Service Operations (SO)

Post Graduate Program for Working Executives 2014-15

Week 5

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Agenda

- Recap
- Service quality
- Servicescapes
- Managing waiting lines

Recap

- Service characteristics
- Strategic service vision
- Service package
- Service blueprinting
- Service quality

Constructing a control chart

- Decide what to measure and count
- Collect sample data
- Calculate and plot control limits on the control chart
- Determine if data is in control
- If non-random variation is present, fix the problem and recalculate control limits.

Example: Control Charts for Variable Data

Sample	Ambulance response time (in minutes) 1	2	3	4	5	$\bar{X}$	R
1	5.02	5.01	4.94	4.99	4.96	4.98	0.08
2	5.01	5.03	5.07	4.95	4.96	5.00	0.12
3	4.99	5.00	4.93	4.92	4.99	4.97	0.08
4	5.03	4.91	5.01	4.98	4.89	4.96	0.14
5	4.95	4.92	5.03	5.05	5.01	4.99	0.13
6	4.97	5.06	5.06	4.96	5.03	5.01	0.10
7	5.05	5.01	5.10	4.96	4.99	5.02	0.14
8	5.09	5.10	5.00	4.99	5.08	5.05	0.11
9	5.14	5.10	4.99	5.08	5.09	5.08	0.15
10	5.01	4.98	5.08	5.07	4.99	5.03	0.10
						50.09	1.15

Constructing A Mean Chart

$$UCL_{\bar{X}} = \bar{\bar{X}} + A_2 \bar{R} = 5.01 + (0.58)\,(.115) = 5.08$$

$$LCL_{\bar{X}} = \bar{\bar{X}} - A_2 \bar{R} = 5.01 - (0.58)\,(.115) = 4.94$$

where $\bar{\bar{X}}$ = average of sample means = $\Sigma \bar{X} / n$

$= 50.09 / 10 = 5.01$

$\bar{R}$ = average range = $\Sigma R / k$

$= 1.15 / 10 = .115$

Constructing an Range Chart

$UCL_R = D_4 \bar{R} = (2.11)\ (.115) = 2.43$

$LCL_R = D_3 \bar{R} = (0)\ (.115) = 0$

where $\bar{R} = \Sigma R / k = 1.15 / 10 = .115$

k = number of samples = 10

R = range = (largest - smallest)

3σ Control Chart Factors

Sample size	$\bar{X}$-chart	R-chart	
n	**A_2**	**D_3**	**D_4**
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2.00
7	0.42	0.08	1.92
8	0.37	0.14	1.86

Other charts

- P-charts
  - Calculate percentage defectives in a sample
  - an item is either good or bad
  - Based on binomial distribution
    - p = number defective / sample size, n
    - $\bar{p} = \dfrac{\text{total no. of defectives}}{\text{total no. of sample observations}}$

$$UCL_p = \bar{p} + 3\sqrt{\bar{p}(1-\bar{p})/n}$$

$$LCL_p = \bar{p} - 3\sqrt{\bar{p}(1-\bar{p})/n}$$

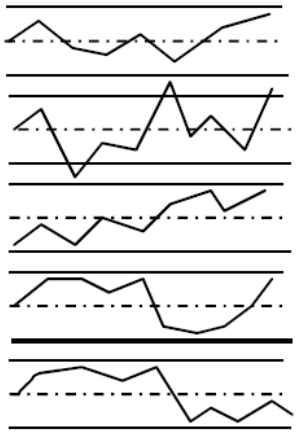
Other charts

- c Charts
  - Count number of defects in an item
  - Based on poisson distribution
    - c = number of defects in an item
    - $\bar{c} = \dfrac{\text{total number of defects}}{\text{number of samples}}$

$$UCL_c = \bar{c} + 3\sqrt{\bar{c}}$$

$$LCL_c = \bar{c} - 3\sqrt{\bar{c}}$$

Performance variation patterns



Stable

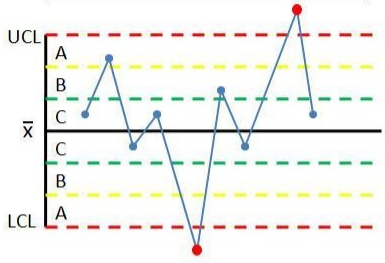
Unstable

Trend

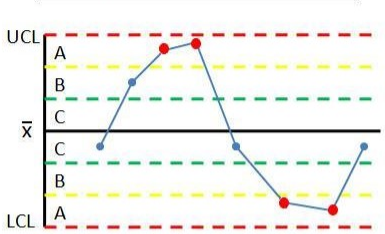
Cyclical

Shift

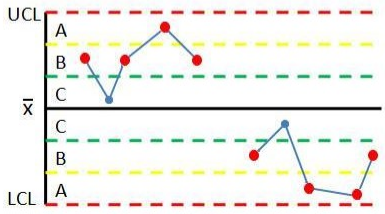
Rule 1: Any point falls beyond 3σ from the centerline(this is represented by the upper and lower control limits).



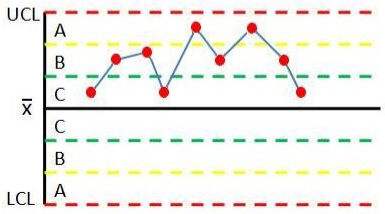
Rule 2: Two out of three consecutive points fall beyond 2σ on the same side of the centerline.



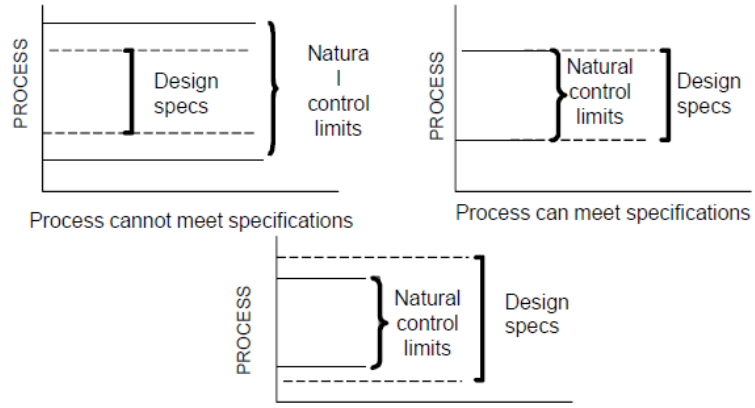
Rule 3: Four out of five consecutive points fall beyond 1σ on the same side of the centerline.



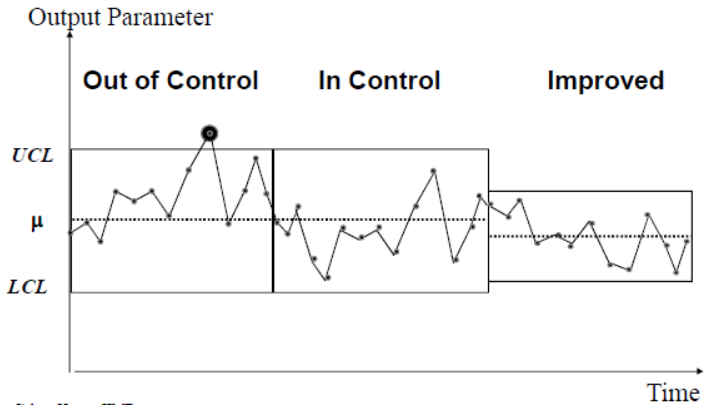
Rule 4: Nine or more consecutive points fall on the same side of the centerline.



Process capability



From Control to improvement



Sigma statistics

1σ	317 per thousand
2σ	45 per thousand
3σ	2 per thousand
4σ	63 per million
5σ	574 per billion
6σ	2 per billion
7σ	0.3 per billion

Key components of six sigma

- Management support
- Project based
- Metrics based
- Structured approach
  - Define-Measure-Analyze-Improve-Control
- Tools oriented

The road to six sigma

	Project	Decision	Technical
Define	Team formation, roles and responsibilities, schedule and report	Choose project	Define "as is" process, nominate potential projects
Measure	Define metrics, schedule and report	Gap analysis	Benchmark, baseline
Analyze	Schedule and report	Determine root cause	Evaluate potential causes, get data, analyze relationships
Improve	Schedule and report	Design pilot experiment	Execute pilot experiment
Control	Schedule and report	Set up control scheme	Evaluate control scheme

SERVICESCAPES

Opening question

Servicescape

- The environment in which the service is delivered and where the firm and the customer interact, and any tangible commodities that facilitate performance or communication of the service
- Not only physical environment as well as virtual environment
- Anchored in environmental psychology

Typology of Servicescapes

Who Performs in Servicescape	Physical Complexity of the Servicescape	
	Elaborate	Lean
Self-service (customer only)	Golf course Water slide park	Post office kiosk E-commerce
Interpersonal (both)	Luxury hotel Airline terminal	Budget hotel Bus station
Remote service (employee only)	Research lab L.L. Bean	Telemarketing Online tech support

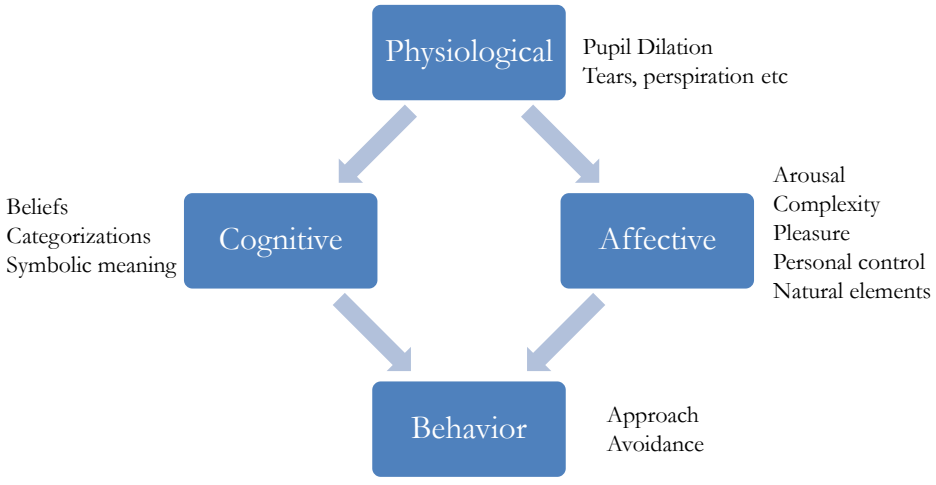
Behavior in a servicescape

- Individual behavior
  - Includes customers and employees
  - Positive internal responses leads to **Approach**
  - Negative internal responses leads to **Avoidance**
  - Customers: attraction, explore, enjoy, spend, return
  - Carryout planned activity
  - Employees: affiliate, explore, stay longer, commitment

Behavior in a servicescape

- Interaction behavior
  - All social interaction is affected by the physical container in which it occurs
  - Hard seats/soft seats
  - Harvard layout of classes/Shouldice hospital
  - Difference between Metro/ordinary platforms
  - Whom do you want whom to interact with?

Responses to the servicescape



Servicescape dimensions and impact

- Ambient conditions
  - Effects on the five senses
  - Perfume at mall entrance
  - Cookies in the mall
  - Oxygen in the casino
  - Music played in the supermarket
    - Familiarity
    - Tempo

Servicescape dimensions and impact

- Spatial layout and functionality
  - The new supermarkets!
  - Self service restaurants
- Signs, symbols, and artefacts
  - Visual metaphor of the organization's offering
  - Aiga symbols
  - Professor's office

Managerial Implications

- Careful and creative management of servicescape necessary
  - Helps firms achieve both external marketing goals and internal organizational goals
- Servicescape is a visual metaphor for the organization's offering
- Servicescape is the packaging of the service
- It facilitates and nurtures a certain type of interaction
- Helps as a key differentiator

MANAGING WAITING LINES

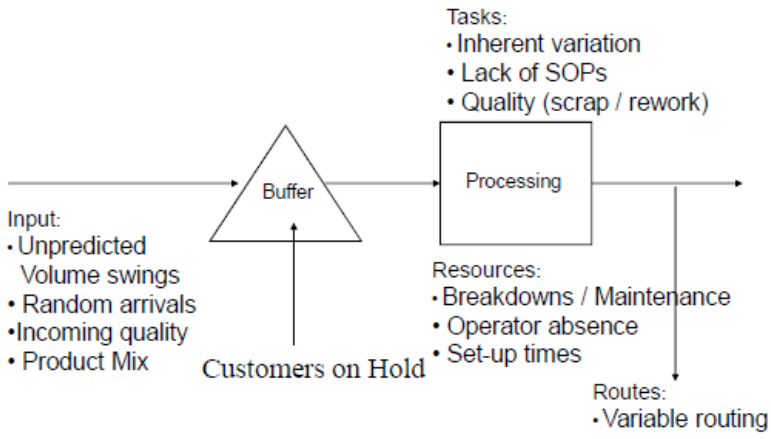
Waiting lines are ubiquitous

- Banks
- Doctors
- Call centers
- Insurance agencies
- Case evaluations!

Typical capacity decisions

- How many additional beds should a hospital add to limit patient backlog below 50?
- What should be the size of a call centre such no calling customer waits more than 30 seconds?
- What is the probability that when a customer walks into a bank she finds at least one teller free?
- How will an additional runway at Mumbai airport reduce aircraft waiting time?

Where does the variability come from?



Need to understand waiting lines

- Customers waiting are like WIP inventory
- Waiting times can have a halo effect on how customers view the rest of the service encounter
- Staffing decisions needs to consider the impact of waiting
- Every second waiting in the queue is a non-value add activity

Essential features of queuing systems

- Arrival process: rate and population
- Service process: rate and capacity
- Queue configuration
- Queue discipline
- Service process

Agree?

- If service rate is higher than arrival rate then there would not be any queue
- With one server if X is the average number of people in the queue, with two servers, the average number of people in the queue would be X/2

Performance metrics of a M/M/1 queue

Server utilisation

In the case of single server: $\rho = \frac{\lambda}{\mu}$

In the case of multiple servers: $\rho = \frac{\lambda}{S\mu}$

Little's Formula

Average time customer spends in system $W_s = \frac{L_s}{\lambda}$

Average time customer spends in queue $W_q = \frac{L_q}{\lambda}$

In the case of a Single Server

Average number of customers in system $L_s = L_q + \frac{\lambda}{\mu}$

The psychology of waiting

- Waiting is an integral part of our lives
  - But causes so much grief!
- Perception is more important than reality
- Unoccupied time feels longer than occupied time
  - Distract and entertain

The psychology of waiting

- Pre-process waits feel longer than in-process waits
  - Communicate as soon as possible and get customers in process
  - Wait in the bar!
- Uncertain or unexplained waits feel longer than known waits
  - Communicate frequently
  - Impact of anchoring and prospect theory

What's new in queuing theory

- Diseconomies of queue pooling in the emergency department http://hbswk.hbs.edu/item/7425.html

THANK YOU