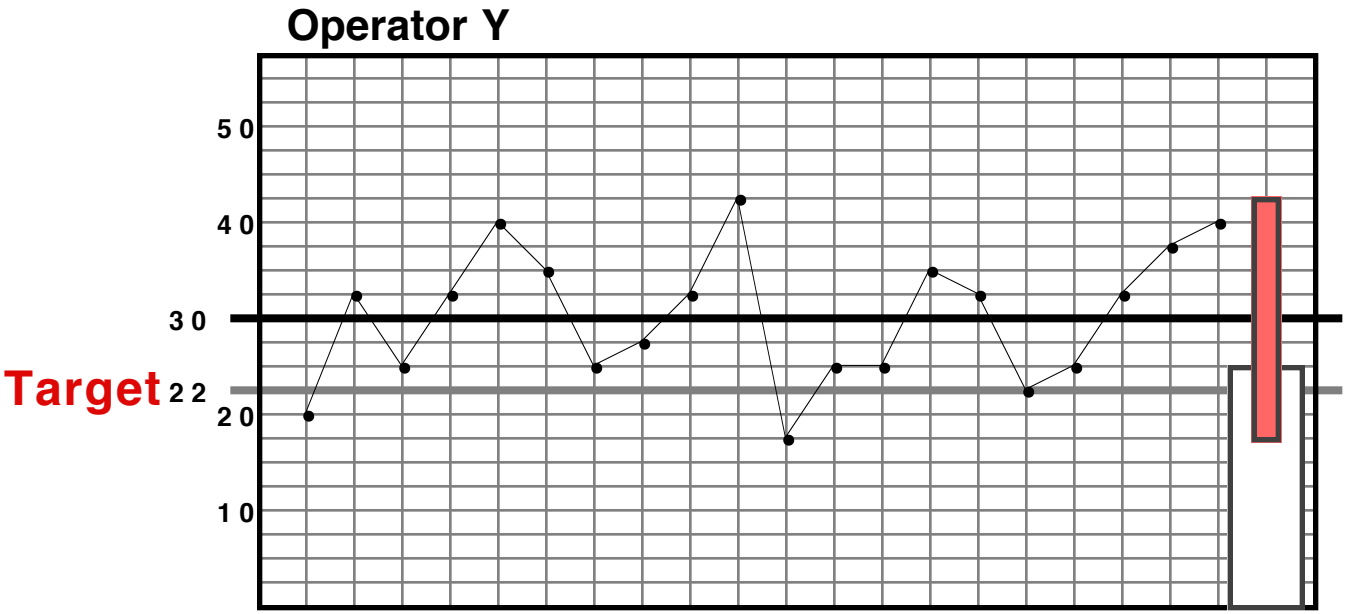
MORE EXAMPLES



Range = 8-20 seconds

% Variation compared to Pc/t = + 0% / - 63%

Lowest repeatable = 13



Range = 18-42 seconds

% Variation compared to Pc/t = + 91% / - 18%

Lowest repeatable = 25

3) RECORD BULLET-POINT OBSERVATIONS

As you draw your block diagram and time exit cycles, what else do you notice about the pattern of how the process is currently being operated?

These are not "issues" or "problems" to address, but simply characteristics of how the focus process currently works. Simply describe what is happening, noting your observations in bullet form.

- STEP FOUR -

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Characteristics of the Current Process

- Make a block diagram of the work pattern.
- Measure exit cycles and graph fluctuation.
- Record your bullet-point observations.

Process metrics and characteristics

Step ④

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

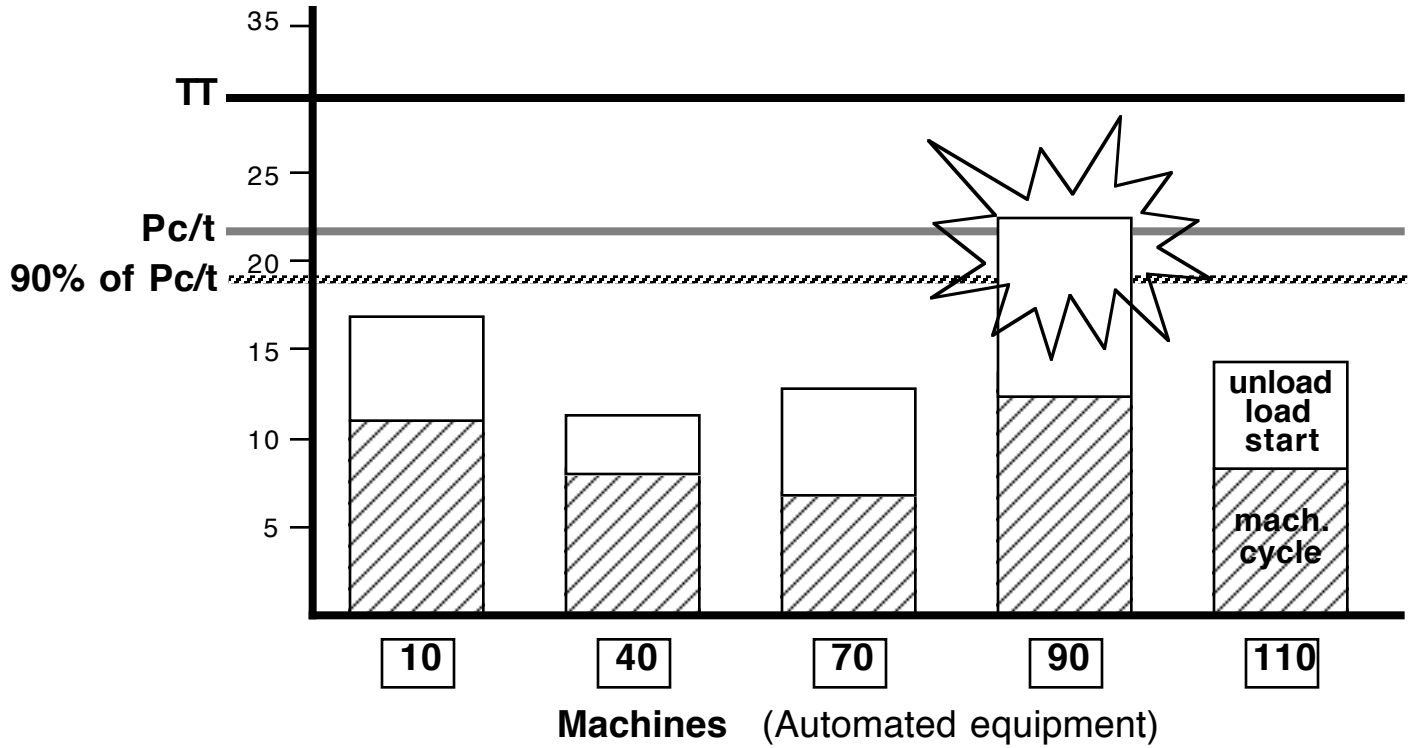
Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

EQUIPMENT CAPACITY

This is an important check for those processes that use automated equipment. "Automated Equipment" = machines that can run a cycle without requiring constant human oversight or activity.

Machine Capacity Chart



If this equipment cannot cycle fast enough to meet the planned cycle time then you must address this obstacle!

MACHINE CYCLE 90% GUIDELINE

This guideline applies only to *automated machines* that are able to cycle while the operator does something else. Do not include machines that require operator guidance, such as hand tools, hand welders, arbor presses, etc. Those cycles are naturally included when you measure operator times.

- **The basic point: It's OK for a machine to finish cycling and wait for the operator to return, but an operator should never have to wait for a machine to finish. A machine only needs to cycle once per takt.**

- **Total machine cycle should be no > 90% of Pc/t in order to make a consistent 1x1 flow possible. (In fully automated lines 95% of Pc/t may be acceptable.) [This guideline applies to machines, not operators.]**

  1. **If machine utilization is too high workstations become close-coupled and small cycle variations telegraph up- and downstream. This causes instability and leads to buffers.**

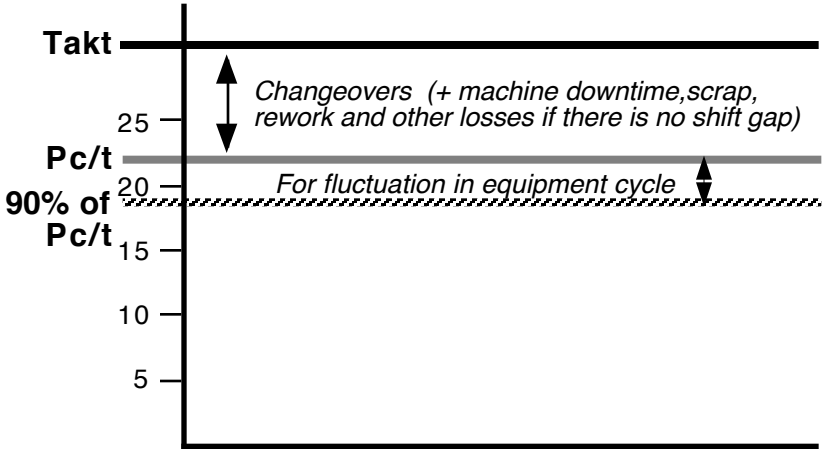
  2. **If machine utilization is too high operators will have to wait for a machine to finish at some workstations, which interrupts their work cycle and causes instability.**

- **The fastest Pc/t a line can run a 1x1 flow (current capacity) is:**

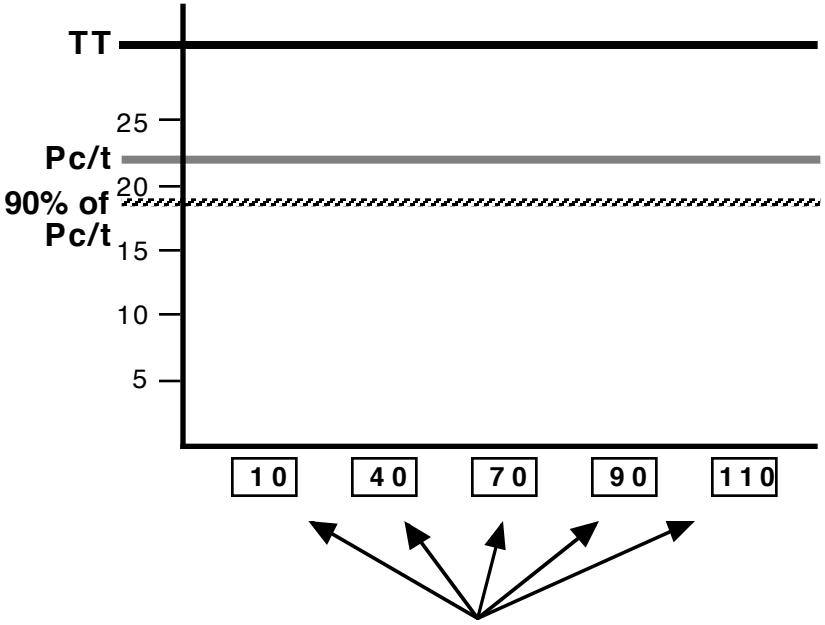
$$\frac{\text{Longest total machine cycle time}}{0.90}$$

MAKING A MACHINE CAPACITY CHART
Step by Step

Accuracy is important in these charts

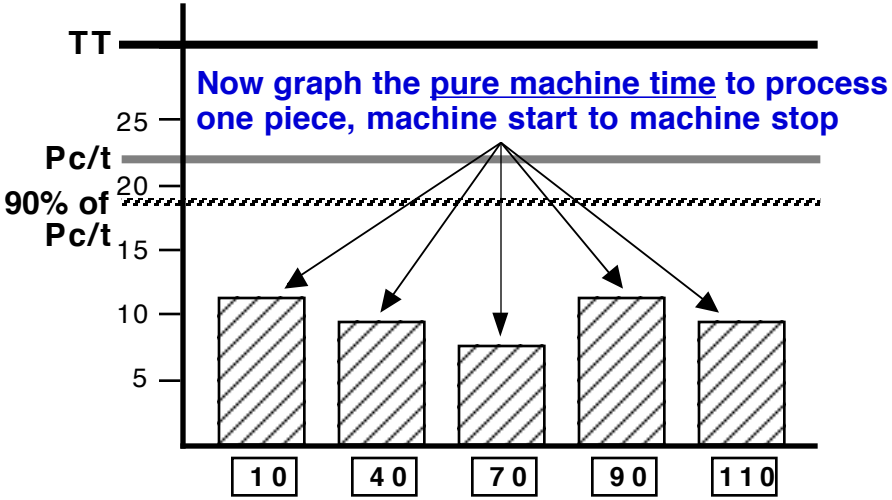


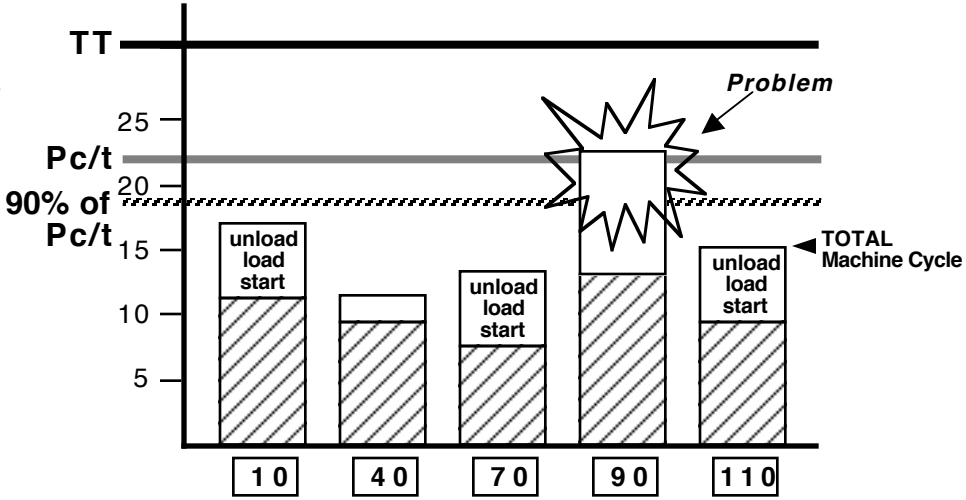
First draw in lines for the takt time (if calculated), planned cycle time, and 90% of planned cycle time.



Next list the automated machines in the process (machines that can cycle without an operator).

MACHINE CAPACITY CHART - Step by Step





Pure machine time is only the time the machine takes from the cycle start to the end of the automatic cycle.

Note: You usually only need to measure a few cycles to obtain this number, since machine cycle times are often relatively consistent.

Finally, add unload and load times to the machine times. This is the time it takes to unload and load the machine, if the machine has to wait during unloading and loading.

The sum of:

Pure machine cycle + unload/load time

Equals the:

Total machine cycle time (TMc/t)

WORKSHEET FOR RECORDING MACHINE TIMES

You don't need to time many cycles when timing machine cycles

Machine	
1	
2	
3	
4	
5	

Machine	
1	
2	
3	
4	
5	

Machine	
1	
2	
3	
4	
5	

Machine	
1	
2	
3	
4	
5	

- STEP FIVE -

Outcome Performance

How is the process performing over time? (Graph)

Outcome metrics

Customer Demand & Planned Cycle Time

What is the rate of demand and the desired rate of 'production'?

Characteristics of the Current Process

- Make a block diagram of the work pattern.
- Measure exit cycles and graph fluctuation.
- Record your bullet-point observations.

Equipment Capacity

Are there any equipment constraints? What are they?

Optional

Process metrics and characteristics

Step ⑤

Necessary Number of Operators (if the process were stable)

How many people are necessary? (Calculated)

NECESSARY NUMBER OF OPERATORS (calculated)
If the process were stable

We'll use the sum of the lowest repeatable times taken from the run charts of each operator, minus any wait time in those cycles, to make this calculation. If you observed wait time in an operator's lowest-repeatable cycles, you'll subtract that wait time from the lowest repeatable time in order to get closer to the actual task time.

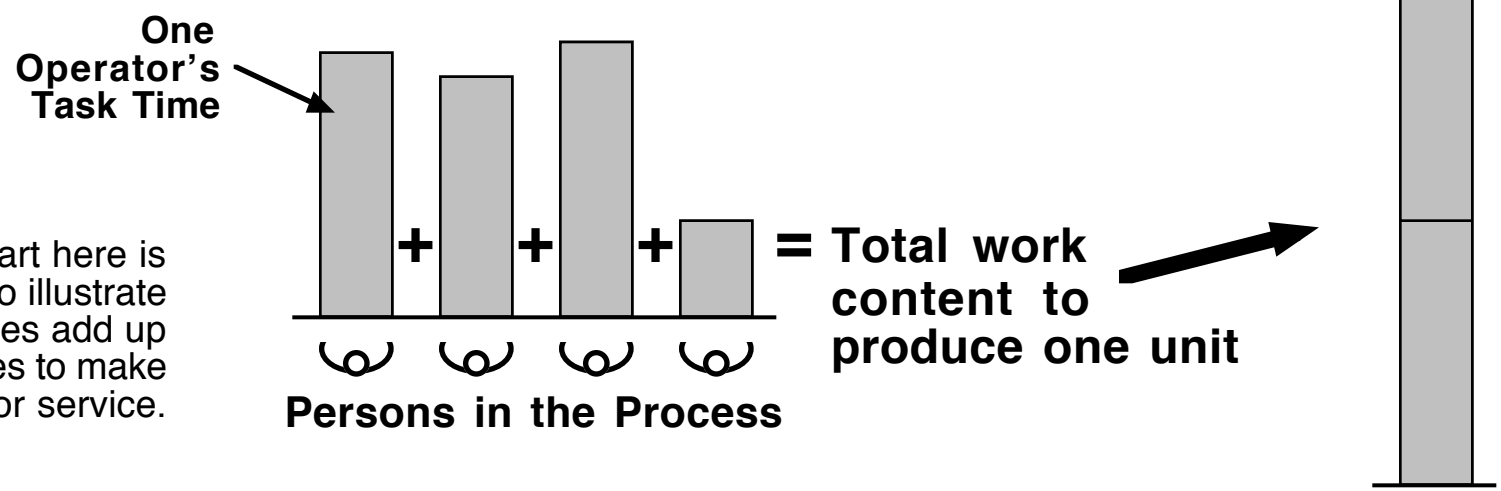
Notes:

- ☑ **This is not about reducing the number of operators, but determining the correct number of operators... if the process were stable and there is no out-of-cycle work.**
- ☑ **Note that this calculation is only an estimate for getting started.**
- ☑ **The calculated number of operators would only be sufficient if you are able to achieve a limited range of fluctuation in the process. The more fluctuation there is in a process, the more extra people will be needed.**

LOWEST REPEATABLE TIME AS AN ESTIMATE OF TASK TIME

You can use each operator's Lowest Repeatable Time as an approximation of the manual work-time content for a task, as long as you now subtract any significant operator wait time that occurred during <u>those</u> lowest-repeatable cycles. An example is waiting for a previous operator to finish. If Operator 2 had to wait for Operator 1, this wait time is not part of the actual work content required to complete a task in that cycle.

You can use the sum of the Lowest Repeatable Time for each operator as an estimate the current <u>total</u> work content to complete one unit of the product or service, as shown below.



The work balance chart here is being used simply to illustrate how individual task times add up to the total time it takes to make one unit of product or service.

THE NUMBER-OF-PEOPLE CALCULATION

Operator time and machine time are two separate things. We're looking only at <u>operator</u> time here.

Operator	Lowest repeatable operator cycle time, minus any wait time	Notes
1	15 seconds	
2	13 seconds	
3	16 seconds	
4	25 seconds	
	Σ = 69 sec	

Estimated total in-cycle operator work time to process one piece

$$\text{Necessary number of people} = \frac{\text{Total work content to process 1 unit}}{\text{Planned cycle time or target rate}}$$

$$\frac{\text{69 sec. total cycle time}}{\text{22 sec. Pc/t}} = \text{3.2 operators}$$

WHY IS IT OK TO USE LOWEST REPEATABLE TIME?

Because these times & the number-of-operators calculation are just a starting point for PDCA!

This approach is acceptable if you plan to work with rapid PDCA cycles (as with the improvement kata) and will do so daily. PDCA starts early.

Then the initial times don't need to be exact, because you will notice analysis errors and other problems along the way, and adjust as you move forward.

You're not setting a standard at this point. You're getting current-condition information & data to establish your first target condition. As you move toward that first target condition:

- **You'll learn more about the process, which can be incorporated into the next target condition**
- **You can get more detailed times for the work elements if necessary**

A FEW SUMMARY POINTS ABOUT TIMING

In Step 3 of Process Analysis:

- **You take the unadultered exit cycles as an indication of fluctuation in each operator's work. For the last operator in the process this is often an indication of output fluctuation for the process as a whole.**

- **As you time the exit cycles you make a note of any significant wait times, but you don't do anything with that information at that point.**

In Step 5 of Process Analysis:

- **Here you estimate the number of people needed in the process by summing the lowest repeatable time for each operator. If there is significant wait time included in those lowest-repeatable times then you would subtract that wait time at this point, because it is not task time.**

SUMMARIZING THE INITIAL CURRENT CONDITION

Outcome Performance

How is the process performin

Customer Demand & Planned Cycle Ti

What is the rate of demand
rate of 'production'?

Characteristics of the Current Proce

- Make a block diagram of
- Measure exit cycles and
- Record your bullet-point

Equipment Capacity

Are there any equipmen
What are they?

Necessary Number of Operator

How many people are

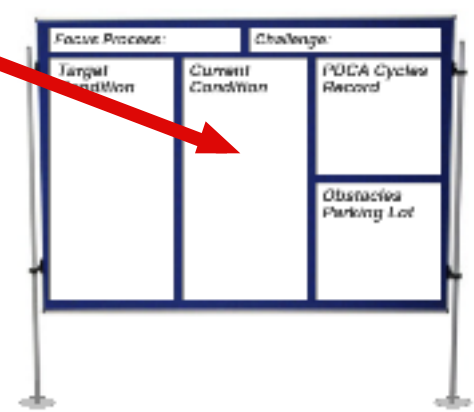
The Learner should use these headings and subheadings in compiling and presenting his or her analysis summary.

This reinforces the analysis pattern and makes it easier for a coach to go from Learner to Learner.

On the next pages are three different versions of a Current Condition Summary Form, for use with many different kinds of work processes.

This form plus any additional pages of data, such as the block diagram, run charts and machine capacity chart, should be posted in the "Current Condition" field of the Learner's storyboard.

Once you've defined the next Target Condition, this form will get cut in half.



CURRENT CONDITION / TARGET CONDITION

Learner:	Coach:	Process:	Challenge:	
			Outcome Metric	Process Metric

Categories	Current Condition Date	Target Condition Achieve-By Date
Outcome Performance *(Results)*	*show run chart*	
Process Characteristics and Operating Pattern *(Pattern of Working)*	*show block diagram or swim-lane diagram*	

CURRENT CONDITION / TARGET CONDITION

Challenge:

Learner: Coach: Process:

Outcome Metric | Process Metric

	Categories	Current Condition Date	Target Condition Achieve-By Date
1	Outcome Performance *(Results)*	*show run chart*	
2	Rate of Demand Rate of Production		
3	Operating Pattern	*show block diagram* *show all run charts*	*show block diagram*
4	Capacity	*show chart*	*show chart*
5	Number of People Required		

CURRENT CONDITION / TARGET CONDITION

Learner:	Coach:	Process:	Challenge:	
			Outcome Metric	Process Metric

Categories		Current Condition (Date)	Target Condition (Achieve-By Date)
1 Outcome Performance	Actual output / shift	*show run chart*	
	Overtime?		
2 Rate of Demand & Rate of Production	Takt time		
	Pc/t		
	# of Shifts		
3 Operating Pattern	Process steps and sequence	*show block diagram*	*show block diagram*
	Batch size		
	Where WIP Accumulates		
	Number of operators		
	% exit cycle fluctuation (at end of line)	*+ show all run charts*	
	Other attributes of the process		
4 Capacity	Capacity chart	*show chart*	*show chart*
5 People Required	Calculated number of operators		