

孫子兵法

The Art of Cost

Sun Tzu's Strategic Insights in Cost Estimating

Dr. Brian Gillespie

Introduction

- ▶ *The Art of War* is one of the most well know works on military strategy, frequently quoted and misquoted

quote

If you know the enemy and know yourself, you need not fear the result of a hundred battles.

misquote

To know your Enemy, you must become your Enemy.

- ▶ Written in the 5th century BCE and attributed to the Chinese military theorist Sun Wu
- ▶ The strategic insights continue to be taught in military academies around the world



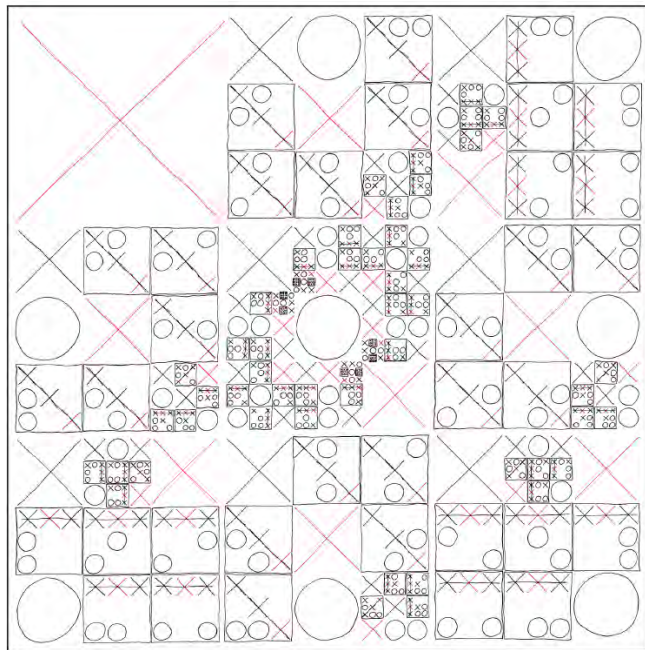
Why is *The Art of War* so well known?

- ▶ The ease with which its advice and proscriptions can be applied to a wide array of topics
- ▶ Its merit as a treatise on strategy

The Link

► Strategy can be defined as:

The process that is employed to determine how political purpose is translated into action



Optimal X strategy in Tic-Tac-Toe

► War serves a political purposes

War is the continuation of politics by other means.
Karl von Clausewitz, *On War*

The art of war is of vital importance to the State.
Sun Tzu, *The Art of War (1:1)*

► As does Cost Estimating

Cost estimation is the attempt to determine the level of resources needed to achieve a political end.

Topics

- ▶ *The Art of War* is composed of 13 chapters discussing different aspects of military strategy and tactics
- ▶ This presentation will focus on 4 of these topics



The Five Factors
Governing War

The Five Essentials
Of Victory

The Four Methods
Of Engaging In War

The Five Types
Of Spies

The Five Factors

The art of war is governed by five constant factors, to be taken into account in one's deliberations

Sun Tzu, *The Art of War* (1:3)

- ▶ The Moral Law
- ▶ Heaven
- ▶ Earth
- ▶ The Commander
- ▶ Method and Discipline

The Moral Law

The Moral Law causes the people to be in complete accord with their ruler, so that they follow him regardless of their lives, undismayed by any danger.

Sun Tzu, *The Art of War* (1:5-6)

- ▶ Harmony between the ruler and the people is critical to the efficient and orderly functioning of the state
- ▶ Applies at every level of authority
- ▶ *The Art of War* makes the claim that the General should wield the power of the military
- ▶ Parallels to Cost Estimating
 - ▶ The Ruler is the Program Manager (PM)
 - ▶ The General is the Cost Estimator (CE)

The Moral Law Challenges

- ▶ The Moral Law presents a great challenge to conventional cost estimating philosophy (grounded in independence)
- ▶ The PM can:
 - ▶ Control programmatic ground rules and assumptions
 - ▶ Exert influence over significant cost drivers
 - ▶ Establishes programmatic schedule
 - ▶ Provide subject matter expert opinion to inform the estimate
- ▶ The savvy PM can manipulate a cost estimate
- ▶ The CE, under the Moral Law, does not have the authority to not follow the PM's direction

The Moral Law Insights

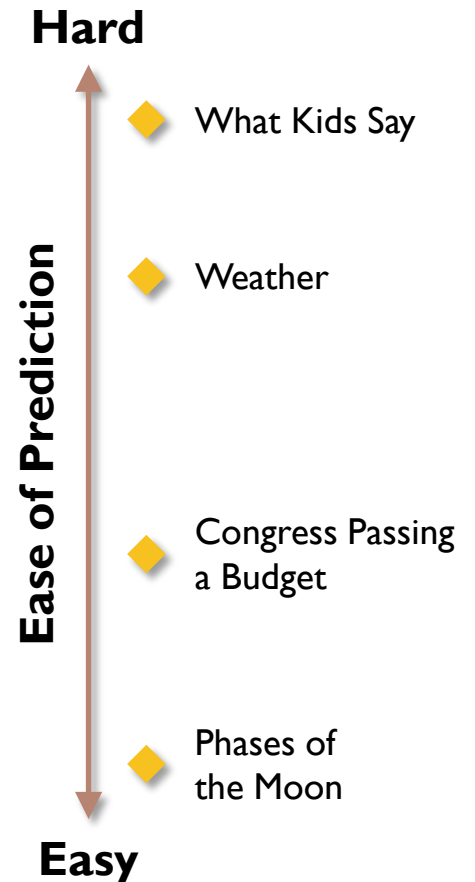
- ▶ **Harmony between the Program Manager and Cost Estimator within the Moral Law**
 - ▶ The PM provides broad goals and plans
 - ▶ The CE translates those goals and plans into a cost estimate
- ▶ **Total cost independence would violate the Moral Law**

Heaven

Heaven signifies night and day, cold and heat, times and seasons.

Sun Tzu, *The Art of War* (1:7)

- ▶ Sun Tzu instructs the clever combatant to be mindful of those things that are beyond control
- ▶ Plan for the uncontrollable so as not to be taken unawares
- ▶ Use the uncontrollable to your advantage
- ▶ It is impossible to build a cost estimate that captures all risks and uncertainties
- ▶ Risk and uncertainty must be acknowledged and accounted for in a cost model to establish credibility



Earth

Earth comprises distances, great and small; danger and security; open ground and narrow passes; the chances of life and death.

Sun Tzu, *The Art of War* (1:8)

- ▶ Terrain is a major factor in all military planning
- ▶ Terrain is the operating environment of war
 - ▶ In Sun Tzu's time: on land and sea
 - ▶ In modern times this is extended to: In the air, in space, and online
- ▶ Sun Tzu identifies 6 different types of terrain and gives general advice on what should be done with each
- ▶ Many different estimating environments
 - ▶ Program Office vs. CAPE vs. Contractor
 - ▶ Excel vs. ACEIT vs. Crystal Ball
- ▶ Knowing how to operate in multiple diverse terrain is important in cost estimating

6 Types of Terrain

1	<i>Accessible</i>
2	<i>Entangling</i>
3	<i>Temporizing</i>
4	<i>Narrow Passes</i>
5	<i>Precipitous Heights</i>
6	<i>Far Away</i>

The Commander

The Commander stands for the virtues of wisdom, sincerely, benevolence, courage and strictness.

Sun Tzu, *The Art of War* (1:9)

- ▶ Sun Tzu's five virtues are very similar to the five constant virtues of Confucianism which predated *The Art of War*
 - ▶ Benevolence, righteousness, propriety, wisdom, and fidelity
 - ▶ In ancient China, Confucianism was highly regarded and widely studied
- ▶ No universally recognized and respected moral code exists in modern day
 - ▶ Sun Tzu's emphasis on education and moral uprightness remains ideal

Method and Discipline

By method and discipline are to be understood the marshaling of the army in its proper subdivisions, the graduations of rank among the officers, the maintenance of roads by which supplies may reach the army, and the control of military expenditure.

Sun Tzu, *The Art of War* (1:10)

- ▶ **What Sun Tzu describes here is Logistics**
 - ▶ The means by which the state can execute strategy and tactics
- ▶ **Logistics are critical to cost estimation as well**
- ▶ **Cost Estimating Logistics encompasses:**
 - ▶ Point of Contact lists
 - ▶ Databases
 - ▶ Processes
 - ▶ Organization Charts
 - ▶ ... And any other indirect aspect of cost estimating

The Five Essentials of Victory

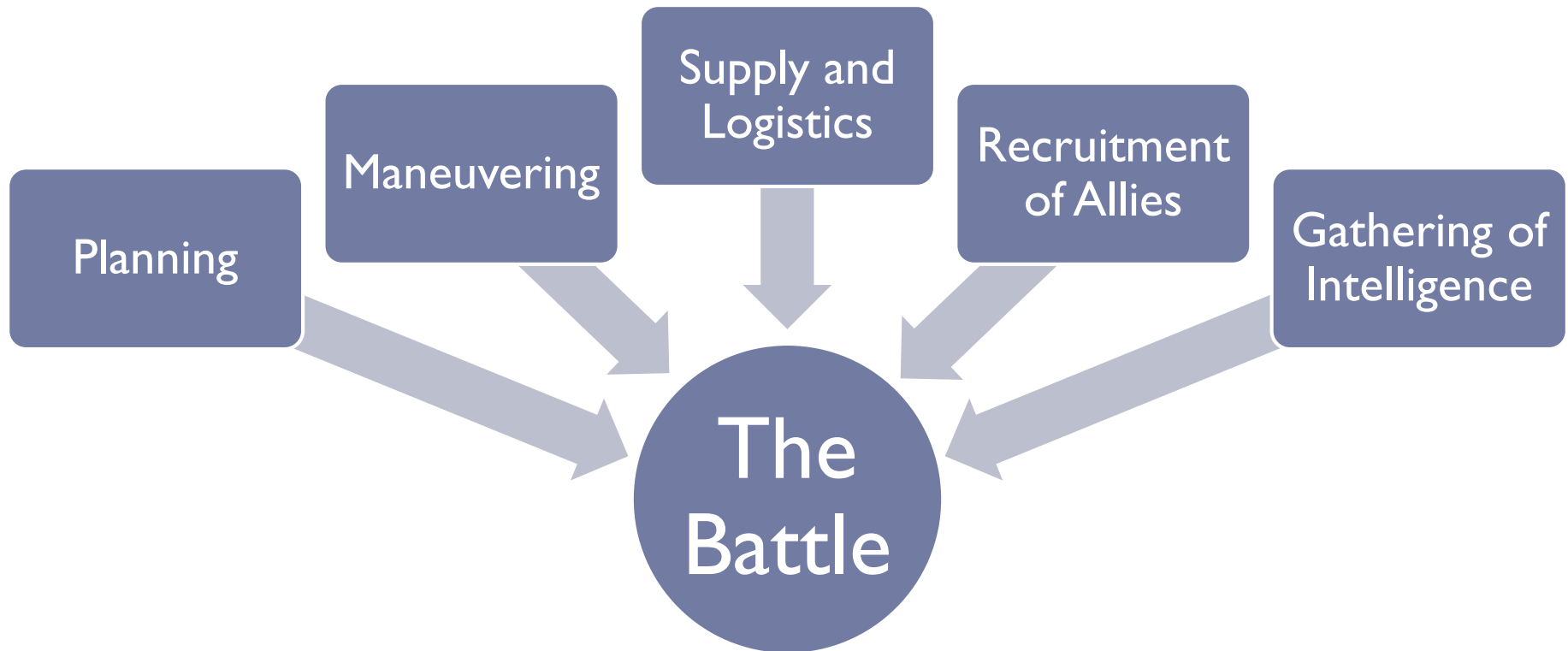
- ▶ To Sun Tzu victory equates with achieving the political purpose and desire of the ruler
- ▶ To this end he proposed five strategic essentials to victory
 - ▶ *He will win who knows when to fight and when not to fight*
 - ▶ *He will win who knows how to handle both superior and inferior forces*
 - ▶ *He will win whose army is animated by the same spirit throughout all its ranks*
 - ▶ *He will win who, prepares himself, waits to take the enemy unprepared*
 - ▶ *He will win who has military capacity and is not interfered with by the sovereign*

What is Victory in Cost Estimating?

- ▶ Is accurately predicting the end cost a good measure of “victory”?
 - ▶ No
 - ▶ How can you measure future success?
 - ▶ How can you be sure that the estimate was not a self-fulfilling prophecy?
 - ▶ By this metric approximately half of all acquisition program cost estimates fail.
- ▶ Cost estimating victory is not objectively measurable
- ▶ Cost estimating victory is subjective
- ▶ Credibility

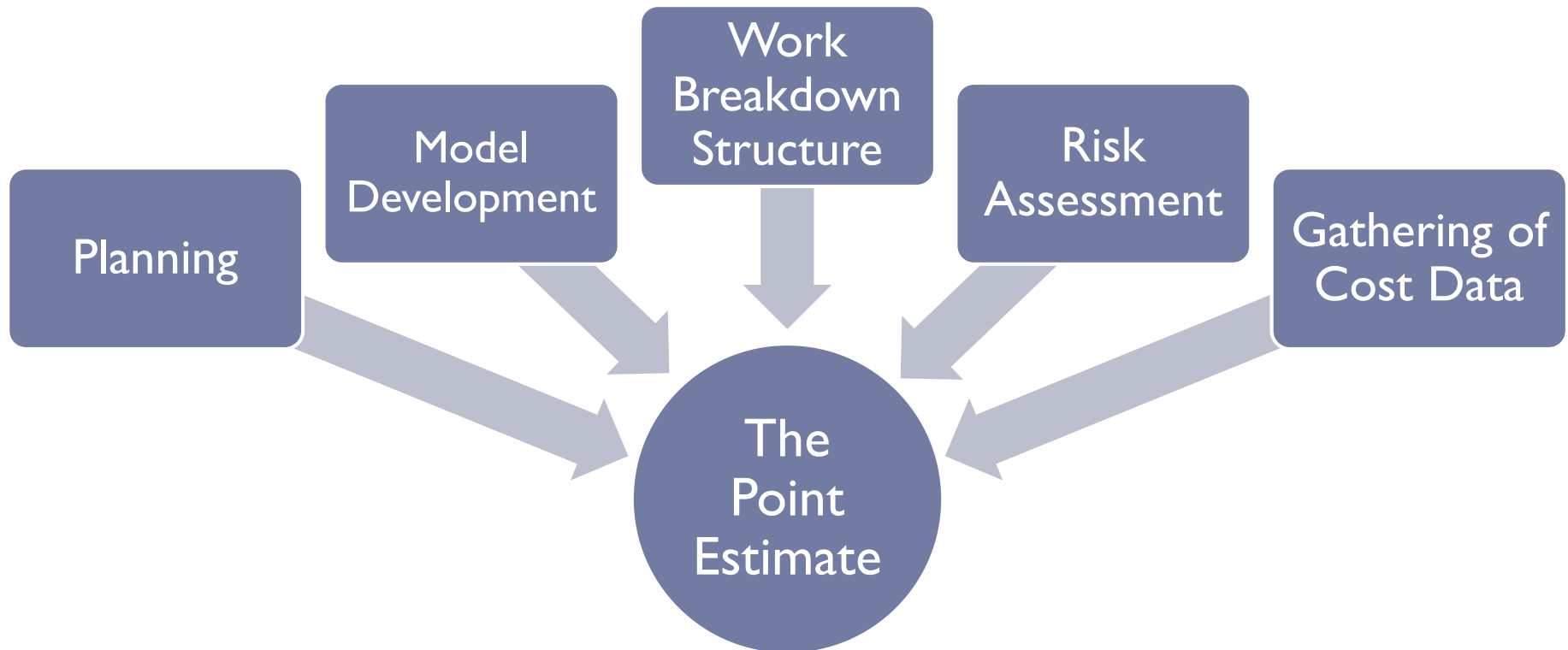
When to fight and when not to fight

- ▶ In war, the battle is the culmination of military activity



When to fight and when not to fight

- ▶ In cost estimating, the point estimate is the culmination



How to handle superior and inferior forces

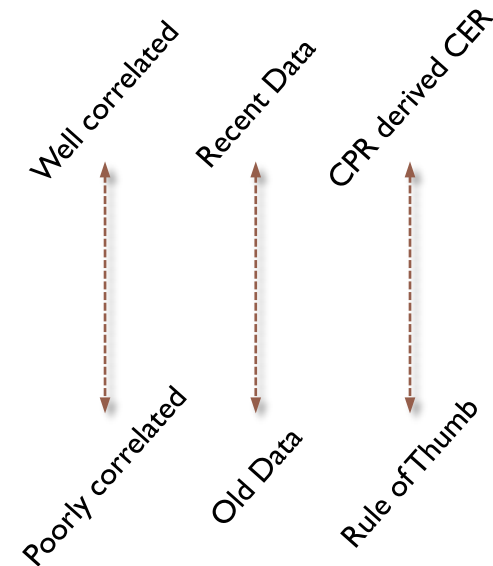
It is the rule in war, if our forces are ten to the enemy's one, to surround him

Sun Tzu, *The Art of War* (3:8)

Numerical weakness comes from having to prepare against possible attacks; numerical strength, from compelling our adversary to make these preparations against us

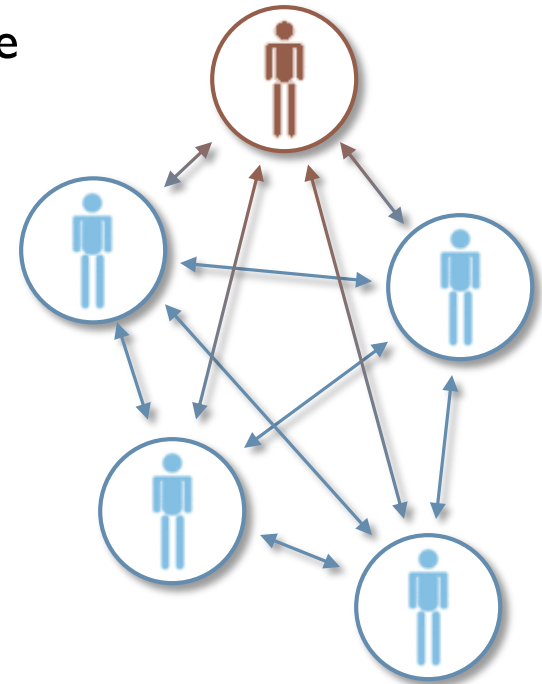
Sun Tzu, *The Art of War* (6:18)

- ▶ There are many different ways that a military force can be superior or inferior
- ▶ The clever commander and the canny cost estimator must be able to recognize and utilize their forces: both good and bad



Animating the Army With the Same Spirit

- ▶ Sun Tzu recognizes the importance of human motivation, morale and a shared vision to the success of the military
- ▶ The cost estimating team lead must also encourage and reward their team for performance as well provide a unifying vision for their team
- ▶ This can be done by:
 - ▶ Award nominations
 - ▶ Verbal recognition and acknowledgement
 - ▶ Establishing clear priorities
 - ▶ Open office policy
 - ▶ Flexibility and trust
 - ▶ Many more...
- ▶ Beyond the cost team it is important to foster:
 - ▶ Reliable point of contacts lists
 - ▶ Program office and contractor relations



Be Prepared; Take the Enemy Unprepared

To secure ourselves against defeat lies in our hands, but the opportunity of defeating the enemy is provided by the enemy himself.

Sun Tzu, *The Art of War* (4:2)

- ▶ **Victory, and credibility, comes to those who plan and prepare**
- ▶ **Common cost estimate preparations:**
 - ▶ Know who the estimate is being briefed to and their area of greatest interest
 - ▶ Tailor the estimate documentation to align with reviewer's preconceptions
 - ▶ Emphasize the estimate's strengths and acknowledge the estimate's weaknesses
 - ▶ Thoroughly review documentation for typos and errors

No Interference from the Sovereign

In war, the general receives his commands from the sovereign.

Sun Tzu, *The Art of War* (7:1)

- ▶ **The ruler who interferes in war hinders the general and makes it more difficult to achieve victory**
 - ▶ Hobbling the army by ordering the army to advance or retreat at the wrong time
 - ▶ Creating restlessness by governing the army like any other government entity
 - ▶ Shaking confidence in the ruler by using the same tactics and strategy regardless of the situation
- ▶ **A PM can interfere with the CE in many ways**
 - ▶ Setting unrealistic deadlines
 - ▶ Assigning tasks that are more suited to financial analysts
 - ▶ Mandating cost estimating methodologies

The Four Methods of Engaging in War

- ▶ Sun Tzu identified and ranked the four basic strategies that can be engaged in war in order of “superiority”
- ▶ The ranking is based on the practical metric of payout to investment
- ▶ It is tempting to attempt to draw a direct comparison between these four methods and the four basic cost estimating methodologies, but this is not possible
- ▶ Instead we will evaluate the four methodologies based on the payout to investment metric

1	<i>Attack the enemy's strategy</i>
2	<i>Isolate the enemy from allies</i>
3	<i>Attack the enemy's army</i>
4	<i>Besiege walled cities</i>

The Direct and the Indirect

- ▶ Sun Tzu explains that there are two broad methods of attack in combat: the **Direct** and the **Indirect**
- ▶ The two methods blend together and can be difficult to differentiate
- ▶ It is the indirect methods that secure victory
- ▶ In cost estimation there are two types of estimating:
Biased and Unbiased
 - ▶ Biased estimating uses people as sources
 - ▶ Unbiased estimating uses cost data as sources



Cost Estimating Methodologies

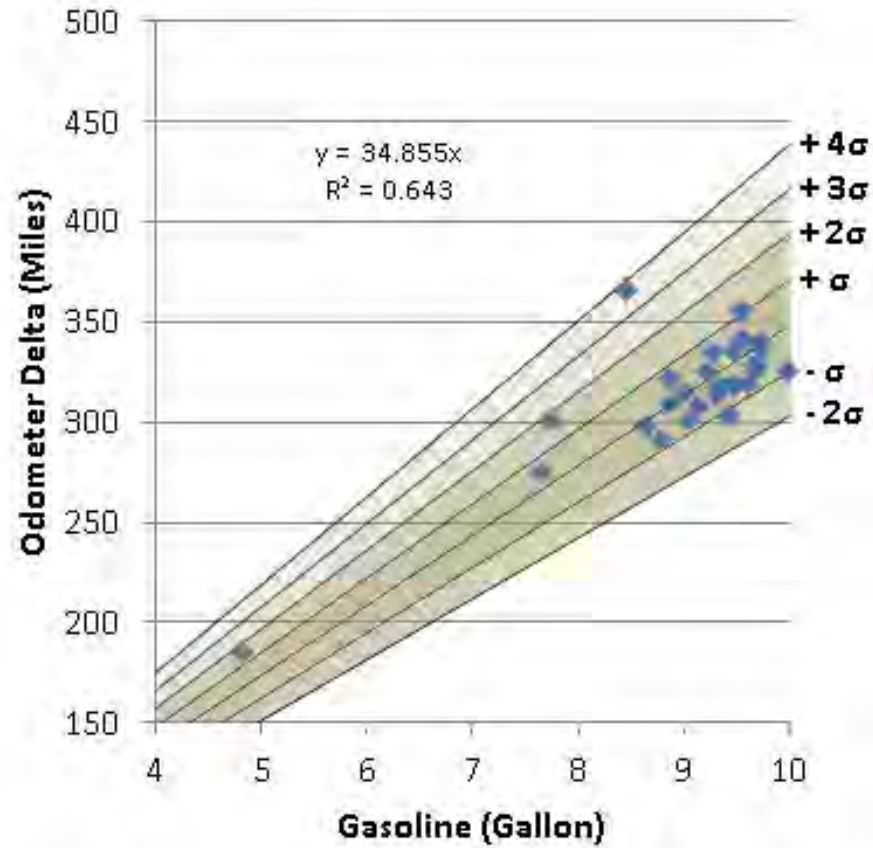
Analogy

- ▶ Trends towards **Biased** due to reliance upon expert opinion
- ▶ Analogies have a low investment/development time
- ▶ To establish credibility emphasize unbiased aspects
 - ▶ Similar technical characteristics
 - ▶ The same developer

Parametric

- ▶ Trends towards **Unbiased** due to reliance upon cost estimating relationships (CERs)
- ▶ Parametric have a high investment/development time
- ▶ Regularly updated and maintained databases can mitigate investment time
- ▶ Bias still appears in the form estimator judgement
 - ▶ Correlation / Causation
 - ▶ Outliers

Gas Mileage Example



Cost Estimating Methodologies

Engineering Build-Up

- ▶ Trends towards **Biased** due to extensive engineering expertise needed to examine a system at the component level
- ▶ Engineering build-ups have a high investment/development time
- ▶ Natural tendency of programs to gravitate to this methodology
 - ▶ PMs want to see cost estimate align with program elements
- ▶ Easy comparison to similar estimates when tasks are broken down to component level

Actuals

- ▶ Trends towards **Unbiased** due to use of cost histories
- ▶ Actuals have a low investment / development time if the program is late enough in the acquisition cycle; impossible before then
- ▶ Examples of Bias in Actuals
 - ▶ Use of EVM data
 - ▶ Production breaks with Learning Curve
 - ▶ Recurring and Nonrecurring costs

The Five Types of Spies

- ▶ The key to Sun Tzu's strategy is revealed in the final chapter of *The Art of War: The Use of Spies*

Knowledge of the enemy's disposition can only be obtained from other men

Sun Tzu, *The Art of War* (13:6)

1 *Local Spies*

- ▶ The people living on the land; non-officials

2 *Inward Spies*

- ▶ Officials in the enemy's government or military

3 *Converted Spies*

- ▶ Enemy spies that you use for your own purposes

4 *Doomed Spies*

- ▶ A spy intended to be captured to give false info

5 *Surviving Spies*

- ▶ A spy who returns from enemy territory

Gathering Cost Data from People

- ▶ All cost data you gather from people (spies) is biased, but biased data is not necessarily bad data
- ▶ A credible cost estimate endeavors to verify and justify bias in the cost documentation

Spies cannot be usefully employed without a certain intuitive sagacity

Sun Tzu, *The Art of War* (13:15)

The Local Spy

- ▶ A person formally associated with the program that is not in a leadership position
 - ▶ Contractor Engineer
 - ▶ Execution Analyst
 - ▶ Factory Line Worker
- ▶ Good source of information on specific tasks and elements of the overall program
- ▶ Good for helping construct Engineering Build-Up or Actuals cost estimates
- ▶ Challenging to use for larger programs due to the number that would need to be maintained

The Inward Spy

- ▶ A person in a position of authority that is indirectly associated with the program
 - ▶ Finance Officials
 - ▶ DCMA Representative
 - ▶ Competing Contractor
- ▶ Good source of information on broad assumptions and ground rules that can impact a program
- ▶ Challenging to use for many reasons
 - ▶ Often outside the social and professional circles inhabited by cost estimators
 - ▶ The number of people indirectly tied to a program is orders of magnitude larger than those directly tied to the program
 - ▶ The cost estimator often cannot make use of this data as ground rules and assumptions are controlled by the PM

The Converted Spy

- ▶ A person assigned to support the program from an outside organization that is directly tied to the program
 - ▶ Contractor Technical Point of Contact
 - ▶ Vendor Representative
- ▶ Intended to represent the interests of their organization, but can serve as a valuable data source for the program
- ▶ Enables the acquisition of Local and Inward spies
- ▶ Good source of data to support all cost estimating methodologies
- ▶ Data provided by the Converted Spy is Bias
 - ▶ Conventionally Biased
 - ▶ Sourced in a person
- ▶ Easy to acquire and maintain
 - ▶ The work is done for you!

The Doomed Spy

- ▶ Not a person in cost estimating (*that would be illegal!*)
- ▶ The Doomed spy is similar to the process of socializing the data and assumptions with the stakeholders with the intent that they correct erroneous elements
 - ▶ Increases estimate credibility in the eyes of the stakeholders by increasing their buy in
- ▶ Makes use of Cunningham's Law

The best way to get the right answer on the internet is not to ask a question, it's to post the wrong answer.

Howard Cunningham

The Surviving Spy

- ▶ Often not a person (conventional spying is illegal)
- ▶ Official reporting
 - ▶ Contractor Data Reports
 - ▶ Proposals
 - ▶ RFIs
- ▶ The result of the program requesting certain information and receiving that information
- ▶ Data can be flawed and bias, as always care must be taken to verify and validate the reports

Conclusion

- ▶ Strategy is important in cost estimating
- ▶ Sun Tzu's strategic insights can be applied to cost estimating
 - ▶ The Five Factors
 - ▶ The Five Essentials
 - ▶ The Four Methods
 - ▶ The Five Types of Spies

Bad strategy, brilliantly executed, is still bad strategy



Questions?