

**APPLICATION OF
PROSPECT THEORY
TO MANAGEMENT DECISIONS
UNDER RISK
ON CONSTRUCTION PROJECT**

ICSC'15

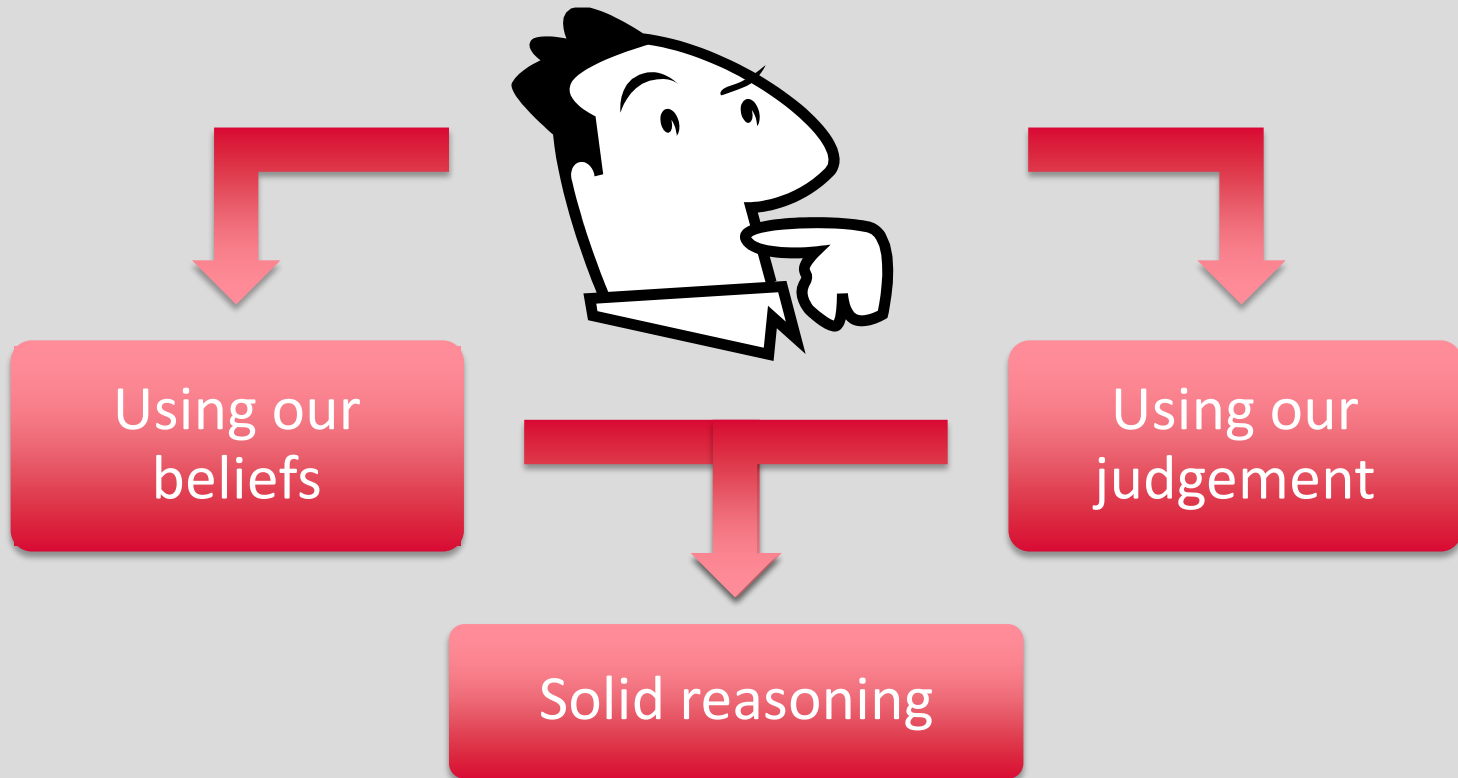
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INTRODUCTION

- How are we making decisions ?



INTRODUCTION

Expected Monetary Value

Income

=

Probabilities

x

Outcomes

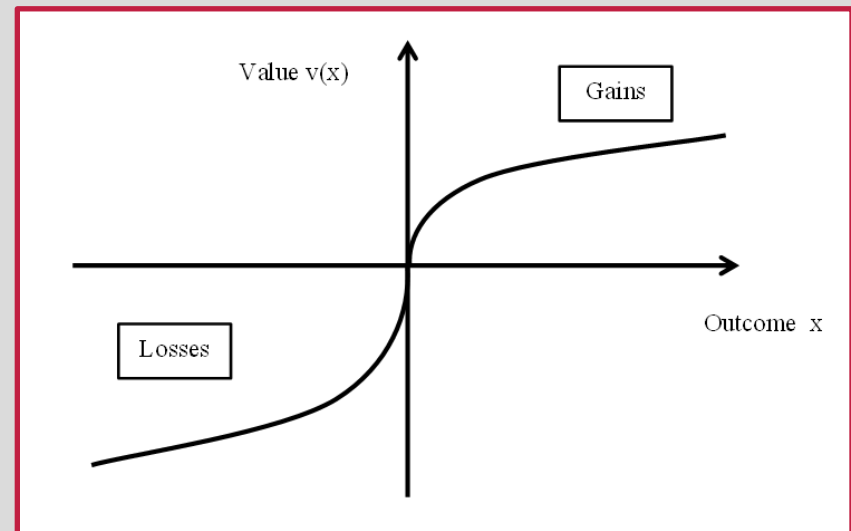
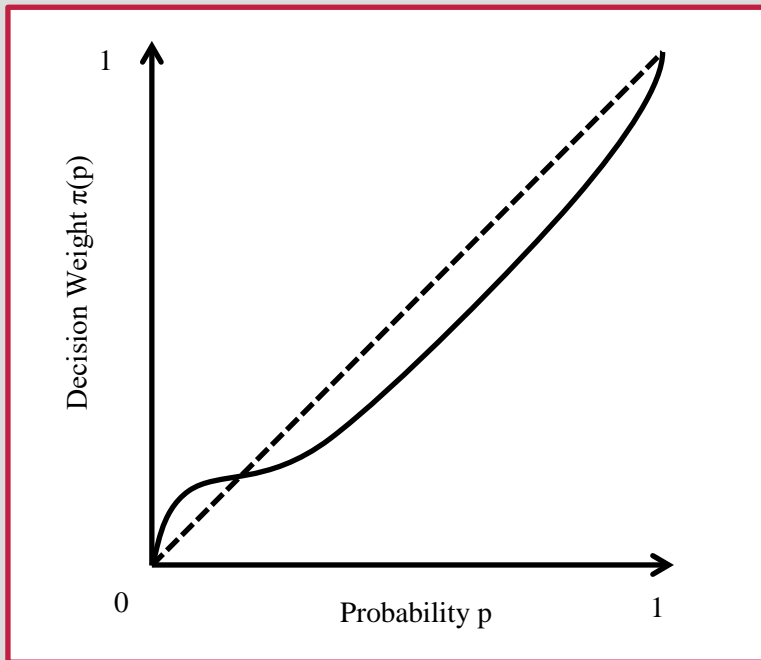
$$EV(x_1, p_1; \dots; x_n, p_n) = p_1 x_1 + \dots + p_n x_n$$

$$p_1 + \dots + p_n = 1$$



PROSPECT THEORY

$$EU(x_1, p_1; \dots; x_n, p_n) = \pi(p_1)v(x_1) + \dots + \pi(p_n)v(x_n)$$



QUESTIONNAIRE

Behavioural Tendencies

Perception of Change

Certainty Effect

Non Compliance

Loss Aversion

Cost Performance

Under Budget

On Budget

Over Budget

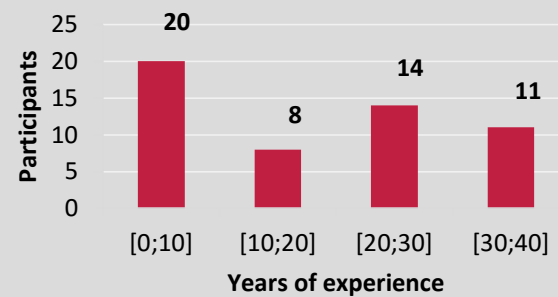
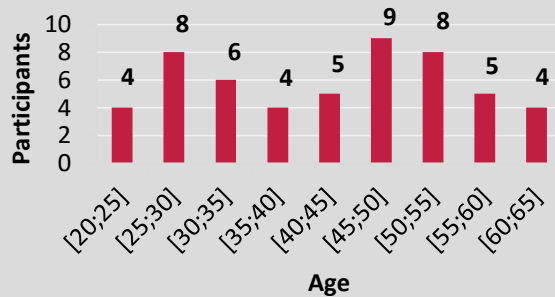
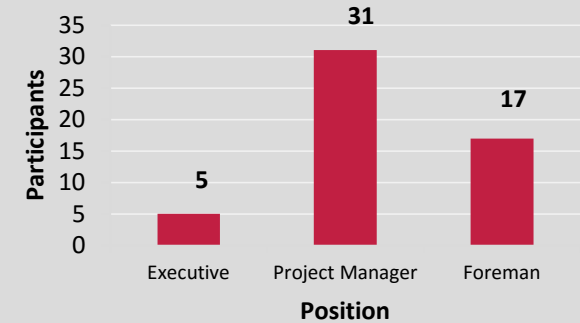
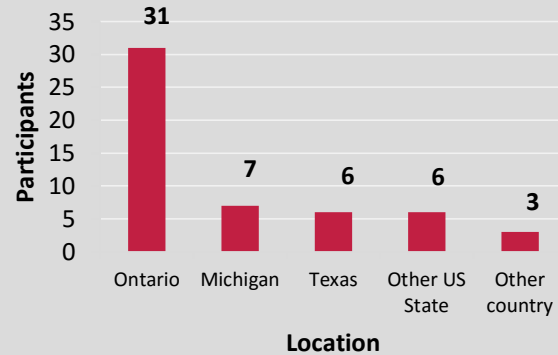
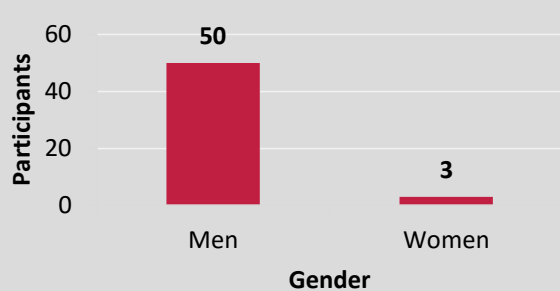
Expected Values

Expected Values Equal

Expected Values different



DESCRIPTION OF THE SAMPLE



EXAMPLE

Question 15:

You are working on a project which is on **time** and on budget.

We need to install many shingles, and there are 2 types of shingles A and B which match the specifications. Which shingle type do you prefer?

The difference in cost per unit and there is a probability of 97% that you will be late during the installation of shingle type A.

The difference in cost per unit and there is a probability of 100% that you will be late during the installation of shingle type B.

A B

| Behavioral Tendencies | Cost Performance | Expected Values |
|-----------------------|------------------|---------------------------|
| Perception of Change | Under Budget | Expected Values Equal |
| Certainty Effect | On Budget | Expected Values different |
| Non Compliance | | |
| Loss Aversion | Over Budget | |



RESULTS EV EQUAL

| | A (Risk Taking) | | | B (No Risk) | | Interval (95% confidence) |
|------------------|-----------------|------------|--------|-------------|--------|------------------------------|
| | Q | Percentage | EV | Percentage | EV | |
| On Budget | 15 | 36% | -\$200 | 64% | -\$200 | +/- 13% |

- Participants are mainly Risk Avoiding
- Project cost performance has an impact on the results



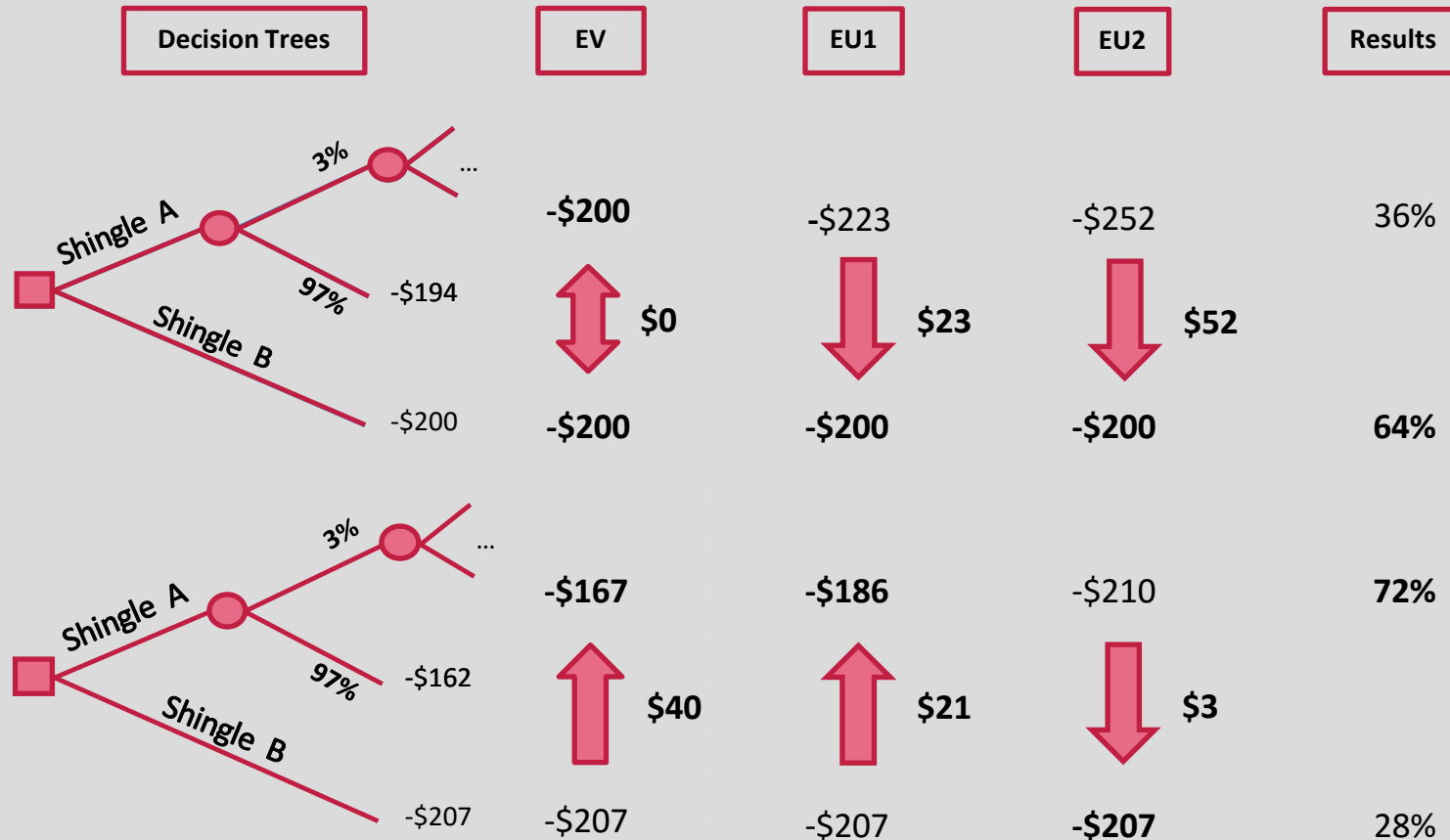
RESULTS EV DIFFERENT

| | A (Risk Taking) | | | B (No Risk) | | Interval (95% confidence) |
|------------------|-----------------|------------|--------|-------------|--------|------------------------------|
| | Q | Percentage | EV | Percentage | EV | |
| On Budget | 2 | 72% | -\$168 | 28% | -\$207 | +/- 12% |

- Participants are mainly Risk Taking
- No influence of the cost performance
- Still 35% of the participants are Risk avoiding



COMPUTATION OF THE EU



CONCLUSION

- Application of Behavioural Economics
 - » Risk-Avoiding Behaviour
 - » Influence of the Project Cost Performance
 - » Influence of the decision-makers experience
- ➔ Creation of small losses

Introduction

Prospect Theory

Methodology

Results

Conclusion

THANK YOU!



COMPUTATION OF THE EU

$$EU(x_1, p_1; \dots; x_n, p_n) = \pi(p_1)v(x_1) + \dots + \pi(p_n)v(x_n)$$

The first scale, π :

Following the PT the scale π increases the probability of the risk:

- EU1: +10%
- EU2: +20%

The second scale, v :

Outcomes are close to each other so the scale v is removed to simplify this computation

$$EU_1 = (p_1 - 0.1)x_1 + (p_2 + 0.1)x_2$$

AGE COMPARISON

Younger
Participants

| | < 45 years old | A (Risk Taking) | | | B (No Risk) | | Interval (95% confidence) |
|---------------------|----------------|-----------------|------------|------------|-------------|---------|------------------------------|
| | | Q | Percentage | EV | Percentage | EV | |
| Under Budget | 6 | 19% | -\$150 | 81% | -\$150 | +/- 15% | |
| On Budget | 15 | 30% | -\$200 | 70% | -\$200 | +/- 17% | |
| Over Budget | 20 | 44% | -\$300 | 56% | -\$300 | +/- 19% | |

- Least experienced participants are more Risk Averse
- Cost performance has an important impact on the results



AGE COMPARISON

Older Participants

| | < 45 years old | | A (Risk Taking) | | B (No Risk) | | Interval (95% confidence) | |
|---------------------|----------------|------------|-----------------|------------|-------------|-----|------------------------------|--|
| | Q | Percentage | EV | Percentage | EV | | | |
| Under Budget | 6 | 31% | -\$150 | 69% | -\$150 | +/- | 18% | |
| On Budget | 15 | 42% | -\$200 | 58% | -\$200 | +/- | 19% | |
| Over Budget | 20 | 62% | -\$300 | 38% | -\$300 | +/- | 19% | |

- Most experienced participants are more Risk Taking
- Cost performance has an important impact on the results

