



The Lighthouse

November 2006

Elyria/Lorain Section 814
Mission Statement

To advance community and member quality excellence through educational opportunities, non-competitive information exchange, networking, forming alliances and leadership growth



Table of Contents

<i>November 15th Meeting</i>	<i>1</i>
<i>Chair's Message</i>	<i>1</i>
<i>Message from the Editor</i>	<i>4</i>
<i>Publish with Quality Press</i>	<i>4</i>
CERTIFICATION CLASS CALENDAR	6
<i>Your Executive Committee</i>	<i>6</i>

consulting company located in the greater Cleveland area. Bud is a registered professional engineer and certified quality management systems lead auditor he has published over forty papers and lectured extensively on the subject of quality concepts and techniques. He is a contributing author to the Juran Quality Control Handbook, McGraw Hill, contributing author to The Product Liability Handbook, Quality Press, and a member of the International TAG's 69 & 176 for ISO Standards, and a Officer of the American National Standard's Z-1 Committee for The United States.

Chair's Message

"Few people do business well who do nothing else " - Lord Chesterfield In one of our LearningLink surveys, 21% of respondents said they put their job first and were workaholics. Another 26% weren't quite sure but are starting to manifest typical workaholic behavior - such as working through lunch and putting in lots of extra hours after work. Most workaholics perceive themselves to be highly disciplined people simply because they work so hard. In reality, our workaholicism is not a sign of discipline, but of another not so flattering trait - that of compulsion or behavior without rational choice. The workaholic has allowed the job to intrude into every area of life, not through choosing that path but by lacking the discipline and skills necessary to define boundaries for business and personal activities. Workaholics have given permission to others to set these boundaries - the boss, the cellphone, the computer, the voice mail and BlackBerry are really in charge of the workaholic's life. Without a strong sense of self and a goal for balance, the workaholic does not know when to say no - literally, does not know when to call it a day.

No matter how ingrained this behavior might be, you can change for the better, starting today. It might be as simple as deciding the hour at which you start and end each day or scheduling an hour to exercise each day. Whatever you decide, take the first step now. The best way is to have a written plan for each day. Set appointments with yourself for important aspects of your life outside the office. Where your personal life is concerned, you have to learn to say yes.

Check out the Section's Web Site
See all the latest changes
www.eriecoast.com/~asq0814

November 15th Meeting

WHAT:

Hope Model for Personal Improvements for Personal Health

by Bud Gookins, ASQ Fellow

WHEN:

Wednesday, November 15th, 2006
Meeting starts at 6:00PM
Dinner 6:00PM to 7:00PM

Talk and Q&A Session: 7:00PM to 8:00PM

WHERE:

Polaris Business Resource Center

[See Map Here](#)
7285 Old Oak Blvd
Cleveland, OH 44130

Section 0814 will cover the cost of the meal for Section 0814 members.

Dr. E.F. "Bud" Gookins is President and Managing Partner of Strategic Quality Consulting; a quality systems and management

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New Section Members

Please welcome the following new members to Section 0814.

Loren H. Dill

George L. Frazier Sr.

Tech Corner

Control charts

From Wikipedia, the free encyclopedia

The **control chart**, also known as the '**Shewhart chart**' or '**process-behaviour chart**' is a [statistical tool](#) intended to assess the nature of variation in a [process](#) and to facilitate forecasting and management.

The control chart is one of the seven basic tools of [quality control](#), which include the histogram, [Pareto chart](#), [check sheet](#), control chart, [cause-and-effect diagram](#), [flowchart](#), and [scatter diagram](#). See [Quality Management Glossary](#).

History

The control chart was invented by [Walter A. Shewhart](#) while working for [Western Electric](#). The company's engineers had been seeking to improve the reliability of their [telephony](#) transmission systems. Because [amplifiers](#) and other equipment had to be buried underground, there was a business need to reduce the frequency of failures and repairs. By [1920](#) they had already realised the importance of reducing variation in a manufacturing process. Moreover, they had realised that continual process-adjustment in reaction to non-conformance actually increased variation and degraded quality. Shewhart framed the problem in terms of [Common- and special-causes](#) of variation and, on [May 16, 1924](#), wrote an internal memo introducing the control chart as a tool for

distinguishing between the two. Dr. Shewhart's boss, George Edwards, recalled: "Dr. Shewhart prepared a little memorandum only about a page in length. About a third of that page was given over to a simple diagram which we would all recognize today as a schematic control chart. That diagram, and the short text which preceded and followed it, set forth all of the essential principles and considerations which are involved in what we know today as process quality control."^[1] Shewhart stressed that bringing a production process into a state of [statistical control](#), where there is only [common-cause](#) variation, and keeping it in control, is necessary to predict future output and to manage a process economically.

Dr. Shewhart created the basis for the control chart and the concept of a state of statistical control by carefully designed experiments. While Dr. Shewhart drew from pure mathematical statistical theories, he understood data from physical processes never produce a "[normal distribution](#) curve" (a [Gaussian distribution](#), also commonly referred to as a "[bell curve](#)"). He discovered that observed variation in manufacturing data did not always behave the same way as data in nature ([Brownian motion](#) of particles). Dr. Shewhart concluded that while every process displays variation, some processes display controlled variation that is natural to the process, while others display uncontrolled variation that is not present in the process causal system at all times.^[2]

In 1924 or 1925, Shewhart's innovation came to the attention of [W. Edwards Deming](#), then working at the Hawthorne facility. Deming later worked at the [United States Department of Agriculture](#) and then became the mathematical advisor to the [United States Census Bureau](#). Over the next half a century, [Deming](#) became the foremost champion and exponent of Shewhart's work. After the defeat of [Japan](#) at the close of [World War II](#), [Deming](#) served as statistical consultant to the [Supreme Commander of the Allied Powers](#). His ensuing involvement in Japanese life, and long career as an industrial consultant there, spread Shewhart's thinking, and the use of the control chart, widely in Japanese manufacturing industry throughout the [1950s](#) and [1960s](#).

More recent use and development of control charts in the Shewhart-Deming tradition has been championed by [Donald J. Wheeler](#).

Details

A control chart is a [run chart](#) of a sequence of [quantitative data](#) with five horizontal lines drawn on the chart:

- A *centre line*, drawn at the process [mean](#);
- An *upper warning limit* drawn two standard deviations above the centre line;
- An *upper control-limit* (also called an *upper natural process-limit* drawn three [standard deviations](#) above the centre line;
- A *lower warning limit* drawn two standard deviations below the centre line;
- A *lower control-limit* (also called a *lower natural process-limit* drawn three [standard deviations](#) below the centre line.

Common cause variation plots as an irregular pattern, mostly within the control limits. Any observations outside the limits, or patterns within, suggest (*signal*) a [special-cause](#) (see *Rules* below). The [run chart](#) provides a context in which to interpret signals and can be beneficially annotated with events in the business.

Choice of limits

Shewhart set *3-sigma* limits on the following basis.

- The coarse result of [Chebyshev's inequality](#) that, for any [probability distribution](#), the [probability](#) of an outcome greater than k [standard deviations](#) from the [mean](#) is at most $1/k^2$.
- The finer result of the [Vysochanskii-Petunin inequality](#), that for any [unimodal probability distribution](#), the [probability](#) of an outcome greater than k [standard deviations](#) from the [mean](#) is at most $4/(9k^2)$.
- The empirical investigation of sundry [probability distributions](#) that at least 99% of observations occurred within three [standard deviations](#) of the [mean](#).

Shewhart summarised the conclusions by saying:

... the fact that the criterion which we happen to use has a fine ancestry in highbrow statistical theorems does not justify its use. Such justification must come from empirical evidence that it works. As the practical engineer might say, the proof of the pudding is in the eating.

Though he initially experimented with limits based on [probability distributions](#), Shewhart ultimately wrote:

Some of the earliest attempts to characterise a state of statistical control were inspired by the belief that there existed a special form of frequency function f and it was early argued that the normal law characterised such a state. When the normal law was found to be inadequate, then generalised functional forms were tried. Today, however, all hopes of finding a unique functional form f are blasted.

The control chart is intended as a heuristic. [Deming](#) insisted that it is not an [hypothesis test](#) and is not motivated by the [Neyman-Pearson lemma](#). He contended that the disjoint nature of [population](#) and [sampling frame](#) in most industrial situations compromised the use of conventional statistical techniques. [Deming's](#) intention was to seek insights into the [cause system](#) of a process ...*under a wide range of unknowable circumstances, future and past ...* He claimed that, under such conditions, *3-sigma* limits provided ... *a rational and economic guide to minimum economic loss...* from the two errors:

1. *Ascribe a variation or a mistake to a special cause when in fact the cause belongs to the system (common cause). In statistics this is a [Type I error](#)*
2. *Ascribe a variation or a mistake to the system (common causes) when in fact the cause was special. In statistics this is a [Type II error](#)*

Calculation of standard deviation

As for the calculation of control limits, the [standard deviation](#) required is that of the [common-cause](#) variation in the process. Hence, the usual [estimator](#), in terms of sample variance, is not used as this estimates the total squared-error loss from both [common- and special-causes](#) of variation.

An alternative method is to use the relationship between the [range](#) of a sample and its [standard deviation](#) derived by [Leonard H. C. Tippett](#), an estimator which tends to be less influenced by the extreme observations which typify [special-causes](#).

Rules for detecting signals

The most common sets are:

- The [Western Electric rules](#);
- The Donald J. Wheeler's rules;
- The [Nelson rules](#).

There has been particular controversy as to how long a run of observations, all on the same side of the centre line, should count as a signal, with 7, 8 and 9 all being advocated by various writers.

The most important principle for choosing a set of rules is that the choice be made before the data is inspected. Choosing rules once the data have been seen tends to increase the economic losses arising from *error 1* owing to [testing effects suggested by the data](#).

Alternative bases

In 1935, the [British Standards Institution](#), under the influence of [Egon Pearson](#) and against Shewhart's spirit, adopted control charts, replacing *3-sigma* limits with limits based on percentage points of the [normal distribution](#). This move continues to be represented by [John Oakland](#) and others but has been widely deprecated by writers in the Shewhart-Deming tradition.

Performance of control charts

When a point falls outside of the limits established for a given control chart, those responsible for the underlying process are expected to determine whether a special cause has occurred. If one has, then that cause should be eliminated if possible. It is known that even when a process is *in control* (that is, no special causes are present in the system), there is approximately a 0.27% probability of a point exceeding *3-sigma* control limits. Since the control limits are evaluated each time a point is added to the chart, it readily follows that *every* control chart will eventually signal the possible presence of a special cause, even though one may not have actually occurred. For a Shewhart control chart using *3-sigma* limits, this *false alarm* occurs on average once every 1/0.0027 or 370.4 observations. Therefore, the *in-control average run length* (or in-control ARL) of a Shewhart chart is 370.4.

Meanwhile, if a special cause does occur, it may not be of sufficient magnitude for the chart to produce an immediate *alarm condition*. If a special cause occurs, one can describe that cause by measuring the change in the mean and/or variance of the process in question. When those changes are quantified, it is possible to determine the out-of-control ARL for the chart.

It turns out that Shewhart charts are quite good at detecting large changes in the process mean or variance, as their out-of-control ARLs are fairly short in these cases. However, for smaller changes (such as

a 1- or 2-*sigma* change in the mean), the Shewhart chart does not detect these changes efficiently. Other types of control charts have been developed, such as the [EWMA chart](#) and the [CUSUM chart](#), which detect smaller changes more efficiently by making use of information from observations collected prior to the most recent data point.

Criticisms

Several authors have criticised the control chart on the grounds that it violates the [likelihood principle](#). However, the principle is itself controversial and supporters of control charts further argue that, in general, it is impossible to specify a [likelihood function](#) for a process not in statistical control, especially where knowledge about the [cause system](#) of the process is weak.

Some authors have criticised the use of average run lengths (ARLs) for comparing control chart performance, because that average usually follows a Geometric distribution, which has high variability.

Message from the Editor

This newsletter is our method for informing you, the members of Section 0814, on meetings, plant tours, educational opportunities and other valuable information to you as Quality professionals. We hope that this information is useful and relevant to your daily activities both professionally at work and personally at home. In addition, attending the meetings, plant tours, and classes will earn you recertification units (RU's) to help maintain your certifications.

To make this newsletter more useful to you we would like your input on how to improve it. In addition to your suggestions we would also like give you the opportunity to publish some of your experiences or knowledge to the other members of the section. Please send your suggestions to michael.haessly@adelphia.net

If you would like to opt out of receiving this e-mail please update your profile on the ASQ website as such. If this is the first time that you have received this newsletter then you need to opt in to receiving e-mails and also need to update your profile on the ASQ website.

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Statistics Humor

It is proven that the celebration of birthdays is healthy. Statistics show that those people who celebrate the most birthdays become the oldest.

CERTIFICATION CLASS CALENDAR

**Classes are always offered in conjunction with the certification and require a minimum of 6 students.
If less than 6 students register for a class it may be canceled.**

Exam Date		December 2, 2006
Registration Date		November 13, 2006
CBA	Biomedical Auditor Certification	
CCT	Calibration Technician Certification	XXXXXXXX
CHA	HACCP Auditor Certification-	
CMI	Mechanical Inspector Certification	
CMQ/OE	Quality Manager Certification	
CQA	Quality Auditor Certification	XXXXXXXX
CQE	Quality Engineer Certification	XXXXXXXX
CQIA	Quality Improvement Associate Certification	XXXXXXXX
CQPA	Quality Process Analyst Certification	XXXXXXXX
CQT	Quality Technician Certification	
CRE	Reliability Engineer Certification	
CSQE	Software Quality Engineer Certification	XXXXXXXX
CSSBB	Six Sigma Black Belt Certification	

Your Executive Committee

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ASQ

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FOR QUALITY™

MEETING: Wednesday, November 15th , 2006