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12-14 June 2007, at US Naval Academy, Annapolis, MD

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Original title on 712 A/B: About Round Pegs and Square Holes

Revised title: About Round Pegs and Square Holes

Presented in (input and Bold one): (**WG28**, CG __, Special Session __, Poster, Demo, or **Tutorial**):

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Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 01 JUN 2007		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE About Round Pegs and Square Holes				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Whitney, Bradley & Brown, Inc. 11790 Sunrise Valley Drive, Reston, VA 20191				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM202526. Military Operations Research Society Symposium (75th) Held in Annapolis, Maryland on June 12-14, 2007, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 21	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



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75TH MORSS

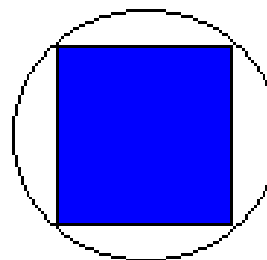
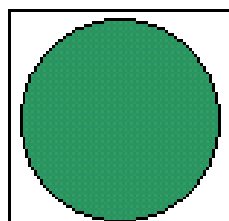
US Naval Academy
Annapolis, Maryland

June 12-13-14 2007

Through Multiple Disciplines, Analytical Power

Working Group 28 – Decision Analysis

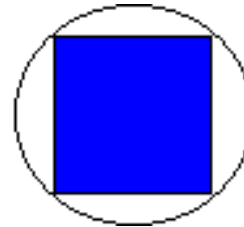
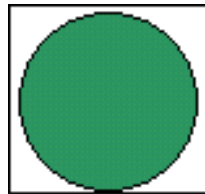
About Round Pegs and Square Holes ...



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The Problem

Does a square peg fit better into a round hole or does a round peg fit better into a square hole? Why are we trying to fit these together?



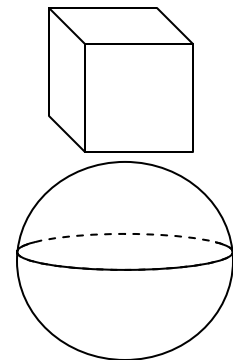
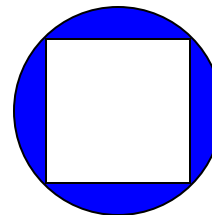
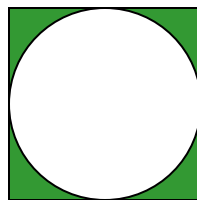
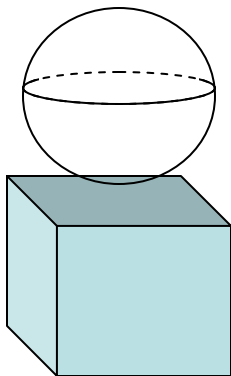
- At times, human beings attempt to fit the wrong solution to complicated problems
- Their solution *MUST* be the one
- A significant amount of time, effort and other resources are devoted to this undertaking
 - If the problem (*hole*) is larger than the solution (*peg*) attempted, parts of the problem would not be solved
 - If the problem is smaller than the solution attempted, there would be some wasted use of the solution – the problem would be solved under suboptimal application of the solution.
- Many times there is a tendency to fit relatively small problems into large solution tools, and vice-versa

Agenda

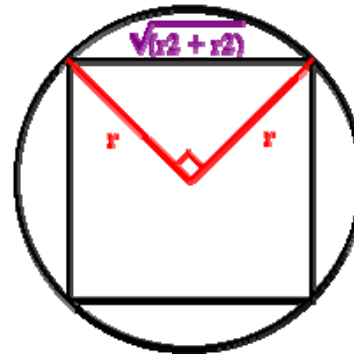
- This lecture attempts to highlight a discussion of common practices based on the Influence of Social And Behavioral Elements on Legacy Linear Analyses.
- Utilizing the well-known phrase "you can't fit a square peg in a round hole" or "you can't fit a round peg in a square hole" and "mathematizing" it, we would attempt to set the stage to discuss which one gives us less uncovered area.
- With this in mind we would look at recent attempts at solving large problems by using less than optimal solutions, and solving relatively small problems with large mathematical models
- We will also discuss possible social and behavioral elements and drivers, and the potential implications of these practices.

Getting Started

- Perhaps the difficult part of this, or any problem is getting started. How can you decide that one is better than the other? This might lead to some useful discussions.
- The first step is to define "fits better".
 - This can be connected to the "*uncovered space*" after the peg is fitted.
 - May be best expressed as a percentage of the larger shape. This is because the answer is then a ratio that is independent of the size of the objects.



Square Peg In Round Hole?



- Now if the radius of the circle is r , then by Pythagoras' Theorem, the side of the square is

$$\sqrt{r^2 + r^2} = \sqrt{2r^2} = r\sqrt{2}$$

- Hence the area of the square is

$$r\sqrt{2} \times r\sqrt{2} = 2r^2$$

- And the area of the circle is

$$\pi r^2$$

Compare The Areas

- Now we may subtract the area of the square from the area of the circle to find the wasted area.

$$\pi r^2 - 2r^2 = (\pi - 2)r^2$$

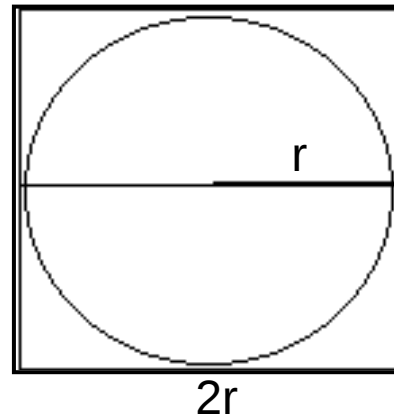
- The percentage wasted is the ratio of this difference over the area of the circle

$$\frac{(\pi - 2)r^2}{\pi r^2} = \frac{(\pi - 2)}{\pi} \approx 36.34\%$$

- Alternatively we could look at the ratio: $\frac{\text{(area of the square)}}{\text{(area of the circle)}}$

$$\frac{2r^2}{\pi r^2} = \frac{2}{\pi} \approx 63.66\% \text{ of circular area covered by the square}$$

Round Peg In Square Hole?



- The area of the circle is πr^2
- From the diagram, the side length of the square is $2r$. Hence the area of the square is

$$(2r)^2 = 4r^2$$

Compare The Areas

- Now we may subtract the area of the circle from the area of the square to find the wasted area.

$$4r^2 - \pi r^2 = (4 - \pi)r^2$$

- The percentage wasted is the ratio of this difference over the area of the circle

$$\frac{(4 - \pi)r^2}{4r^2} = \frac{(4 - \pi)}{4} \approx 21.46\%$$

- Alternatively we could look at the ratio: $\frac{\text{area of the circle}}{\text{area of the square}}$

$$\frac{\pi r^2}{4r^2} = \frac{\pi}{4} \approx 78.54\% \text{ of square area covered by the circle}$$

In Summary

- The circle covers more of the square than the square does the circle
- Therefore, it is better to be a round peg in a square hole than a square peg in a round hole
- In our analogy to problem solving it would be intuitive to assume that a solution which give you less uncovered area would be better than the alternative
- However our interest is to look into the uncovered area and select what items were not covered by our solution
- Let's explore the Influence of Social And Behavioral Elements on Legacy Linear Analyses

Defining Legacy Linear Analyses

- By moving only ONE coin, could you place four coins in both directions (left-to-right and top-to-bottom) ...?

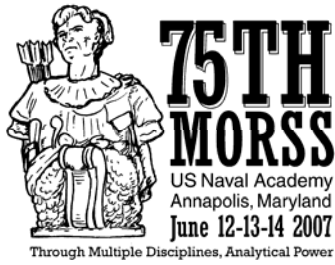


Defining Legacy Linear Analyses

- By moving only ONE coin, could you place four coins in both directions (left-to-right and top-to-bottom) ...?



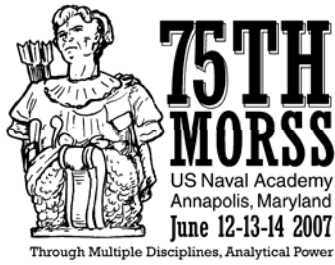
- We have the tendency to think in two dimensions or in linear relationships



Social and Behavioral Elements



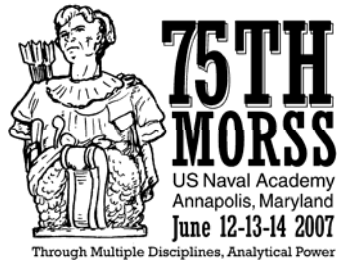
- Recent analyses emphasize evaluation of activities by certain groups of individuals, e.g.:
 - Recruiting
 - GWOT
 - IEDs
 - Personnel Rotation Policies
- Some data available is sparse
- Evaluations based on historical (past) performance
- Attempts concentrate on linear relationships to establish trends
- Not necessarily predictors of future performance



The Internal Influence



- Evaluation of these attributes proves to be cumbersome, to say the least
- *Legacy Linear Analysis* practices drive assumptions that fix past performance and assume it would not change
- Social and behavioral elements may prove to be countless, challenging to sort and assess their effectiveness, and too complex to establish correlations to the data if they exist
- However, if relationships exist among metrics under study with social and behavioral elements, and we are able to establish the same, our analysis would be more complete filling some of the “*uncovered space*”



More Internal Influence



- Social and behavioral elements may not be limited to the subject under study
- YOUR OWN elements
- YOUR TEAM's elements
- The relationship between the two

The External Influence

- Who is your target audience when you report the results of your analysis?
 - Junior to you
 - Senior to you
 - Piers
- Do you understand the social, cultural and behavioral elements of the individuals and their organization?
- How would you present your message?
- How would they receive your message?
- Understanding interests and motivations may add a positive dimension to your results

Dangers!

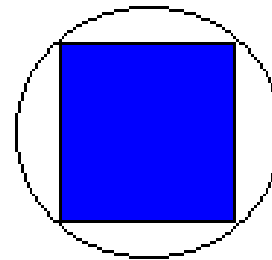
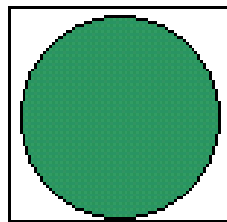
- Legality of the data used, its interpretation and conclusions reached based on this data
- Locking up to stereotypes
- Discriminatory assertions
- Pre-judged expectations



Conclusions

- It may be beneficial to consider human factors not only from the programmatics of human systems integration (HSI) point of view
- The influence of social and behavioral elements have played – and still play – a critical role in traditional analysis efforts
- Many times these are overlooked or not considered due to the complexity of the issues dealing with human behavior
- “Our interest is not necessarily to predict human behavior, but to compute – and attempt to influence – the probability of occurrence of future behavior-driven activities”
- Not a sermon, just some observations...

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However....

...a round peg fits better into a square hole than a square peg fits into a round hole result is true only in dimensions $n < 9$, and for $n \geq 9$, the unit n -hypercube fits more closely into the n -hypersphere than vice versa (Singmaster; Wells 1986, p. 74).

