STATISTICS Newsletter ©

Volume 18, No. 1 **Winter, 1999**

Chair's Message

by Don Williams

As the year flies by it is time for another newsletter. It seems like yesterday was Christmas, except for paying the bills. The Fall Technical Conference (FTC) was a success. The officers and council members met and started implementing some of our long-range plans. Specifically, we determined that the most important plans to be immediately implemented were to provide new products and services to our members. To this end, we are developing a list of products and services that we can provide in a timely fashion, and we are determining those that will need more time and effort to develop.

Marcey Abate of Sandia Corporation is in charge of our new Statistical ClearingHouse, which is nearing completion and should be available shortly. We think this will be of great benefit and interest to our members and other customers. Jim Lenhart of Sandia Corporation is our new Web Master, replacing Mark Kiel. We extend a hearty "thank you" to Mark for getting our webpage up and running and for all the effort he has put forth. Mark needed to step aside from that responsibility due to his heavy load as Chair of the Chicago section and employment commitments. He will be involved in future efforts. We also thank Jim for taking on the task. He has hit the ground running and has made numerous changes already.

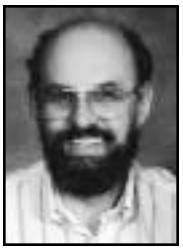
The Annual Quality Congress (AQC) will be in Anaheim, California on May 24-26. You are encouraged to attend AQC and also attend the Division business meeting at 7:00-9:00 p.m. on May 24. Of course, we welcome any who wish to participate in our Division planning meeting, which will be held on Sunday, May 23 from 8:00 a.m.-5:00 p.m. Actually, we encourage any member wishing to get involved in Division activities to attend these meetings. We can always use 'new blood'. If you do attend AQC but are unable to participate the meetings, at least come by our booth in the exhibition area. We would like to meet you and get your opinions concerning your Division's operations and what you would like to see us do in the future.

We always have need for fresh ideas and energy in making the Division move forward. If you are interested in getting involved, please check elsewhere in this newsletter for openings that currently exist. The involvement of our members is the primary fuel that makes the Division function. We look forward to having you get involved and meeting you in Anaheim. Even if you can't make the meeting, send us an e-mail message.

(Please see the list of email addresses and position openings elsewhere in this newsletter.) Δ

Editor's Message

by Ralph St. John



As most of you have noticed, this newsletter is a few weeks late in arriving. Blame for that lies squarely on my shoulders. The reasons are irrelevant, the truth is that I have tried to do all of the editing by myself. Oh, I've advertised that I wanted an assistant, but I wasn't ready to relinquish control. Then, when a 'speed bump' gets put in my path, there's no one to turn to and deadlines fall by the wayside. So, I've

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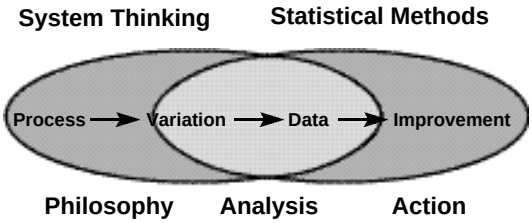
Inside This Issue

MISSION

- Promote Statistical Thinking for Quality and Productivity improvement.
- Serve ASQ, business, industry, academia and government as a resource for effective use of Statistical Thinking for quality and productivity improvement.
    1. Our primary customers are Statistics Division members.
    2. Other key customers are:
        a. Management
        b. Users and potential users of Statistical Thinking
        c. Educators of the above customers
- Provide a focal point within ASQ for application-driven development and effective use of new statistical methods.
- Support the growth and development of ASQ Statistics Division members.

VISION

Statistical Thinking Everywhere



DESIRED DIVISION END-STATE

- Our members will be proud to be part of the Division.
- Our Division's operations will be a model for other organizations.
- We will be a widely influential authority on scientific approaches to quality and productivity improvement.

PRINCIPLES

- Our customers' needs will be continuously anticipated and met (i.e. customer focused rather than customer driven).
- Our market focus for products and services is weighted as follows:
    1. Greatest weight on intermediate level.
    2. Nearly as much weight on basic level.
    3. Much less weight on advanced level.
- Focus on a few key things.
- Balance short-term and long-term efforts.
- Value diversity (including geographical and occupational) of our membership.
- Be proactive.
- Recognize that we exist for our customers.
- View statistics from the broad view of quality management.
- Apply Statistical Thinking ourselves; that is, practice what we preach.
- Uphold professional ethics.
- Continuously improve.

STRATEGY

- Design and deliver selected useable products.
- Have a strong and vibrant Division infrastructure.
- Demonstrate the broad effectiveness of Statistical Thinking.
- Integrate Statistical Thinking into educational curricula.
- Develop a vibrant information communication system.
- Influence key decision makers.

Disclaimer

The technical content of material published in the ASQ Statistics Division Newsletter may not have been refereed to the same extent as the rigorous refereeing that is undergone for publication in **Technometrics** or **J.Q.T**. The objective of this newsletter is to be a forum for new ideas and to be open to differing points of view. The editor will strive to review all articles and to ask other statistics professionals to provide reviews of all content of this newsletter. We encourage readers with differing points of view to write to the editor and request an opportunity to present their views via a letter to the editor. The views expressed in material published in this newsletter represents the views of the author of the material, and may or may not represent the official views of the Statistics Division of ASQ.

Criteria for Basic Tools and Mini-Paper Columns

Basic Tools

Purpose: To inform/teach the "quality practitioner" about useful techniques that can be easily understood, applied and explained to others.

Criteria:
1. Application oriented/not theory
2. Non-technical in nature
3. Techniques that can be understood and applied by non-statisticians.
4. Approximately three to five pages or less in length (8 1/2" x 11" typewritten, single spaced.)
5. Should be presented in "how to use it" fashion.
6. Should include applicable examples.

Possible Topics:
New SPC techniques
Graphical techniques
Statistical thinking principles
"Rehash" established methods

Mini-Paper

Purpose: To provide insight into application-oriented techniques of significant value to quality professionals.

Criteria:
1. Application oriented.
2. More technical than Basic Tools, but contains no mathematical derivations.
3. Focus is on insight into why a technique is of value.
4. Approximately six to eight pages or less in length (8 1/2" x 11" typewritten, single spaced.)
   Longer articles may be submitted and published in two parts.
5. Not overly controversial.
6. Should include applicable examples.

General Information

Authors should have a conceptual understanding of the topic and should be willing to answer questions relating to the article through the newsletter. Authors do not have to be members of the Statistics Division.

Submissions may be made at any time to the Statistics Division Newsletter Editor. All articles will be reviewed. The editor reserves discretionary right in determination of which articles are published.

Acceptance of articles does not imply any agreement that a given article will be published. Δ

LETTERS TO THE EDITOR:

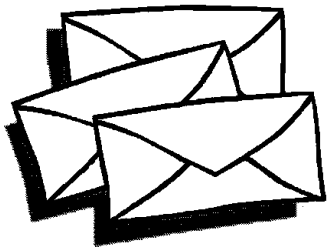
To the Editor:

Folklore has it that Vince Lombardi, late coach of the Green Bay Packers, used to begin each football season with this speech to his team: "We will begin with the basics. Gentlemen, this is a football." Coach Lombardi's focus on basics – blocking and tackling – and his belief in executing simple plays with consistent perfection – created a football dynasty. Coach Lombardi was a man that understood how to improve football quality – reduce variation.

Thinking about the importance of basics in achieving success brings me to Davis Balestracci's paper, **"Data Sanity, Statistical Thinking Applied to Everyday Data**", and Dr. Lloyd Nelson's criticisms of it. Recently, when my management asked for help with a better way to present and analyze organizational performance data, I would not, and did not refer them to a basic text on statistics. Instead, I discussed and presented them with a copy of the author's paper. Mr. Balestracci's approach is to teach by demonstrating examples of practical applications. And we desperately need practical applications of statistical thinking – not just theory.

The Statistics Division's Mission, Vision…, Principles, and Strategy identifies its members as primary customers and the greatest market focus as intermediate and basic levels. Education, learning and knowledge of basic statistical tools and statistical thinking are critical to the development of ASQ's membership. With due respect to Dr. Nelson, us real world quality practitioners desperately need basic statistical tools. I commend Davis Balestracci for his important contribution to our understanding and use of basic statistical tools for data analysis.

Thomas C. Trible
Richland, WA



To The Editor:

As a new member of ASQ and the Statistics Division, I've just received the fall '98 issue of the Newsletter. Two pieces really caught my attention: Your message on Statistical Thinking, and a letter to the editor from Dr. Lloyd S. Nelson.

Is there some way I can get my hands on the publications referred to in these pieces? Specifically, I'm very interested in obtaining a copy of:

1) Don Emerling's Message in the Spring '98 issue of the Stat Division Newsletter;

2) A Special Publication by the AQC Statistics Division titled "Data Sanity: Statistical Thinking Applied to Everyday Data" by Davis Balestracci.

Can you be of assistance? Your help would be appreciated.

Sincerely,
Philip Cline
Washington and Lee University

EDITOR'S MESSAGE

Continued from page 1

got to bite the bullet. I've been editor since August, '97, and the shelf life of Stat Division Newsletter Editors isn't much over two years. Sometime before September, 2000, I will retire as editor. Is there someone out there who would like to be editor-in-training for twelve months? You would have an opportunity to work as assistant editor, learning the ropes before being set loose. Qualifications? Broad background in statistics, enjoy writing and editing, willing to travel to FTC in October and AQC in May for Stat Division meetings, able to work independently, willing to devote 30 hrs or more for each issue of the newsletter (three issues per year), work well with other volunteer officers and committee chairs. Compensation: working with a great bunch of people, major travel expenses reimbursed, and the satisfaction of seeing the finished product. If you're interested, please contact me.

Capability Indices. Either you love them or you hate them. Unless you're Pignatiello, Ramburg, or Gunter, in which case you are known to both love and hate them. Bob Mitchell has written an "introduction" to capability indices article for this issue. I hope this article will stir some of you to write. Which index do you use? Why? What's wrong with using indices? How bad can they be? Isn't it ok to just calculate them for descriptive purposes? What about robustness to non-normality? What about sample size? What about…? Send me your comments and recommendations at rstjohn@cba.bgsu.edu.

Don't delay, don't put the newsletter down, just send me email right away. Based on referee's comments to this article, I anticipate a 'spirited' response. All responses received before June 1 will be included in the June newsletter. Please try to be brief and to-the-point, otherwise editing may be necessary. This is not a popularity contest; I simply want readers to share their experience with capability indices. Thanks for writing. Δ

1998 FALL TECHNICAL CONFERENCE (42nd Annual)
OCTOBER 22-23, CORNING, NY
A PICTORIAL SUMMARY

Dot Sempolinski
Conference Chair

John Randall
Thursday Luncheon Speaker

Ed Sylvestre, Hunter Award
Recipient, with Don Williams

Mouli Venkataramani,
Student Scholarship
Recipient and Speaker

Don Williams with
Youden Speaker Doug Montgomery

Bert Gunter
4000 Observations??

Stat Division Head Table:
Don Williams, Janice Shade, Bob Brill and Bob Mitchell

Friday Luncheon Speaker David Moore,
ASA President, with John Cornell

"Applied Statistics in the 21st Century"
43rd Annual Fall Technical Conference
October 13-15, 1999 • Wyndham/Greenspoint Hotel • Houston, Texas

STATISTICS DIVISION MEETINGS AT THE 1998 FALL TECHNICAL CONFERENCE

Corning Radisson, Corning, New York

Council Meeting

7:30pm – 9:30pm, Oct. 22, 1998
Present:

Don Williams	Chair
Bob Mitchell	Chair-Elect
Janice Shade	Treasurer
Ralph St. John	Newsletter Editor
J. Van Bowen	Secretary
Ed Schilling	Standards Committee Chair
Bob Brill	'98-'99 FTC Program Chair

Three student scholarship recipients were present, as were Art Holms and Melanie Day. Van Bowen kept minutes, Shade kept time, Mitchell was facilitator, and Williams chaired.

Agenda:
Distributed and agreed to by all.

Williams reviewed Mission, Vision, Principles, and Strategy, Market Weighting, and Meeting Ground Rules.

'98 AQC Council Meeting minutes were approved with minor amendments.

JL Madrigal presented, in absentia, his Membership Report (Please see attached report). Statistics Division membership is roughly 10,206 with 40 section liaisons in 28 states. Report approved.

Treasurer's report was distributed; roughly $37,000 in checking and $52,000 in money market. The report was approved, noting that membership dues are down a bit, and postage for our large (44pgs) Special Publication was higher than normal (see attached).

McDermond application: we have achieved Level III since its inception and Don Williams reports the 1997-1998 application has been submitted.

Reviews of Philadelphia '98 AQC Strategic Planning and July '98 Operational Planning sessions: Mitchell and Williams reviewed both.

GTC activities: Don Williams reported that each Group had been assigned a Special Project by the GTC. Group I (includes the Statistics Division) is asked to design and deliver an industry-specific product. Annual GTC meeting is scheduled in Milwaukee for November 21.

Committee Reports given:
- Organizational vacancies were identified.
- Paula Sommers was identified as the Education chair.
- New FTC contract (2000-2004) is due by April 1, 1999.
- '99 AQC – no status report available.
- Pre-FTC edition Newsletter is in the mail.
- Marketing. A written report from Margolis was circulated.
- Certification committee – no report.
- Examining committee – no report.
- Standards committee – Shilling indicated the need for updating several of the ANSI/ASQ Standards we now shepherd.
- Statistical Clearinghouse – Marcey Abate has completed design of the structure of this tactical plan. Implementation is underway. To visit, see: **http://internet. roadrunner. com/~webstar/.**
- Webmaster. Mark Keil is stepping down, and Jim Lenhart has agreed to serve as our new Web Master. (Jim will also be working with Marcey on the Statistical Clearinghouse.) A BIG "Thank-you" to Mark for bringing the Statistics Division into the digital communications age!!
- Special Publications Volume Pricing. Janice reported on special pricing concerns with respect to multiple-quantity orders for the Special Publications. We plan to offer graduated discounts for various volumes of purchases.

Wrap-Up:
- Concerns – Low attendance (may be related to lack of employer support for travel, or inaccessible location). We may need to use conference calls for key committee reports.
- Good organization of meeting – well received org. chart.

Tactical Planning

Saturday, October 24
8:00am – 3:00pm

Present: Don Emerling - Past Chair; Don Williams - Chair; Bob Mitchell - Chair-Elect; Ralph St. John - Newsletter Editor; Janice Shade - Treasurer; JL Madrigal - Membership Chair; Van Bowen - Secretary.

Agenda approved: expectations centered on focus and passion for moving ahead on a few doable things for May.

Review:
- Statistical Thinking – "How To Improve Processes…" is in 3rd draft form.
- Section Liaisons – 40 in 23 states. Communication and member nurturing is the focus and progress is noted.
- Clearinghouse – initiative is moving very well.
- Division Dashboard (customer satisfaction) – we can track the number of new members, Section Liaisons, and interested volunteers; but we have no measure of Member Retention.

FTC REVIEW
- Bob Brill reviewed the '98 FTC details – 230 attending, Short Courses had 30 and 31 students respectively. Discussions with CPID indicate possible expansion of Short Courses to including Saturday offerings. Vendors may be invited. Stat Division web page promotion of the FTC is recommended for next year. SAS sponsored the FTC website this year. Bob Brill and Van Bowen will represent the Stat Division in negotiating the new 5-year FTC contract (2000 – 2004).

Objective: Deliver one new product by the 1999 AQC
Ideas:
- Publish old Newsletter articles packaged together under 3-4 themes.
- Develop Powerpoint presentation for each Special Publication.
- Develop short course for each Special Publication
- Complete the old Newsletters website; promote at AQC.

Review of status of Section Liaisons – Section liaisons are section members who act as a liaison between their section and the Stat Division. They will tell us what their section needs, and tell their section what the Stat Division offers to help sections with training and education in Statistical Thinking. This function is an important lever/conduit to increase interest in Stat Division activities at the local Section level. Suggestions:
- Develop an Orientation Package for Section Liaisons (Galen Britz).
- Develop a CD learning process for a self-paced learning environment.
- Write a Newsletter article on using the Powerpoint slides to give a Statistical Thinking presentation.
- Survey of Section Liaisons regarding their needs for after-dinner technical speakers, or section conference speakers. i.e. What do you need to function effectively as a section liaison, and how can we help?

Preliminary list of existing products:
- "How To"… series. (16)
- Special Publications. (3)
- Glossary and Tables for Statistics.
- Newsletters (28 years), including Youden Addresses, Minipapers, and Basic Tools Papers.
- Statistical Thinking Powerpoint Presentations. (2)
- Web Sites (Stat Division home page, Statistical Clearinghouse, and Old Newsletters site).
- Short courses (FTC and AQC courses, and other short courses).
- ANSI Standards.

Ideas for new products from the Publications Committee:
- "Improving processes"…Series. Improving performance using Statistical Thinking.
- Collected works, on specific topics or by specific authors, from previous publications
- Seminars/workshops. Developed by request. Section sponsors & pays presenter.
- "How To"… Series (Tools - focused):
  Effective teamwork
- "Understanding…" Series (concepts & theories)
  Team concepts
  Team dynamics
- Special Publications.
  1. Powerpoint slides for each special publication.
  2. Video
  3. CD-ROMs
- Develop and market "packets" with/through the QIC, where each packet is a collection of past articles (from various sources) on a common theme or by a famous author.

MEMBERSHIP REPORT – MAY '98 - SEPTEMBER '98

Submitted October 22, 1998

Nurturing Program - Section Liaison

This has been an exciting year. The section liaison program is something that members think was long overdue. In my interaction with members, they have great expectations about this program. One of my goals as membership chair is to do whatever is needed (in coordination with division officers and Regional Councilors) to make sure that the purposes of the section liaison program are accomplished.

There is excitement and enthusiasm for the benefits that we foresee for the local section members and our division. In April '98, we had 25 section liaisons in 18 states. Alabama (section 1503 - Daniel Dankovic), California (711 - Tom Vaden), Colorado (1300 - Steve Taylor, 1309 - Richard Schleusener), Delaware (506 - Richard Christy), Ontario (401 - Michael Cohen), Georgia (1525 - Ernie Miller), South Carolina (1112 - Tom Slack), Illinois (1201 - Joe Heinz, 1205 - Bob Dovich), Indiana (903 - John Murphy), Kansas (1301 - Glen Fondaw), Louisiana (1518 - Michael Laviotte, 1521 - Michael Donelly), Maryland (502 - Mel Alexander), Michigan (1000 - Rajinder Kapur, Greg Gruska), New York (303 - Mohan Gupta, 204 - Mary Garfield), Ohio (800 - Charlie Margolis, 810 - Bill Bleau 909 - Ha Dao), Pennsylvania (203 - Rich Eckenroth), Texas (1402 - John Jennings), Utah (615 - Gordon Booth), Virginia (1108 - George Marrah).

Since April, these members have agree to be section liaisons: Sonja Kinzlmaier (MA, S102), Lewis Wilford (PA, S505), Charles Yarnall (NJ, S307), Karen Pitts (S306), Murray Therrell (ARK, S1415), Daniel Parks (OR, S607), John Chen (MS, S1304), Kevin Walters (MA, S103), Jerome Chaffee (UT, S618), Robert Nash (PA, S500), James Doebereiner (OH, S810), Gregory Gay (MI, S1003), Stan Broskey (PA, S503), James Benneyan (MA, S100), Don Walters (IN, S918), Shamik Pandit (NJ, S304), Glen Gee (IN, S920), Jerry Whitson (TN, S1118), Gary Reidenbach (WI, S1202). The addition of these members as SL brings our total to 40 in 23 states.

As part of the new nurturing program, since April '98 55 new members have replied to the questionnaire they received in their welcome package. They all like the idea of participating in local meetings with other Stat Division members. Their expectations of the division are similar to those previously reported, i.e., seminars at the local level, development of material about statistical thinking, discussion about new techniques, etc.

Membership Dynamics/ Retention

Based on the ARIMA model that we developed to study membership, I predicted (in April '98) that the Statistics division would end the 1997-1998 year with 10699 members (95% C.I. 9405 – 11902). In reality, we concluded the year with 10493 members.

JL Madrigal, Membership Chair

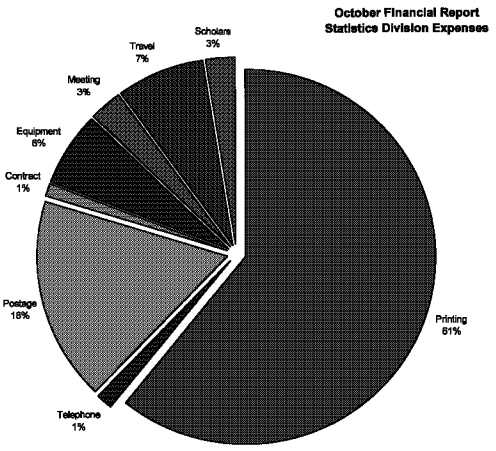
The data for the last quarter of '97-98 are:

Month	Total - 1996	Total - 1997	Total - 1998	% Variation 1997-1998	% Variation 1996-1997
July	11348	11143	**10517**	**-.056**	-.018
August	9545	9325	**8638**	**-.073**	-.023
September	9882	9607	**8855**	**-.078**	-.028

STATISTICS DIVISION
BALANCE SHEET AS OF SEPTEMBER 1998

Assets	
Cash or Cash Equivalents	37,503
Money Market Savings	52,243
Cash or Equivalents	**89,746**
Accounts Receivable	2,198
Prepaid Postage	0
Advances	0
Prepaid Expenses	0
Capital Assets	5,811
Accumulated Depreciation	–5,811
Capital Assets (Net)	**0**
Current Assets	**91,944**
Long Term Assets – Reserve Fund	
Long Term Assets	285,471
Total Assets	**377,415**

Liabilities	
Due to General Fund	–1,275
Deferred Revenue	**–1.275**
Deferred Revenue	0
Total Liabilities	–1,275
Fund Balance	
Beginning Balance	–365,191
Current Year Excess	–10,949
Total Fund Balance	**–376,140**



REVENUE

	Printing	*Telephone*	*Postage*	*Contra*	*Equipment*	*Meeting*	*Travel*	*Scholars*	*Ott Schol*
$	13,648	318	3,953	258	1,395	658	1,666	565	30,000
% Change	82.1	13.7	7.2	–7			–37.3		

ASSETS

	Dues	*Sales*	*Interest*
$	63,078	173	158
% Change	–8.30	17.70	–49.50

THE WILLIAM G. HUNTER AWARD

AWARDED AT THE FALL TECHNICAL CONFERENCE, CORNING, NY, OCT. 20, 1998

William G. Hunter was the founding chair of the Statistics Division of the American Society for Quality. The Statistics Division established the Hunter Award in 1987 to promote, encourage and acknowledge outstanding accomplishments during a career in the broad field of Applied Statistics. Criteria for the Hunter Award are that the recipient be: (a) a consultant; (b) an educator for practitioners; (c) an integrator of Statistical Thinking with other disciplines, and; (d) an excellent communicator. This is the 11th anniversary of the award. Previous winners are:

1988 William J. Hill
1989 Rudolf G. Kittlitz
1990 Ronald D. Snee
1991 Gerald J. Hahn
1992 Brian L. Joiner
1993 John F. MacGregor
1994 J. Edward Jackson
1995 William H. Lawton
1996 Douglas C. Montgomery
1997 Lynne B. Hare

Nomination forms for the Hunter Award for 1999 and beyond can be obtained from Galen Britz, chair of the William G. Hunter Award Committee, at:

Galen C. Britz
3M Center, Building 220-9W-08
St. Paul, MN 55144
Phone: 612-736-6499
Email: gcbritz@mmm.com

Nominations for the 1999 award must be received by June 30, 1999.

Let us now turn to this year's award. We are pleased to report that the 1998 Hunter Award recipient is Edward A. Sylvestre.

Ed is the Principal in Quantitative Insights, a company specializing in Market Research, Market Modeling, Voice of the Customer and Quality Improvement. Prior to 1992 his career at Eastman Kodak Company spanned 27 years. Ed also was on the Adjunct Faculty at the Rochester Institute of Technology and the University of Rochester.

Ed received a B.S. in Engineering Mathematics from the University of Rhode Island, and an M.S. in Statistics from the University of Rochester. He has published nine papers and has presented numerous papers. He developed techniques for Self-Modeling Non-Linear Regression, Self-Modeling Curve Resolution, and the Grid Technique. His work on curve resolution is recognized in the chemometrics area as the fundamental paper in this area and is heavily referenced.

Ed is a member of the American Marketing Association and the American Statistical Association. He is a Fellow of the American Society for Quality where he has served as:

- Member of Review Board of the Series, "The ASQC Basic Reference in Quality Control"
- Associate Editor of Technometrics
- Member of Technometrics Management Board
- Secretary, ASQC General Technical Council
- Chair, ASQC Statistics Committee (the predecessor of the Statistics Division)
- Board of Directors – Rochester Section

Let's measure Ed against the Hunter Award Criteria:

- Consultant – He has done a lot, both in his own organization and external to his organization
- Educator for practitioners – Ed has taught at RIT, U of R and provided training for engineers and scientists at Eastman Kodak
- Integrated Statistical Thinking with other Disciplines – Ed has integrated statistics into the fields of chemistry and business research to name just two.
- Excellent communicator – If you have worked with Ed or heard him speak, I'm sure you agree that he is an excellent communicator.

Ed more than meets the criteria, and that is why he was chosen as the recipient of the 1998 Hunter Award. Please join us in congratulating Edward A. Sylvestre. Δ

HUNTER AWARDEE ED SYLVESTRE'S COMMENTS

"When Galen called me about two months ago to inform of the award I was obviously very pleased and honored but interestingly enough my first response was to collect additional data. I asked Galen to send me a copy of the names of the past winners of the award. Through my career with Kodak and my association and activities with AQC and ASA I was fortunate to work closely with 7 out of the ten past winners of the award as well as with Bill himself.

After reviewing the list of past winners, the first thing that came to my mind was the role that the Fall Technical Conference and the Gordon Conference on Statistics in Chemistry and Chemical Engineering has had on the development of my career as well as most of the past winners of the award. I have always viewed these two conferences as premier opportunities to learn more about the application of statistics and to associate with the individuals who were driving the application of statistics into new areas.

Over the past month I had the opportunity to talk to four past winners of the award: Bill Hill, Ron Snee, Ted Jackson and Bill Lawton. Again falling into the old trap of data collecting, I asked them to list the top five attributes that come to mind when they think of Bill Hunter. Not exactly a scientific sample but on the other hand it was 40% of the population.

Continued on page 22

W.J. YOUDEN MEMORIAL ADDRESS

Presented at the
42nd Annual Fall Technical Conference

Corning, New York
22 October, 1998

A PERSPECTIVE ON MODELS AND THE QUALITY SCIENCES: SOME CHALLENGES AND FUTURE DIRECTIONS

Douglas C. Montgomery
Professor of Engineering
Arizona State University

Introduction

When I was approached about presenting the Youden Memorial Address, I was deeply honored. For me, the Youden Address has always been one of the high points of the FTC. I thank the Statistics Division for this honor. Stu Hunter, Brian Macpherson, Bill Woodall, and Geoff Vining provided some valuable criticism of an earlier draft of this presentation, for which I am grateful. I also thank Stu for sharing some memorabilia, and some personal insights about Jack Youden.

During the years I have attended the FTC, I have heard many excellent Youden Addresses. There are two that are particularly outstanding, and that I would recommend as "required reading". John Cornell (1992) gave a thorough and insightful review of the main body of Jack Youden's technical work, and provided many valuable insights about how this work still has relevance today because it has become part of our standard practice. Ed Schilling (1986) talked about communicating with statistics, and held Youden up as a role model for us all.

John and Ed pointed out that Youden was a tremendously effective communicator. During a 40 year career, he published 109 papers appearing in over 40 different journals, 5 books, a bimonthly column (36 articles) in Industrial and Engineering Chemistry from 1954 to 1959, and he gave 211 talks under 125 different titles dealing with statistical methodology and experimental design. This is a remarkable accomplishment.

Advancement of Scientific Thought

I would call Jack Youden a contributor to the advancement of scientific thought. There is a process by which this takes place. Let's use how our understanding of the physical world has evolved as an example. Then I would like to use this to draw some parallels in the quality sciences.

Aristotle in 340 B. C. in his book On The Heavenspostulated that the Earth was a round sphere, not a flat plate. This was based on three empirical observations. First, eclipses of the moon were caused by the Earth coming between the sun and the moon, and the Earth's shadow was always round. Second, the North Star appeared lower in the sky when viewed from more southerly latitudes than it did when viewed from the north. Third, one sees the sails of a ship approaching from over the horizon before one sees the hull. Aristotle thought the Earth was stationary, and that the sun, moon, planets, and stars moved in circular orbits around the Earth.

Ptolemy expanded these ideas in the second century A.D. to form a complete cosmological model, with the earth at the center surrounded by eight spheres that carried the moon, sun, known planets, and the so-called fixed stars. What was beyond the last sphere was never really made clear, but the Christian church adopted the model because it seemed to fit the Scriptures, and there was plenty of room outside that last sphere for both Heaven and Hell. Ptolemy's model had flaws – it predicted the positions of heavenly bodies reasonably accurately, but to do so, it was necessary to assume that the moon followed an irregular path that sometimes brought it twice as close to the Earth as at others. Empirical observation revealed that this was not the case, since the moon would then at times appear twice as large as at others. And there was certainly other disagreement with his model – Geoff Vining has pointed out that Dante thought that Hell was at the center of the Earth. In 1514 Copernicus proposed a simpler model in which the sun was stationary and the planets moved in circular orbits around it. Galileo and Kepler, once again after empirical observation, modified this theory allowing for elliptical orbits, and now the predicted and observed positions matched much more closely. However, elliptical orbits were a rather messy complication, as at this time, it was thought that magnetic forces were responsible for planets orbiting the sun.

Isaac Newton published the Principia Mathematica in 1687. In this book, he resolved this dilemma. Newton proposed a law of universal gravitation. He also developed a theory of how bodies move in space and time - what we refer to as "classical" or Newtonian mechanics, involving the familiar concepts of mass, force, momentum, kinetic and potential energy.

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Gravity is the weakest of all the physical forces, but it always attracts and it operates over very long distances. This meant that the model with a stationary sun with planets revolving around it was not appropriate. The sun was in motion. Eventually, the model of an expanding universe was developed. This model was confirmed by Edwin Hubble in 1929 – once again, by empirical observation of the phenomena.

Newtonian mechanics are very adequate for "classical" objects such as airplanes, cars, planets – large-scale structures. However, in measuring the speed of light, a problem arose in the Newtonian view of the world. James Clerk Maxwell predicted that light "waves" should travel at a certain fixed speed, but Newton's theory of gravity had eliminated the idea of absolute rest. Therefore, the speed of light had to be measured relative to something. This led to the theory that there was a substance called the "ether" that was everywhere, and that the speed of light was relative to the ether. The Michelson-Morley experiment showed that this was not true, and the resolution of this fault with the then-current theory ultimately led to the publication of a famous paper in 1905 by Albert Einstein in which he postulated what ultimately became in 1915 the general theory of relativity. By this we mean that the laws of science are the same for all freely moving observers (this was already true for Newton's laws of motion, but Einstein extended it to include Maxwell's unification of the forces of electricity and magnetism, and the velocity of light).

Even this theory has its failures. When one applies the general theory of relativity on an atomic scale, we would predict that electrons would decay in their orbits so the atom (and indeed, all matter) would rapidly collapse on itself. Niels Bohr, Max Planck, Werner Heisenberg, Erwin Schrödinger, and P. A. M. Dirac reformulated mechanics into quantum mechanics to resolve these difficulties. Richard Feynman was one of the key developers of quantum electrodynamics, which now attempts to unify all of the theory of light and matter, excluding gravitational and certain nuclear effects.

Today, our understanding of the physical world is in terms of two partial theories; the general theory of relativity that describes gravitational effects and the large-scale structure of the world, and quantum theory that deals with phenomena on a very small (atomic and sub-atomic) scale. Quantum theory unites the electromagnetic force, the weak force, and the strong force – all of which are quite powerful, but operate only over extremely small distances. The fourth force, gravity, is excluded.

Notice how these partial theories have developed in an essentially continuous manner, albeit over a long period of time. Ptolemy built upon the ideas of Aristotle, correcting observed inconsistencies or flaws. So did Copernicus, Galileo, and the others, in a steady and unending manner, right up to the present. Each scientist took the model or theory that had been proposed and refined it, or in some cases rejected it and reformulated the theory. This is how science works. Each participant reviews the work of others, refining, rejecting, reformulating and improving what has been proposed, with all of the ideas out in the open for everyone to see, to study, to criticize, and ultimately to improve.

This scientific process is not purely of academic interest. These two partial theories have played important roles in the development of our society. For example, quantum mechanics has been one of the key factors in the development of modern microelectronics.

What is a Scientific Model or Theory?

Please note that I have painted (perhaps an overly-long) portrait about the development of models and theories, using the familiar world around us as the canvas. Models are essential to the scientific process regardless of the field of science involved. Models are typically based on empirical observation of some phenomena, and they are used to improve our understanding of how that phenomena behaves, or how it will react to certain forces or inputs.

What is a model or theory? To paraphrase Steven Hawking, it's a set of rules that relate quantities in a quantitative manner to physical observations. For a model (or theory) to be useful, it must satisfy two requirements:

1. It must accurately describe real-world observations with only a few arbitrary parameters, and
2. it must make precise predictions about future observations.

These are Hawking's requirements, not mine.

How do these concepts of models and theories relate to the work of the industrial statistician? Consider Figure 1. This figure presents 200 (suitably disguised) observations on the output of an industrial process. These observations were taken during a period of operation where the operating personnel thought that the process was not experiencing any upsets, external interventions or assignable causes. Perhaps a reasonable model for these data is

$$x_t = \mu + \varepsilon_t \qquad (1)$$

where μ is an unknown constant and ε_t is a disturbance term, which we will assume to be a random error with mean zero and standard deviation σ. We will also assume that the disturbances and hence the observations are uncorrelated.

The model in equation (1) is often called the Shewhart Model, because Shewhart control charts are very effective as a monitoring procedure for process data of this type. Shewhart control charts will detect shifts or drifts in the mean μ and changes in the standard deviation σ reasonably quickly, provided the upsets are of at least moderate size. Furthermore, if

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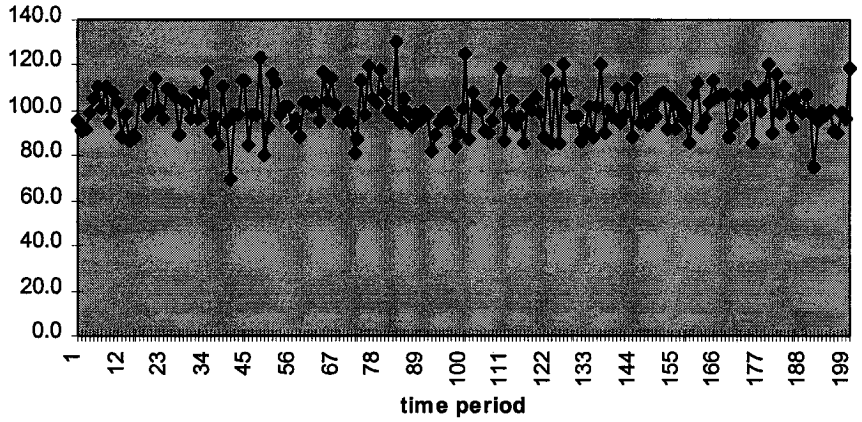

Figure 1. Uncorrelated Data

the control chart is designed in the usual manner, it will produce a false action signal about once every 370 samples if the parameters are estimated accurately.

Now consider the process data in Figure 2. I don't think that the Shewhart model would work very well as a model for this data, using Steven Hawking's criteria. For example, the best predictor for the next observation using the Shewhart model is the sample average. I don't think very many of us would be comfortable with using the average as a predictor of the observations in Figure 2.

It is not difficult to show that a reasonable model for the data in Figure 2 is

$$x_t = \xi + \varphi x_{t-1} \quad \mu + \varepsilon_t \qquad (2)$$

where $-1 < \varphi < 1$. This as an autoregressive model of order 1. It incorporates autocorrelation in the process data; that is, adjacent observations on the process are dependent. In most real-world industrial process where this type of behavior is evident, the parameter $\varphi > 0$. When φ is large, close to unity, there is a lot of dependent structure in the data, and when φ is near zero there is only weak dependency. Notice that when φ is zero the autoregressive model reduces to the Shewhart model.

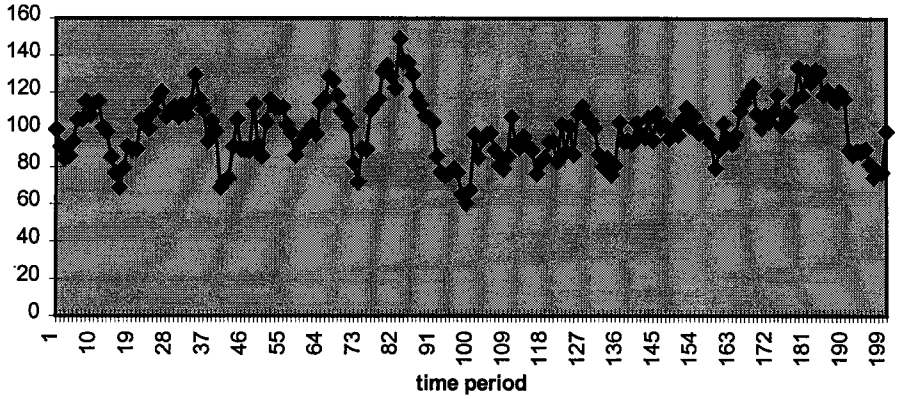

Figure 2. Correlated but Stationary Data

Now consider the process data in Figure 3. Notice that the process seems to drift; that is, the mean wanders about, taking on different values in different local segments of time. It turns out that neither of the two previous models would be satisfactory for this data. A plausible process model is

$$x_t = x_{t-1} + \varepsilon_t - \theta\varepsilon_{t-1} \qquad (3)$$

where $-1 < \theta < 1$. This is the integrated moving average model, referred to as IMA (1,1), and it is capable of describing the wandering mean behavior exhibited in Figure 3.

Figures 1 - 3 present three different types of process behavior; stationary and uncorrelated, correlated but stationary, and nonstationary. Data that is correlated but stationary is typically observed in systems where the sampling rate is short relative to the time constant of the system. Nonstationary data is often the result of inertial forces arising from tanks, reactors, changes in input material properties, and other dynamic behavior that is an integral part of the process itself. In

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only one situation is the Shewhart model really entirely appropriate, and will the Shewhart control chart provide a consistent and effective framework for process monitoring.

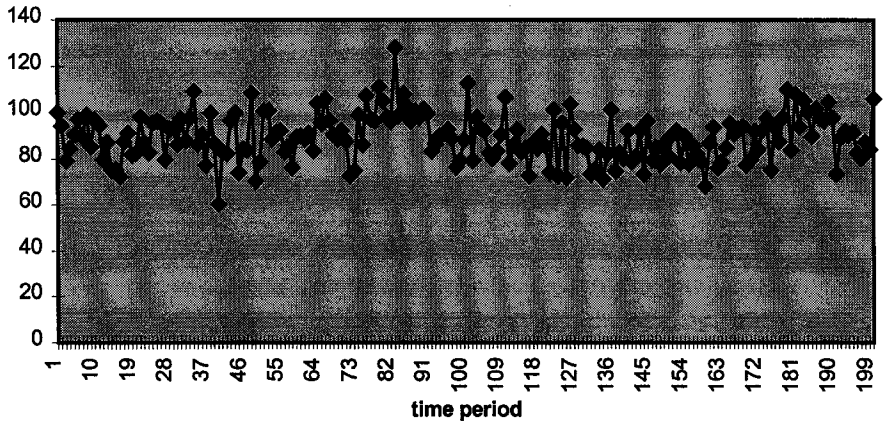

Figure 3. Nonstationary Data

These ideas seem straightforward, even simple. There is not (yet) a universal model that will describe the behavior of all processes, just as there is not (yet) a unified theory that describes the physical world. However, as George Box has said, "all models are wrong, some models are useful." None of these process models may be entirely right, but all of them can be useful in certain circumstances.

There are individuals who claim that there is only one model, or perhaps more accurately, that there is no need for a model at all, and that the Shewhart control chart for individuals, or pre-control, or some other technique is the universal monitoring tool, appropriate for any and all situations. They criticize models, new theories and new ideas as impractical, unnecessary or wrong. They question the relevance of research in statistical quality control, claiming that there have not been any really useful innovations since the pioneering work of Shewhart. They tell us that even when we have many related process variables to monitor that the faithful use of the individuals control chart is still all we need. How can anyone that understands the fallacy of experimenting with process variables one-at-a-time accept this last bit of logic? Bill Woodall and I have recently written about some aspects of this controversy and responded to some of the criticism of research on SPC in a paper that will appear in the Journal of Quality Technology [Woodall and Montgomery (1998)].

These individuals remind me of the old woman in the story recounted by Steven Hawking. A famous astrophysicist was delivering a lecture on the latest cosmological model, with planets revolving around stars, stars clustered into galaxies, all moving away from each other at great speed as a result of the "big bang". At the end of the lecture, the old woman stood up and announced that the speaker's ideas were rubbish, and that the world was a flat plate supported on the back of a gigantic tortoise. "I see," the astrophysicist said, "and upon what does the tortoise stand?" He knew he had her with this one. "You think you're very clever, young man," the old woman replied, "but it's turtles, all the way down."

The thought of the earth as a plate supported on the backs of an infinite stack of turtles is rather amusing. However, the old woman was ignoring some basic facts that can easily be verified by empirical observation. Similarly, I think that you can verify by direct observation that the critics of a modern approach to process monitoring and control who argue that one chart fits all are wrong. Is there any modern applied field where we are still using the technology of the 1920s? Do we travel on the land and air vehicles of that era – or use the communication and computing devices? Do we use the statistical tools of the 1920s in design and empirical modeling? The answer is no, because there have been many useful advances. How can you rationally believe that there have not been similar important and useful advances in process monitoring and control?

What Process is Used to Validate a Model or Theory?

Simply put, the validation process is based on skepticism. Perhaps we should call it professional skepticism. You reduce the chance that you will make a mistake, that is, having the wrong theory or model, by testing the underlying ideas. The ideas are reduced to a hypothesis (not a hypothesis in the statistical sense, but the broader scientificsense), and subjected to a rigorous standard of evidence. The necessary experiments or observations are made by other workers, the analyses or measurements repeated, the results and conclusions verified. If there is an error in the model or theory, modifications are made and the model or theory evolves to a new form. Look at how our models of the physical world have evolved as an example of this process at work.

Peer-review of ideas is an essential part of this process. It is one of the pillars of the scientific method. Jack Youden believed deeply in peer-review, and participated in it throughout his career, both as an author/researcher and as a re-

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viewer. Consider his extensive contributions to our field in the form of refereed journal papers, or his discussion in Technometrics on random balance experimentation, a not-so-good idea that did not survive the process of peer-review. Jack Youden didn't self-publish his ideas. In fact, neither does George Box, Stu Hunter, Ray Myers or other intellectual leaders of our profession.

We have seen peer-review work in our own time. Consider the controversy over "Taguchi Methods" that begun in the early 1980s. These ideas were initially introduced to American industry by entrepreneurs. We were told that "traditional" methodology based on statistical design principles that have evolved since Fisher's time and response surface methods didn't work, or that they weren't appropriate for robust design problems, or that they were too "complicated". The entrepreneurs said to just "trust us, we know what's best". Eventually, of course, Taguchi's ideas were peer-reviewed, although the entrepreneurs didn't volunteer for this – it was forced on them. The result was that Taguchi's strategic ideas were useful, but his technical ideas such as the on-line methods, signal-to-noise ratios, accumulation analysis, inner- and outer-array designs, and some very novel uses of the analysis of variance were found to be inefficient, ineffective, and in most cases wrong. Now Taguchi methods are still around, largely because the salesmen are still at work, driving their wagon into various new communities, and like the days of yesteryear, opening the tailgate and selling the snake-oil. But the professional community of industrial statisticians have done their job, the results of peer-review are out there for anyone who is interested to see, and hopefully the potential damage from the technical errors in these ideas has been largely contained.

The critics of a more modern approach to process monitoring and control have not undergone similar evaluation. I issue a challenge to the critics that tell us that models are unnecessary, that there has been no useful research since Shewhart's time, and that the methodology of the 1920s is universally applicable today. Write up your ideas and submit them for peer-review. Don't self-publish these ideas, don't present them at conferences, and don't publish them in non-refereed outlets. Start at the top. Send your ideas to the Journal of Quality Technology or Technometrics.

Now I'll let you in on a secret. These critics are not going to do this. The reason that they aren't going to participate in the scientific process is that, just like the people that brought us Taguchi Methods, they are entrepreneurs, and salesmen need something to sell. The easier and simpler the idea, the better, because it's easier to sell. Furthermore, management is often looking for an easy solution to a hard problem, and selling simple ideas plays right into their hands. The critics will not participate in peer-review because if their ideas are discredited, their business will suffer. It is in their best personal interests to spread doubt and confusion, and to obfuscate.

The critics will say that they aren't going to participate in peer-review because the potential reviewers of their ideas "don't understand the problem", or because only they have the divine wisdom to know what's right (that is, they have no peers). In other words, they are saying that peer-review doesn't work. That flies in the face of centuries of scientific thought and progress, and is so ridiculous that it doesn't deserve further discussion.

Please don't think that I am being unduly harsh on the entrepreneurs. There is absolutely nothing wrong with making a living selling ideas, and helping others solve problems and improve their businesses for a fee. I'm calling for selling the right ideas. However, when critics of an updated, modern approach to process monitoring and adjustment attack new ideas and cause confusion and misapplication of statistical methods, purely for their own financial self-interest, I think that they are creating a big problem for all industrial statisticians.

You must realize that there are some very smart people out there that will recognize very quickly that they are being given bad advice. They are, among others, the process engineers, control engineers, scientists, and computer specialists that know quite a bit about their processes. These individuals have strong backgrounds in the sciences and mathematics, they understand the dynamical behavior of systems, the multivariate nature of their processes, and the complexities of actual process operations. It will not take them long to determine that the Shewhart control chart is not the right answer for all of their problems. Unfortunately, when they do that, industrial statisticians in general suffer the consequences. We all look bad.

Some Challenges for Industrial Statisticians

In August I gave a presentation at the Joint Statistical Meetings [Montgomery (1998)] on some challenges confronting industrial statisticians today. One of the technical challenges I addressed was the need to adopt a more modern approach to process monitoring and adjustment. I have expanded somewhat on that theme today. It is indeed time to modernize the training and education that we deliver on SPC, both in universities and in industry, and to modernize its professional practice.

I would like for you to consider a brief list of some of the other challenges that I think surround us.

- Today's industrial environment is often data-rich and highly automated. Data is often multivariate in nature, highly autocorrelated, and impacted by several components of variation. Training, however, is focused almost exclusively on small sample size techniques for the univariate situation using techniques that assume independence over time and a single component of variation. John MacGregor (1997) stressed some of these identical points in his 1995 Youden address. We have not yet responded to this challenge.

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- Designed experiments have penetrated many areas of industry – resulting in many opportunities; including handling "unusual" responses – possibly with generalized linear models. Multiple responses are commonplace, and nonstandard designs are often required because of constrained design spaces or restrictions on blocking or randomization.
- Methods for reliability improvement are of increasing importance. This is being driven by reduced design/development leadtimes, and higher customer expectations. The reliability aspects of software and process equipment (predictive maintenance, for example) are becoming major considerations.
- Often the industrial statistician is viewed as a "manufacturing" person. We must broaden this perspective into other key aspects of the business, such as information systems, supply chain management, and research and development. We must learn how to deal more with issues in the health and services industries.
- Certification/Registration activities – ISO/QS 9000. The statistical components of these activities are extremely weak; in fact, some statistical aspects of these standards suggest (require?) use of poor methods. The problem is further compounded because often the auditors, registrars, and consultants in this field have "modest" statistical backgrounds. As a result, a lot of money is being wasted, insufficient effort is being devoted to reduction of variability, and too many important activities are being taken over by bookkeepers and paper-shufflers.
- The industrial statistician is not often viewed as a full team member in product and process design and development work. As evidence of this, I don't often see statisticians included in team recognition awards or patent awards, and statisticians are not usually asked to lead yield enhancement activities. One cause of this is that many statisticians lack the background in science and engineering to make content contributions to industrial development projects; consequently, they may be regarded as little more than "data technicians". Students in statistics programs should be encouraged to take more advanced courses in physics, chemistry and the engineering sciences (such as thermal and electrical science, fluid mechanics, materials science, and so forth) as electives possibly replacing courses in mathematics. Statistics programs should work actively to recruit students from engineering and the sciences and not just from mathematics. Possibly statistics programs should become interdisciplinary programs, housed jointly in colleges of arts & sciences, engineering, and management, with all statistics faculty holding joint appointments in an engineering, science or management department.

Some of these issues are, obviously, easier to address than others. I think that a significant part of our failure to deal with these (and other) challenges is organizational in nature. Does the modern industrial statistician truly have a "home"; that is, a place where idea exchanges over issues such as the ones I have raised, networking, and continuing education occur in the most effective manner? Do our current professional societies – ASA (SPES, Q&P), ASQ (Statistics, CPI, and Reliability Divisions), and the Institute of Industrial Engineers (QRE Division) completely meet our needs?

Industrial statisticians are only a small percentage of the memberships of these societies. The FTC is the only truly "joint" activity focused on the needs of industrial statisticians, and only the ASA and ASQ members participate. Furthermore, the national organizations don't even recognize this conference. If you call either society headquarters to obtain information about the FTC, they won't know what you are talking about. In the words of Stu Hunter, we're Balkanized. Therefore, is it time for a "new" society – a **Society for Industrial and Applied Statistics?** That is, an organization that is not concerned about government statistics, or the soft side of quality management, and which is not largely made up of bureaucrats and human resources managers.

I think that the answer to that question is yes. Not because I think that starting a new professional organization would be fun, or easy. I think that we are confronted by a world that is changing rapidly, and that presents many difficult challenges – some of which I have attempted to describe today. The problems are real, and because they are important, they are going to be addressed. There is an old saying with which I am sure you are familiar – "Statistics is too important to be left just to statisticians." If we do not successfully confront some of the problems that I have raised, then engineers, scientists and computer specialists will step into the gap we have left, and, sadly, much of the practice of industrial statistics will be taken over by others. Δ

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SECTION LIAISON CORNER

Last month, I held a conference call with some of the 40 section liaisons. It is always exciting to talk with our section liaisons. I thank all of them for the excellent work they are doing.

As mentioned previously, the purpose of this corner is to share with all division members some of the exciting activities that take place in their local sections. My goal is to ignite in all of you the desire to meet with other SD members, and other ASQ members, to increase the interaction among ourselves.

John Jennings, Region 14 councilor and section liaison for the Dallas section, recently sent me the following report:

The Dallas Section had a one-hour tutorial before the Sept. '98 monthly dinner meeting. John Jennings presented the "Statistical Thinking Presentation" from the 49th Annual Quality Congress. The Dallas section also has Special Interest Groups (SIG) on ISO9000, Auditing, Process Improvement, Software, and Quality Awards (TQA/MBNQA). These SIG's meet on non-section-meeting nights to provide training and presentations based on their core topic. The Process Improvement SIG studies statistical and problem solving tools and techniques used to improve processes. The "Statistical Thinking Presentation" was presented at the Oct. '98 Process Improvement SIG meeting.

The Dallas Section Website (www.asq.org/about/join/sections/sect1402/) provides members with current information and can also be used to share info with others. Drop by and say 'howdy'.

J.L. Madrigal
Membership Chair

(**Editor's note:** The presentation mentioned here is available as a Powerpoint presentation package. I'm sure John would be willing to share his experience using this package.) ∆

1999 ANNUAL QUALITY CONGRESS

"Sur fin' Into The Next Millennium"

53r d Annual Quality Congr ess
American Society for Quality
May 24 - 26, 1999, Anaheim, CA

The Statistics Division will again be very active at the Annual Quality Congress. Greg Gruska, Regional Councilor for region 10, served on the AQC Program Committee. The result is a session category dedicated to Continuous Improvement – Statistical Thinking. In addition, the Statistics Division-sponsored AQC session will present a case study for the application of Statistical Thinking in Education.

In the 9:30am - 11:30am session on Tuesday, May 25, four Statistics Division Past Chairs (Britz, Emerling, Hare, and Hoerl) and our current Treasurer (Shade) will present an experiential learning session (T102) on **"Statistical Thinking for Management"**. This session will involve the attendees in determining how the concepts of Statistical Thinking can help managers improve results. Statistical Thinking will be defined and contrasted with statistical methods, per se. The attendees will then help determine how statistical thinking can be effectively applied to their own roles as managers.

At 1:00pm Tuesday, May 25, JL Madrigal, our Membership Chair, will moderate a session on the **"Use of Statistical Thinking in the Air Force and at Home"**. Steven Flowers will present a performance management system to support decision making for enterprise-wide improvement in the Air Force Medical Service. Tom Pohlen, 3M, will present a case study on the application of process behavior charts to monitor and control his diabetic wife's blood glucose levels.

In support of the Statistics Division Vision, "Statistical Thinking Everywhere", our division-sponsored AQC session this year will feature our Education Committee Chair-Paula Sommer and Charlie Blanton reporting on a case study of teaching 15 principals how to improve school administration in small and rural schools using Statistical Thinking. **"Implementing Statistical Thinking in Education: A Case Study of School Principals"** (W208). The case study was performed in the Texas Women's University Principal's Academy and builds on what they learned using Statistical Thinking in one middle school in downtown Dallas. The Academy met in five sessions of 1.5 days length from June 1998 to January 1999. The premise of the Academy was to teach three aspects of Dr. W. Edwards Deming's Theory of Profound Knowledge to reduce variation in schools. These three aspects are:

- Theory of knowledge (PDSA),
- Theory of psychology (Change Process)
- Systems thinking (5 C's of Systems Suffering).

Statistics Division Chair Donald Williams will moderate the session.

Other STAT Activities at 53rd AQC

The Statistics Division hospitality suite in the Anaheim Marriott will be open nightly Sunday through Tuesday. Come enjoy a drink and snacks, meet the Officers, converse with the Speakers, network with your peers and colleagues, discuss Statistics Division plans and initiatives, offer to help implement our tactical plans, or just plain relax! Stop by the Statistics Division booth in the exhibition hall for suite room number and times.

The Statistics Division exhibit booth will be set up in the area of the ASQ Megabooth. In keeping with the conference theme and the Division's Vision, our focus this year is to demonstrate our presence on the World Wide Web. Our web homepage as well as links to our past Newsletters on the web, the new "Statistical Clearinghouse", and the "Virtual Academy" (K-12 educational modules for statistics) will be demonstrated. Our interactive activity this year will be to poll visitors to the booth for suggestions on how we can further use these electronic tools to enable the broad application of Statistical Thinking, and thus to better serve members of the Statistics Division. An Affinity Diagram will be generated real-time from the responses. We will solicit and invite ideas for future Virtual Academy modules and authors.

We will not be sponsoring an AQC Short Course this year. Instead, we are working with ASQ Tutorials to develop and offer a regional short course and/or workshop. Δ

Statistics Division Meetings At the 53rd AQC

The Statistics Division will hold a number of meetings during the AQC. Members of the Division are invited and welcome to attend any of these meetings. If you wish to become actively involved to better the Division please come by to express your views and interest.

1. Tactical Planning Session
   8:00am - 5:00pm, Sunday, May 23.
   At this session we will report on the past year's activities, discuss current activities, and evaluate future activities. In keeping with our revised mission, we expect to undertake fewer activities, do them well, and discontinue activities which we cannot complete successfully. This is a working session, and we work well together. Come join us.
2. Council Meeting
   8:30pm - 10:00pm, Sunday, May 23.
   At this meeting, we will hear the treasurer's report, the membership report, and a report from each committee chair. Any member may comment on committee activities and make suggestions for change or new activities.
3. Annual Business Meeting
   7:00pm - 9:00pm, Monday, May 24.
   Similar in content to the Council Meeting.
   This is another opportunity for the STAT leaders to listen to members' views. We welcome interested members with good ideas and/or a willingness to help. Δ

MINI PAPER
Process Capability Indices

By Robert H. Mitchell
3M Company

Process capability indices have been popular for over 20 years, since Joseph Juran[12] popularized the Capability Ratio (Cr) in his Quality Control Handbook. Eagerness to establish a single index to measure process capability has resulted in the proliferation of indices: Cp/Cpk, Vp/Vpk, Pp/Ppk, Cpm, Tz, %OOL, PPM, and more recently – "Generalized" Cp/Cpk. Abuse of these indices is well documented (Gunter)[8]. Though simple to compute, they can lead to scorekeeping by management, incorrect interpretations and tampering, with little or no product or process improvement. This article reviews the basics of estimating process capability and introduces new process capability indices.

Cp, Cpk

The original Capability Index published in Juran's Quality Control Handbook is defined as Tolerance Width divided by Process Capability.

Cp = Process Potential
= (Tolerance Width) / (Process Capability).

Juran defines Process Capability as six standard deviations for a process in statistical control. **Process Capability** = 6σ where σ is the in-control process standard deviation. The easiest method to determine process standard deviation is from the control chart of a stable process: Process Std. Dev. = R-bar/d_2, where the appropriate value of d_2 is read from a table for the subgroup size.

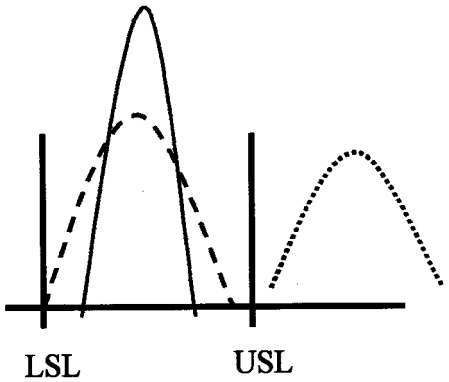
For the Cp/Cpk index to be valuable, the tolerance width, or specification range, should have real meaning, i.e. be based on functional limits per known end-user requirements ("Voice of the Customer"). Occasionally, for lack of end-user requirements, one is asked to set specifications (specs) based solely on the producer's process capability. The danger is that a process' aim and natural variation can have little relation to customer-perceived quality. How does one choose specs: use arbitrarily wide limits (+/- 6s) to ensure good Cpk values? Use arbitrarily narrow limits in an effort to lock out competition (and unwittingly, perhaps yourself)? Neither strategy focuses on the customer. Furthermore, focusing on specs alone asks, "What is the worst we can get away with?" while emphasis on target alignment and variability reduction asks, "What is the best we can do?"

According to Quality Assurance for the Chemical and Process Industries – A Manual of Good Practices 2nd Edition[1]:

> Values of Cp exceeding 1.33 indicate that the process is adequate to meet the specifications. Values of Cp between 1.33 and 1.00 indicate that the process, while adequate to meet specifications, will require close control. Values of Cp below 1.00 indicate the process is not capable of meeting specifications.

Cp is called the "Process Potential" - it simply relates the Process Capability (6σ) to the Spec Range; it does not relate the location of the process with respect to the specs. Consider the three distributions in fig. 1, all from processes having a Cp of 1.00 or better.

Figure 1



If the process is centered within the specs, and is approximately "normal" then Cp = 1.00 results in a fraction non-conforming (f.n.c.) of 0.27%. Note that Cp=1.00 doesn't guarantee that there will be only 0.27% non-conforming product. What it does guarantee is that, assuming normality, a stable process centered with respect to the specs, and the correct value of σ, there will not be less than 0.27% of non-conforming product.

Cpk = Process Capability Index.

CPK is used to summarize how a process is running relative to its spec limits. As with Cp, this measure is appropriate only when the process is stable (in-control).

$$\text{Cpk} = \text{minimum of} \left\{ \frac{\text{X bar - LSL, USL - X bar}}{3\sigma} \right\}$$

where Xbar and σ are the mean and standard deviation of the process. So, Cpk measures how far the process mean is from the nearer spec limit in terms of 3σ distances. For processes with a one-sided spec the term corresponding to the 'missing' limit is omitted.

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Special consideration must be made for non-normal distributions. Cpk works well only for the bell-shaped "normal" (Gaussian) distribution. For others it is an approximation. Unlike Xbar control charts there is no Central Limit Theorem effect in estimating process capability because Cp and Cpk relate to the distribution of **individual** items. We need to be concerned about non-normal distributions. Table 1 gives the fraction non-conforming (PPM) for different distributions, all having Cpk=1.

Table

Distribution	f.n.c.
Chi-Square (4.5df)	14,000
Heavy-tailed (B_2>3)	4,000
Uniform	0
Normal	2700

One approach to dealing with non-normal data is to transform the data. Typical transformations include taking the reciprocal, reciprocal square root, natural log, or square root of the raw data. The corresponding spec limits must be similarly transformed. Box, Hunter, and Hunter[5] offer a relatively simple method for determining a transformation to give constant variance.

Theoretical Cp, Cpk

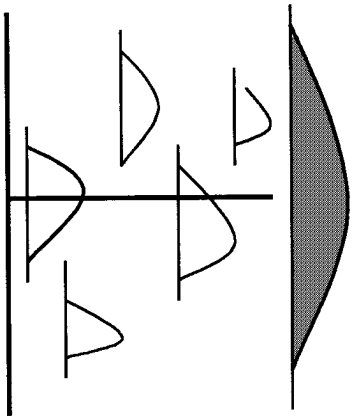
Cp* and **Cpk*** are calculated when the process is not stable, yet one desires to estimate how good the process might be if no Special Causes existed. **Theoretical Cp, Cpk** use a "best estimate" of the true process standard deviation (sigma-hat). Special Causes are excluded from the data when appropriate, to estimate the "potential" natural process variation. A theoretical process sigma-hat is calculated and Cp*/Cpk* estimated.

In general, I advise against this methodology because of potential confusion. Although meant as a measure of how good the process might be, one cannot predict since the process is not stable. These are not true Cp, Cpk values.

Pp, Ppk

Pp and Ppk are measures of process performance from a customer perspective. Process capability measures short term ability of a process to meet specs. Process performance measures long term ability of a process to meet specs. Process Performance should be distinguished from Process Capability. Pp is similar in definition to Cp, and Ppk is similar in definition to Cpk but in each we use the overall standard deviation of the data, including any Special cause variation, rather than the short term estimate of standard deviation. The overall standard deviation is a weighted average of both within-group and between-group variation. As a customer, one wants to measure performance based on total incoming variability. This is illustrated in figure 2.

Figure 2. Within subgroup Capability versus weighted average of both the within and between spread (Performance).



Cpm (Cp-Taguchi)

The **Cpm** index was introduced in 1988 (Chan[6]). The principal difference between Cpm and Cpk is the relative importance of Conformance to Specs versus Run to Target. Cpk measures how well the process mean is centered within the spec limits, and what percentage of product will be within spec. Instead of focusing on spec limits Cpm focuses on how well the process mean corresponds to the process target, which may or may not be midway between the spec limits. Cpm is motivated by Taguchi's "Loss Function". The denominator of Cpm includes the Root Mean Square deviation from the target.

$$\mathbf{Cpm} = \frac{USL - LSL}{6\{\sigma^2 + (Xbar - Tgt)^2\}^{1/2}}$$

Cpk is preferred to Cp because it measures both process location and process standard deviation. Cpm is often preferred to Cpk because the variability term used in the index is more consistent with Run to Target philosophy.

Cr

Capability ratio (Cr)[12, 13] is the inverse of Cp. If Cp = 1.33 or more is considered a capable process, then a value 0.75 or less is desired for Cr.

$$\mathbf{Cr} = \frac{6\sigma}{USL \quad LSL}$$

Tz

Target Z is a measure of targeting and is similar to, but simpler to estimate than Cpm.

$$\mathbf{Tz} = \frac{(Xbar - Target)}{\sigma}$$

Values of Tz between –0.5 and 0.5 are considered good.

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%OOL

Percent Outside of Limit uses the z-statistics to estimate the porportion of a population that lies beyond the spec limits. This measure assumes a Normal distribution. For a two-sided specification, the Z_{Lower} and Z_{Upper} proportions are calcuated from the process measn, standard deviation, and spec limits.

$$Z_{Lower} = \frac{Xbar - LSL}{\sigma}$$

$$Z_{Upper} = \frac{USL - Xbar}{\sigma}$$

Then look up the proportions from any Z-table. One-sided or nonsymmetrical specifications usually correspond to heavily skewed distributions and can yield exaggerated %OOL values.

PPM

Parts Per Million (defective) is similar to %OOL. One multiplies the Z_L and Z_U proportions by 1,000,000 each, then sum together. Again, these are theoretical estimates based on the assumption of a normal distribution. Table 2 illustrates the relation between Cpk and PPM. If receiving inspection is performed, then it is possible to compare PPM-Observed (from receiving inspection) and PPM-Calculated (from the Normal Distribution).

Table 2 PPM and Cpk fraction non-conforming (f.n.c.)

Cpk	PPM
.333	317,400
.667	45,500
1.0	2,700
1.33	63
1.50	7
1.67	0.6
2.00	2.0 PPB

*Note: This comparison of Cpk and PPM does not include the 1.5σ shift included in the "Motorola Six Sigma" program.

GCpk, GPpk

Traditional Cpk can only be estimated from a stable process; i.e., no Special Causes. Joe Voelkel[19], at the 1998 Fall Technical Conference, introduced Generalized Cp/Cpk ("GCp/GCpk"). Joe noted that there are two distinct types of Assignable (Special) cause variation, as discussed by Brian Joiner[11] - ***Erratic cause*** and ***Structural cause***. Examples of erratic special cause are an untrained operator, raw material variability, or an unknown process shift. Tool wear, and multiple cavity tools are examples of structural variation. GCpk is calculated from the fraction non-conforming (f.n.c.) of a given process. Traditional Cpk should only be estimated for stable, predictable processes; Generalized Cpk is promoted for use in cases where structural type of Special Causes is present, and Ppk should be calculated for processes affected by erratic Special Cause variation. Again, without stability there is no prediction. Software to estimate Generalized Cp/Cpk is not yet commercially available.

Additional Considerations

Structural Variation

Structure occurs when there are consistent, repeating patterns in the data. The patterns can occur over time (e.g. cycles, process deterioration), or within a subgroup (e.g. multiple cavity tooling, fixed crossweb differences, etc.). The effect of structural variation is exaggerated (wide) control limits. Structural variation is usually fairly easy to identify; points plotted on the X-bar or I chart cluster around the centerline. The ideal solution to structural variation is to eliminate the structure; however, this requires a process change, often difficult to achieve. If the structure occurs within the subgroups the 3-Chart method (Wheeler[20]) will limit the effects to the within-subgroup Range chart. The preceding paragraph introduced erratic and structural types of Special Cause variation. Stu Janis[10] elaborated on the topic of structural variation for Moving Web, Injection Molding, and batch processes. Stu explained that the standard deviation used to determine control limits should be based on the random portion of variability. It should not include biases such as fixed differences between cavities in mold tooling or crossweb differences in a web. The fixed bias only comes to play in determining the central line of a chart to control variability across cavities or across a web. Fixed differences often result in exaggerated control limits.

Multiple Sources of Random Variation

In the same paper Janis also explained the "Space vs. Time" concept of random variability. The sources of variability affecting within-subgroups (i.e. cavity-to-cavity or crossweb) are different than those affecting between subgroups (shot-to-shot or jumbo). Attempts to use within-subgroup variation (space) to set control limits for between subgroup averages (time) often result in limits that are too narrow. "3-Way Control Charts" (Don Wheeler[20]) monitor within-subgroup variability (space) using a Range chart, use a Moving Range chart to monitor short-term between-subgroup variability (time), and an Individuals charts to monitor differences between subgroup Means (time - longterm).

These same considerations may apply when estimating the standard deviation of individuals for Cp, Cpk indices of 3-Chart processes. If no bias exists, then the σ for

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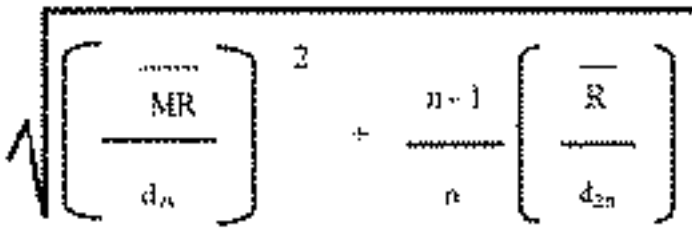
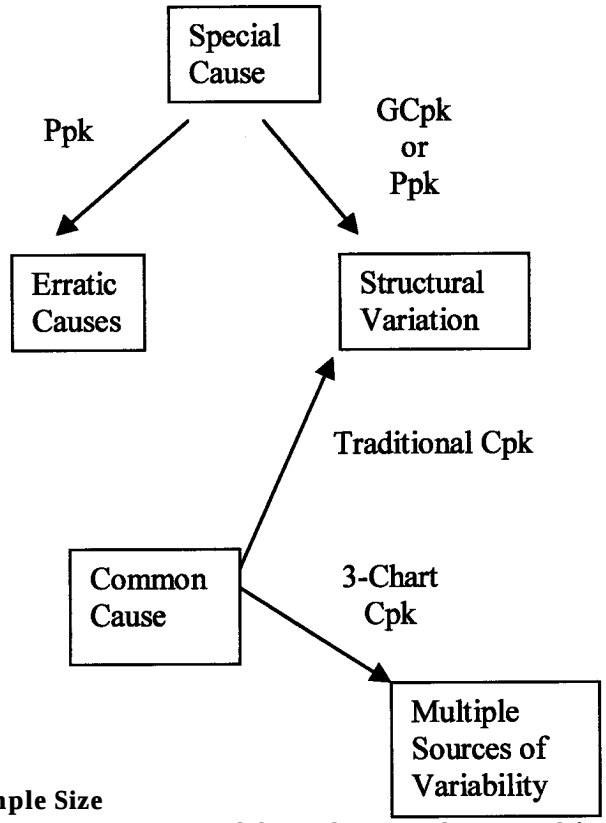
Individuals can be estimated using:
where d_{2k} = the value for d_2 using k number of sub groups



in the Moving Range, and
d_{2n} = the value for d_2 using n number of individuals within a subgroup

Roadmap



Sample Size

Because process capability indices are determined from estimates of standard deviation, they are affected by sample size (degrees of freedom). As expected, the stability of estimates of the standard deviation increases with sample size. We can show, using Chi-square tables and bootstrap techniques[7] , that a sample size (n) of 10 does not provide a very stable estimate of process capability. Even when n is 40 there is still substantial uncertainty in the estimator of Cpk. Tables 3 and 4 provide estimates of 95% Confidence Bounds for Cpk (lower bound) and Ppk (two-sided interval), assuming normality:

Table 3[7] Approximate 95% lower bound for Cpk.

Cpk	n=30	n=50	n=75
1.00	0.72	0.79	0.83
1.10	0.80	0.87	0.91
1.50	1.12	1.21	1.26
1.667	1.25	1.35	1.40

Table 4[15] 95% Confidence Interval for Ppk

Ppk	n=30	n=60	n=120
1.00	.76-1.31	.83-1.21	.88-1.14
1.33	1.02-1.76	1.11-1.61	1.17-1.52
1.67	1.29-2.19	1.49-2.01	1.47-1.90

Formulas (and further discussion) to compute the 95% Confidence Intervals for process capability indices are shown in Montgomery's[16] Introduction to Statistical Quality Control.

Practitioners often forget that process capability indices are merely **point estimates**. To avoid the pitfalls of making decisions using point estimates the concepts of Statistical Thinking should be employed (variability exists), and Cpk values plotted on control charts. A plot of Cpk values assists in the detection of process deterioration (or improvement).

Capability Studies

Process capability refers to the uniformity of the process. Montgomery[16] defines process capability analysis as an engineering study to estimate process capability. The AT&T Statistical Quality Control Handbook[3] defines the process capability study as a "Scientific systematic procedure for determining the capability of a process"… and defines capability as "the predictable series of effects produced by a process when allowed to operate without interference from outside causes…". The estimate of process capability may be in the form of a probability distribution having a specified shape, center, and spread. For this definition a process capability analysis may be performed without specs. i.e. Process Capability = 6σ.

Or, process capability may be expressed as a percent of product outside spec limits. This type of capability study ususally measures product functional performance, not the process itself. When the engineer can directly observe the process and can control the data collection methods this study is a "true process capability study" (Montgomery). When historical data is used and direct observation of the process is not possible, Montgomery refers to this as a product characterization study. "In a product characterization study we can only estimate the distribution of the product quality characteristics; we can say nothing about the statistical stability of the process."

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There are three primary techniques used to estimate process capability: histograms and probability plots, control charts, and hierarchical (nested) designed experiments.

Histograms (or stem-and-leaf plots) require at least 100 observations. If the data sequence is preserved, Mean Square of Successive Differences (MSSD) can be used to estimate the Short Term Standard Deviation (STSD). Or, an estimate of process standard deviation can be obtained from σ-hat=Rbar/d_2.

The probability plot has an advantage over histograms since it produces reasonable results for small sample sizes (Montgomery). However, other statistical methods are often needed to supplement the probability plots.

The control chart method is a simple, effective tool for process capability analysis. The control chart is the preferred technique for process capability analysis because it displays the potential capability of a process: patterns, trends, and other Special Cause signals.

An important consideration with use of the control chart method is selection of the proper rational subgroup to estimate the common cause process variability, against which special cause variability estimates are compared.

The hierarchical experimental design is a systematic approach to document and quantify the sources of variability in a process, and aids in identifying variation reduction opportunities. The fully balance, nested model is generally preferred due to its ease of statistical analysis, though unbalanced, staggered, and mixed models can be more accurate.

Final Thoughts

I have just spent several pages introducing various process capability indices. Nonetheless, I prefer to monitor progress of continuous improvement efforts with control charts rather than columns of process capability indices.

Bert Gunter[8] eloquently listed problems associated with focus on Cpk values:

1. Cpk cannot be used with one-sided specs or when the process is not normal.
2. Because the sampling distribution of the Cpk statistic is so variable it should not be used unless relatively large sample sizes are obtained (100-200).
3. Cpk goals can be impossible to meet when measurement error is large. Recall that
$$\sigma^2_{\text{Total}} = \sigma^2_{\text{Product}} + \sigma^2_{\text{Test error.}}$$
Reducing test error improves the Cpk value but does not really improve the product. Conversely, any process variability reduction without test method improvements may not result in much larger Cpk values.
4. Widening the product specs will result in a better (bigger) Cpk value but do nothing to improve the product or satisfy the customer.
5. Most importantly, Cpk is a meaningless measure of process capability unless your process is in a state of statistical control. Without statistical control a process is not predictable.

Unfortunately, a simple to understand, easy to calculate alternative to Cpk does not exist. Paraphrasing Bert Gunter, we must exercise caution to prevent process capability index scorekeeping from being confused with real improvement. Δ

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NEW FTC AGREEMENT

The three sponsors of the Fall Technical Conference (Stat and CPI Divisions of ASQ and SPES Section of ASA) recently signed a new sponsorship agreement covering the next five FTC's. There are a number of changes to the agreement, changes intended to improve the FTC, and thus provide a better experience for members. Changes have been made in site selection procedures, vendor displays, Youden speaker selection, and short course availability.

Some of the changes:

Site selection; CPID will select the site, but will now do so following input from SPES and STAT.

Vendors: A Vendor Chair will be appointed, and vendors will be allowed to exhibit at future FTC's.

The Technical Program Committee will continue to have complete authority to fill the entire technical program, with three tracks: 1) Statistics, 2) Quality Control, and 3) Tutorials and Case Studies.

A committee of past-chairs of the three sponsors will select the Youden Speaker. The STAT past-chair will chair this committee, and the STAT Division will be responsible for administrative detail for this speaker.

The Conference Registration fee will be kept as low as possible. This fee will be waived for one speaker for each technical talk, and for the two luncheon speakers, the Youden Speaker, and the Hunter Award recipient.

Short Courses; There will be as many as four short courses, and these will be scheduled either on Tuesday/Wednesday preceding the conference or on Saturday following the conference. STAT will "own" two courses, and CPID and SPES one each. STAT will be fully responsible for planning and executing the entire short course program. Short course fees will be kept to a minimum, and be consistent across sponsors. Δ

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Bob Mitchell is a Sr. Quality Specialist with 3M Personal Care & Related Products Division. Bob is a senior member of the American Society for Quality, a Certified Quality Engineer, a Certified Quality Manager, and Chair-elect of the ASQ Statistics Division.

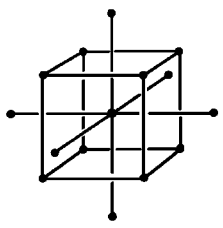
WEB SITES

The Statistics Division is responsible for developing and maintaining three web sites. The URL for each of these sites, and a brief discussion of the purpose/content of each site follows.

1. Statistics Division web page (www.asq.org/statdiv) is the official division electronic home. The viewer will find a list of officers, committee chairs and other volunteers; information on upcoming conferences (such as AQC, FTC and Applied Statistics); a list of division products and how to obtain them; the Virtual Academy, a page of links to statistics on-line tutorials; minutes of Stat Division meetings, etc.

2. The Statistical Clearinghouse. This page will primarily provide links to various Statistical resources on the web. For example, there will be links to major software vendors, major publishers of statistics materials, major statistics journals, and other statistics societies. There will also be reviews of statistics texts, software, etc. We expect this to be one of the first places someone would look in trying to answer the question – I wonder if… statistics…. – Temporarily, the URL for this page is internet.roadrunner. com/~webstar/

3. Previous copies of the Statistics Division Newsletter, beginning with the 1980 issues, are being posted at www.cba.bgsu.edu/asor/asqnews/letter.html. We hope to eventually have all previous newsletters posted, with separate pages for past Youden Addresses, past minipapers and tutorials, past lists of officers and committee people, etc. Δ



MEMBER SURVEY REGARDING LOCAL TRAINING FROM STAT DIVISION

At our Tactical Planning meeting at the fall '98 FTC, the Stat Division Council agreed to conduct a survey to identify training needs of division members at the section level. Based on information collected from new members by JL Madrigal, an overwhelming majority of them expect to receive some type of statistical training from the division. As part of a strategic plan to implement such local training, we are conducting a survey of members to determine member interest in local training sponsored by the Stat Division. This preliminary survey data will be supplemented by data collected by our Section Liaisons.

For this preliminary sample the U.S. was divided into six strata, each comprised of several regions. Within each stratum a sample proportional to stratum size was selected. The data were collected by telephone. Note that other purposes of this preliminary survey are (a) to check the questionnaire in terms of wording of questions, sequence, number of questions, etc. (b) estimate non-response, and (c) estimate variance.

Question #1 (Personal Interest). Results to date indicate that 27.7% of members are 'very interested' in participating in Statistics Division sponsored training at the local level, and 50% are 'somewhat interested'.

Question #2 (Colleagues' Interest). 44% of respondents indicated that their colleagues are 'very interested' in such Stat Division sponsored training. Another 36% stated that their colleagues are 'somewhat interested'.

Question #3 asked respondents to list specific topics of interest. Tabulation is not complete.

Respondents were given five choices for training session options, and were asked to select their top three choices. The five choices were:

- after-dinner speaker;
- two-hour seminar/tutorial;
- four-hour short course;
- one-day short course;
- two-day short course;
- don't know/refused was added to the response list.

Their **first choice** from this list was distributed as follows:

Two-day short course (31%); two-hour short course (25%); four-hour short course (19%); and one-day short course (19%).

Their **second choice** was distributed as follows:

One-day short course (56%); and four-hour short course (38%).

Their **third choice** was distributed as follows:

Two-hour seminar/tutorial (31%); and two-day short course (25%)

The final question listed six potential new products. Respondents were asked to rate these products on a five-point Likert scale, with 1 being poor and 5 being excellent ('no response' was coded separately). The six products and their average rating are the following:

1. A Web site with links to statistical information. (4.13)
2. A Web site with past division newsletters. (2.94)
3. Virtual Academy Training on the web. (3.80)
4. A compilation of mini-papers and basic tools from the newsletter. (3.68)
5. An "Improving Performance" book series. (3.70)
6. An "Understanding a Concept" book series. (4.00)

This preliminary survey doesn't provide sufficient information to significantly differentiate between the new products. It is anticipated that with more data the products will differentiate themselves. In addition, with the full survey an explanation of the new products will be included. The preliminary survey and this report were prepared by Jared Sturgeon, Kristina Swenson, Michael Given and Brian Crow under the direction of Dr. JL Madrigal. Δ

HUNTER AWARDEE

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From their list of top attributes two clearly came across as high on everyone's list: (a) broad interest in the application of statistics; and (b) excellent communicator.

To collect additional data on these attributes I did a search in the citation index that gives a listing of published references to papers Bill had published. The results showed 63 different publications were referenced with a total of 285 citations from 1983 - 1997. In reviewing the origin of the citations it was interesting to note that most were from publications in applications areas like: Chemistry, Chemical Engineering and Environmental Science. These results demonstrate that Bill's broad interest in the application of statistics and his excellent ability to communicate was motivated by many individuals outside the area of statistics and quality to apply these techniques to new and unusual applications.

In my own career I have had the opportunity to apply statistical techniques throughout the broad range of business processes: (a) Research and Development; (b) Manufacturing; and (c) Marketing. Application areas have included: (a) The Photographic Process; (b) Copiers; and (c) Clinical Chemistry; and most recently in the area of (d) Estimation of Sale and Use Tax.

Bill worked hard to point out that the application of Statistics can have a tremendous impact on helping to solve "REAL" problems. All of us in the field must continue to work not only on our technical skills but also our communication skill so that we can position our product, statistical and quality tools, to reach the broadest possible market – scientists, engineers, brand managers and general managers.

In closing, I want to thank the ASQ Statistics Division for this award and I feel very honored to be recognized as worthy to receive the award named after such an outstanding individual." Δ

NEW FACES, NEW BLOOD

The following people have recently accepted new responsibilities with the Statistics Division. Some of them are new to the group, and some are 'recycled.' Welcome aboard, or welcome back. My apologies to anyone I forgot.

Beth Propst (Past Chair and Past Newsletter Editor) is the new editor of our summer Special Publication (The summer issue of the newsletter, devoted to one topic/paper for the entire issue)

Cliff McCormick is the Short Course Chair for the Fall Technical Conference to be held in Houston October 14-15, 1999.

Marcey Abate is the Chair of the Electronic Commerce Committee. She will be overseeing and implementing webpage development and Statistical Clearinghouse development.

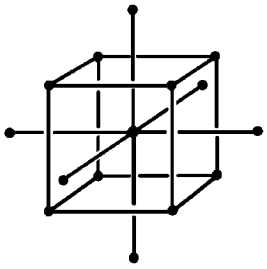
Jim Lenhart is the new Webmaster. He is responsible for developing and maintaining the Stat Division webpage, and will also be working with Marcey Abate on the Statistical Clearinghouse.

Bert Gunter is the new Statistics Division representative to the Applied Statistics Conference, held annually in December in the NY-NJ metropolitan area, and which our section co-sponsors.

Bob Mitchell (currently Chair-Elect) will be the Stat Division representative on the Program Committee for the October, 2000, FTC in the Twin Cities.

Harry Koval (a recent 3M retiree) will be Short Course Chair for the October, 2000, FTC in the Twin Cities.

A number of volunteers have stepped forward to offer their assistance for the May, 2000 AQC to be held in Indianapolis, IN. **Mark Kiel** (past Webmaster) will be the Division-Sponsored Session Manager. **Gordon Booth** and **George Marrah** will both be Topic Session Managers. **Marcey Abate, John Vandenbemden, Nancy Belunis** (past Chair), **Babatunde Ayeni, Mike Thomas** and **Ram Sitaraman** will be paper reviewers. Thanks to everyone for offering your assistance. You've chosen to work with a great bunch of people. Δ



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Spring '99	18	2	May 15, 1999

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