Effective Interdisciplinary Collaboration between Statisticians and Other Subject Matter Experts

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Søren Bisgaard

1951-2009

- In 2009, the applied statistics / statistical engineering communities lost a giant
  - Fellow of ASA (1997), Fellow of ASQ (2002), Academician of the International Academy for Quality (2007)
  - Shewell Award (1981, 1987), Brumbaugh Award (1988, 1996, 2008), Ellis R. Ott Award (1990), Wilcoxon Prize (1998), Shewhart Medal (2002), William G. Hunter Award (2002), George Box Award (2004), W. J. Youden Memorial Address (2005), Cecil C. Craig Award (2006)
  - Søren was the founding father of the European Network for Business and Industrial Statistics (ENBIS)

- The ASQ Statistics Division established the **Søren Bisgaard Award** in 2011 to recognize the paper in the ASQ journal, *Quality Engineering*, with "greatest potential for advancing the practice of quality improvement."

Outline

- Motivation:
  - A flawed collaboration example with lessons learned
  - Impact and benefits
- Six fundamentals of effective collaboration
- How should statisticians prepare
- Conclusions

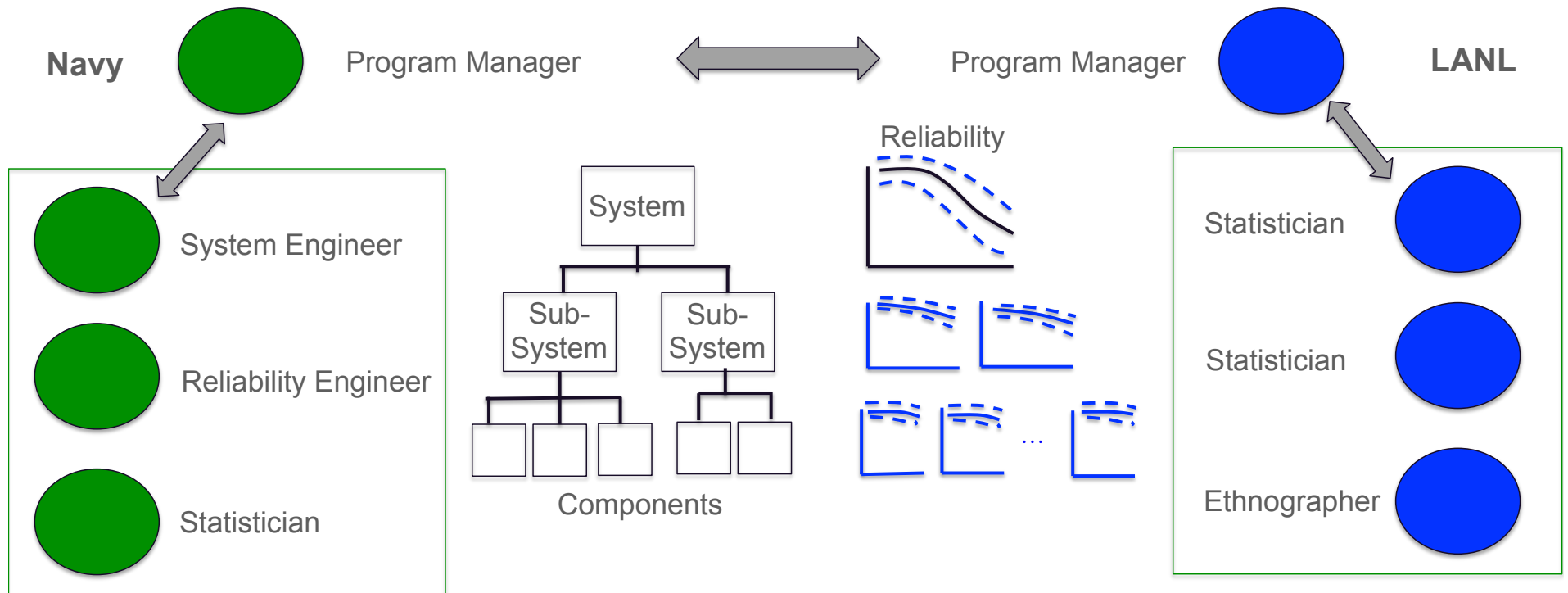R. Hoerl   W. Jensen   B. Slade   S. DeHart   K. White   E. Typhina   A. Wilson   M. Litano

An Ineffective Collaboration Example

An Ineffective Collaboration Example

- **An interdisciplinary collaboration project between LANL and DoD on reliability assessment for complex systems**

  - Reluctance to change → lack of commitment to new solutions and project goals
  - Lack of shared common goals (different interpretation on "improved reliability estimates")
  - Lack of understanding → translated into lack of trust from both sides

  - Team failed to establish sensible ground rules for how to communicate
  - Individual agendas (fear of change and losing control of their own program) led to a lack of trust and hindered the commitment to execute team plans and decisions
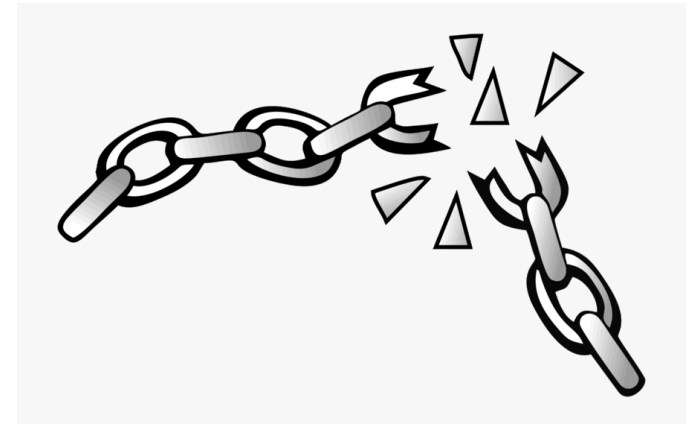
Lessons Learned

Early in the process:

a. Statisticians should have worked harder to understand the status quo of reliability assessment and priorities of the engineers

b. Discuss how the project would affect individual team members' careers would help build trust and improve communication and commitment

c. Clearly define quantitative metrics for the project goals to avoid discrepancies and provide a strong focus for the team

d. Invest in common knowledge

e. Establishing ground rules for communication to reduce confusion and tension later

Be proactive:

a. Avoid being passive and address issues immediately

b. Incorporate team self-assessment strategies throughout the project

Motivation

- **Cognitively diversity** improves creativity, innovative breakthroughs, and quality of solutions
- **Leverage diverse expertise** and approaches to accelerate problem-solving
- There is a great opportunity for statisticians to utilize data-driven tools and methods to help **bridge gap between multiple disciplines** and offer structure to integrate cognitive diversity to improve team functionality
- Statisticians can have **a greater impact and lead** a multidisciplinary teams with effective interdisciplinary collaboration skills

Innovation comes from diverse industries, cultures, and disciplines when they all intersect, bringing ideas from one field into another.
-- Frans Johannson (The Medici Effect)

As you navigate through the rest of your life, be open to collaboration. Other people and other people's ideas are often better than your own. Find a group of people who challenge and inspire you, spend a lot of time with them, and it will change your life.

-- Amy Poehler

Advantages of Being Members of Interdisciplinary Teams

- **For individual statisticians:**
  - Improve job satisfaction and career with more impact
- **For interdisciplinary teams:**
  - Better statistical thinking (role of variability and uncertainty)
  - Better statistical engineering (integrate multiple tools and methods into the problem-solving process)
  - Structured data-driven problem-solving and decision-making
  - Opportunity to challenge standard practices with innovative solutions
- **For the organizations:**
  - Improved productivity (more efficient use of time and resources) and competitiveness (better solutions)
- **For the discipline of statistics:**
  - Elevate perception through contributions to high impact problems

Fundamentals of Effective Collaboration

Fundamental # 1: Respect

- Embrace different backgrounds and perspectives
  - Mutual appreciation of each other's disciplines
  - Avoid ranking important roles of different expertise
  - Understand strengths and weaknesses
- Build a safe environment for discussion
  - Have unfiltered and healthy conflict around ideas
- Asking questions to build common information for decision-making

- Key distinction between respect for individuals and respect for their disciplines - both important in a successful collaboration (Litano)

Fundamental # 2: Shared Common Goals

- Have a clear set of end goals for the project to direct, motivate, and engage members
- Goals need to be:
  - specific, objective, and quantifiable
  - clearly articulated (avoid distinct interpretations due to different background and perspectives)
  - agreed upon (to avoid putting individual agenda above the common goals)
- challenging and motivating
- reiterated, evaluated and fine-tuned along the process

Fundamentals # 3: Trust

• Foundation of a highly functional team

• Lack of trust → discourages frank discussions

  → creates boundaries within team

• High levels of trust encourages:

  • unhindered open discussion

  • constructive questions or feedbacks,

  • buy-in and support of team decisions

• Importance of establishing mutual trust through face-to-face interactions and spending time together (Jensen)

• When expectations differ, have team members find solutions (Typhina and Wilson)

• There is a distinction between respect and trust. They are highly interconnected (Jensen)

Focusing on... RESULTS

Embracing... ACCOUNTABILITY

Achieving... COMMITMENT

Mastering...

Building...

"Red-hot relevant!"
—William G. Parrett, CEO, Deloitte Touche, Tohmatsu

THE SPEED OF TRUST

The One Thing That Changes Everything

Foreword by Stephen R. Covey

STEPHEN M. R. COVEY

with REBECCA R. MERRILL

Fundamentals # 4: Commitment

- Commitment to the team success and shared attention to results
- Ensures team decisions and action plans are followed through to deliver results
- Allows team members to hold each other accountable
- Avoid delays in the progress or deviations from project goals

- It is helpful for statisticians to
  - ensure statistical thinking is integrated throughout
  - statistical tools are properly used
  - realistic decisions are made based on appropriate quantification of uncertainty

Fundamental # 5: Intercommunication

- Comfortable, friendly environment for discussion
- Reduces misunderstanding and conflicts
- Improves work efficiency and productivity
- It is helpful for statisticians to
  - ask lots of questions, listen effectively and actively (connect with team tasks / decisions)
  - limit the use of jargon and explain concepts without unspoken assumptions.

- Focus on *what* and *how* to communicate for different audiences (Litano / Jensen)
- Role of statisticians to ask "naive" questions to help build common understanding about the basics and assumptions to match proposed solutions to the actual problem
- Showing vulnerability by asking simple questions is a good complement to our "educational responsibility" for conveying statistical thinking and methods (Slade)
- Ineffective communication can damage trust (Dehart/White, Litano)

Fundamentals # 6: Execution

▪ Attention to the complete and faithful execution of the team plan to implement the best available solution

▪ It is helpful for statisticians to
  ▪ ensure relevant and good quality data are collected with attention to the measurement system of the data
  ▪ ensure appropriate analyses are implemented
  ▪ stay connected to the implementation of the solutions
  ▪ expect potential complications and be prepared to adapt to new challenges or situations

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How Should Statisticians Prepare

1) **Embrace Cognitive Diversity**

   ▪ Practice actively listening to diverse views and approaches to problems → soften disagreements with more balanced assessment of trade-offs

   ▪ Develop awareness of objective (right/wrong) and subjective (preference) parts of the collaboration

   ▪ Embrace diverse interpretations of information and use visualization tools to encourage productive discussion

   ▪ Exploring different ways of presenting the same information and select the right strategy for delivering intended messages

   • We will fail if we try to promote diversity as an end unto itself. Emphasize how we achieve better business solutions (Jensen)

   • Statisticians should practice appreciation of cognitive diversity within our own profession with vigorous discussions of merits of different methods and how to select between alternatives for problem-solving (Hoerl)

How Should Statisticians Prepare?

2) **Share Well**

- Communicate statistical ideas well to people from diverse backgrounds
- Share technical concepts in everyday language
- Avoid technical jargon and be sensitive to different connotations of keywords (e.g. "design", "model", "parameters") across different disciplines
- Prepare "elevator speeches" for basic statistical concepts and tools
- Highlight key differences between approaches and clearly communicate important assumptions
- Use graphical and numerical summaries to facilitate discussion and decision-making

How Should Statisticians Prepare

3) Tailor Message to Match the Framework

- Understand the mission / culture of the organization and how people function / interact
- Match message to the corporate culture and project goals
- Explore past solutions to understand what succeeded / failed and the reasons behind outcomes
- Anticipate limitations of potential solutions to refine the solutions, reduce conflicts, and guide more objective discussion about alternatives
- Use one-on-one discussion with key team members before presenting to the larger group

# How Should Statisticians Prepare

4) Participate Fully

- Build appreciation and core understanding of domain knowledge
- Be an active listener to incorporate important information in the development of solutions

- Practice extracting and communicating key messages with more experienced statisticians to accelerate learning

- Build curiosity in other subject areas to improve understanding, engagement, and building connections with other experts
- Build friendships with colleagues from other disciplines and practice sharing and questions techniques in a causal setting

How Should Statisticians Prepare

5) **Facilitate/Lead the Process**
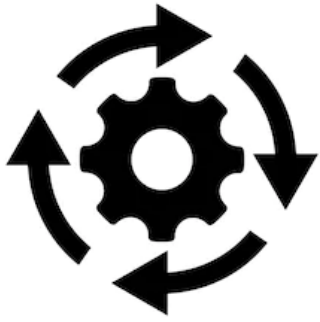
- Use structure for data-driven processes to keep team on tasks and reduce nonproductive disagreements
  - DMAIC problem-solving: Define-Measure-Analyze-Improve-Control
  - DMRCS decision-making: Define-Measure-Reduce-Combine-Select
- Practice these skills and tools outside the project (use smaller examples to gain experience and practice using the tools)
- Be prepared to lead the process
  - Find opportunities to lead and managing conflict outside work
  - Volunteer organizations are great opportunities

- A formal process is the seventh fundamental of collaboration (Hoerl)

How Should Statisticians Prepare

6) **Training**

- It takes more than just a willingness to exhibit all the fundamentals → training and mentoring are key ingredients of improving our ability to be effective collaborators (Hoerl)

- Emphasizing the proactive development of these skills will have key benefits for early career statisticians (Slade)
- Continuously honing these skills can benefit statisticians at all stages of their careers (Slade)

- Deliberate rehearsing in preparation for collaboration in specific situations (Litano)

Conclusions

- From literature in other disciplines, we identified 6 (+1) fundamental elements key to effective interdisciplinary collaborations.
- **Respect** and **Trust** → a healthy team environment

  Shared common goals guide the team efforts & motivate **Commitment**

  Intercommunication and **Process** foster smooth functioning

  Execution ensures successful implementation of team plan

- Our hope is to fill the gap between the current methodology and tool-based university training and statisticians taking on effective and leading roles in a multidisciplinary setting to solving important problems
- By improving our collaborative skills,
  - we as statisticians can be more impactful at work and in society
  - our discipline is elevated with more proven contributions & impact

References

Anderson-Cook, C.M., Lu, L., Parker,
Collaboration Between Statisticians a
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Thanks to ....

R. Hoerl   W. Jensen   B. Slade   S. DeHart   K

Free to join:

International Statistical Engineering Ass

isea-change.org

The final 2020 ISEA Online Summit webinar will be held on November 19, 2020:

Statistical Engineering: What it is, What it is Not, and How it Relates to Other Disciplines - A Member's Perspective

Invited speakers and panelists provide their own perspectives on the emerging field of statistical engineering and describe how they believe it relates to and differentiates from other disciplines. Through this open venue, we hope to sharpen how we articulate our motivation for establishing ISEA as a unique society to promote the development of the field of statistical engineering.

Our Speakers:

- Caleb King (JMP)
- William Guthrie and Dennis Leber (NIST)

Our Discussion Panelists:

- Marcus Perry (University of Alabama, US)
- Murat Testik (Hacettepe University, Turkey)
- Xavier Tort (Universitat Politècnica de Catalunya, Spain)

Time: 10:00-12:00pm (US EDT) / 5:00-7:00pm (Europe ECT)