

# Prospective Evaluation Design: The Importance of Being CRITICAl

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# Outline of Session

- An Introduction to CRITICS
- The origins of CRITICS
- Experimental Design: power vs. significance
- CRITICS in practice
- Conclusions and Implications

## In evaluation design, we need to consider

- **Crime history** (how crime-prone action and control sites are)
- **Reduction** (in terms of proportional reduction in the crime problem anticipated in the action sites when compared to the control)
- **Intensity** (in terms of the number and/or strength of interventions necessary per target exposed to crime risk)
- **Time period** (that over which the action and control sites are tracked before and after implementation)
- **Immensity** (in terms of the number of *units of analysis at risk of crime* to be tracked)
- **Cost** (in terms of the unit cost per intervention) and
- **Statistical testing** (including significance level and the choice of 1-v 2-tailed testing)

## All Bar One – Evaluation 1

- Evaluation of ‘anti-theft clips’
- Research Design
  - One action bar and a matched control
  - Pre-test: **1st October to 8th December 2004**
  - Post-test : **9th December 2004 to 31st March 2005**
    - Use of police data
    - Recording within bars
  - Observation of how clips are used
  - Customer feedback
- Results were mixed
- Inferring conclusions difficult
- Why?



# Lessons from initial evaluation

- Reduction in action was larger than control.
- But....
  - there were few thefts (a rare event);
  - over too short a time frame;
  - with too few bars (n= 2)
- The numbers were too small to indicate a statistically significant reduction – even though it was heading in that direction.
- The findings were convincing enough to secure funding of a larger project
  - the time for planning and the available funding were much greater (as was the scope for waste)

# Statistical Power ...Trip

- Power is the complement to significance
  - significance being the probability of type 1 error (false +), (rejecting a correct null hypothesis)
- Power is the probability of type 2 error (false -), (rejecting a correct alternative hypothesis)
  - In evaluation this means stating there was no effect of an intervention which was in fact effective
- Trivial?
- Lack of power foredoomed our research design to detect the significant findings
  - lack of sample size and suitable time frame.

## Striving for a powerful future

- Currently there is **no future in power** – only retrospective – as applied in meta-analysis
- Yet we hold that ***power analysis in criminological research may possess greater utility when used prospectively as a planning tool for experimentation.***

# CRITICS as a decision making tool

- A broader (contextual) definition of power:
  - We wanted to select sufficient action and control sites that would make the evaluation *powerful* enough to detect statistical significance if it was indeed present, without expanding the data collection and implementation tasks to an unmanageable and unaffordable degree. In this instance *the design's the thing* for the evaluation as much as the anti-theft clips under test.
  - Hence, we had to develop a framework for decision-making, and an accompanying tool, which incorporated certain key parameters and showed the effect of varying these on the likelihood of finding a statistically significant outcome, cost-effectively achieved, and which was intelligible and convincing to our designer partners.



# CRITICS: a practical example

- For the anti-theft clip evaluation
  - Spreadsheet allowed us to run a variety of scenario testing through critics - implications on research design as well as clip design – cost

**Table 1: Default Entry into CRITICS**

<b>Crime History</b>	No. thefts per bar per month	7
<b>Reduction</b>	Reduction expected	20%
<b>Intensity</b>	Number of clips installed in each bar	120
<b>Time</b>	Timescale (before & after- months)	12
<b>Immensity</b>	No. action and control bars (each)	4
<b>Cost</b>	Cost of each clip	£3
	Cost of theft	£340
<b>Statistical Testing</b>	Level of significance	Alpha <0.05 Two tailed

# Example projection from CRITICS

Highest possible unit price for real-world cost-effectiveness	£47
Overall cost-effectiveness	+£21408
Cost of all interventions	£1440
Saving	£22848
Total crimes reduced relative to expectation based on control	67
Lower confidence limit of Odds ratio	1.00
Upper confidence limit of Odds ratio	1.56
Z score of Odds ratio	1.98
SE Log Odds Ratio	0.112
Odds ratio	1.25

## Values of parameters in different scenarios

	Reduction (%)	Time scale (months)	Number of bars	Average thefts per month	Number of clips per bar	Z-score
1	20	12.00	4.00	7.00	120.00	1.98*
2	20	12.00	6.00	7.00	120.00	2.43*
3	20	12.00	6.00	5.00	120.00	2.05*
4	20	12.00	6.00	4.00	120.00	1.84
5	20	9.00	6.00	7.00	120.00	2.10*
6	20	6.00	6.00	7.00	120.00	1.72
7	10	12.00	6.00	7.00	120.00	1.17
8	10	12.00	20.00	7.00	120.00	2.13*
9	15	12.00	8.00	7.00	120.00	2.06*
10	20	12.00	6.00	7.00	500.00	2.43*
11	20	12.00	6.00	7.00	80.00	2.43*

# Cost effectiveness considerations

	Reduction (%)	Time scale (mons)	No of bars	Average thefts per month	Number of clips per bar	No of thefts saved	Money saved (£1000s)	Max spend per clip
1	20	12.00	4.00	7.00	120.00	67	23K	£47
2	20	12.00	6.00	7.00	120.00	101	34K	£47
3	20	12.00	6.00	5.00	120.00	72	24K	£34
4	20	12.00	6.00	4.00	120.00			
5	20	9.00	6.00	7.00	120.00	76	26K	£35
6	20	6.00	6.00	7.00	120.00			
7	10	12.00	6.00	7.00	120.00	50	17K	£23
8	10	12.00	20.00	7.00	120.00	168	57K	£79
9	15	12.00	8.00	7.00	120.00	101	34K	£47
10	20	12.00	6.00	7.00	500.00	101	34K	£11
11	20	12.00	6.00	7.00	80.00	101	34K	£71

# *Conclusions and Implications*

## **Methodological concerns**

- Philosophical issues - who decides?
- Assumptions

## **Advantages of approach**

- Not prescriptive but raises awareness of necessary issues
- More importantly their inter-relatedness

## **Scope for use and development**

- Possibility of factoring in displacement/diffusion
- Sara/ 5I's – are both academic and practical and widely used
  - worry is power mentioned in neither

# References

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