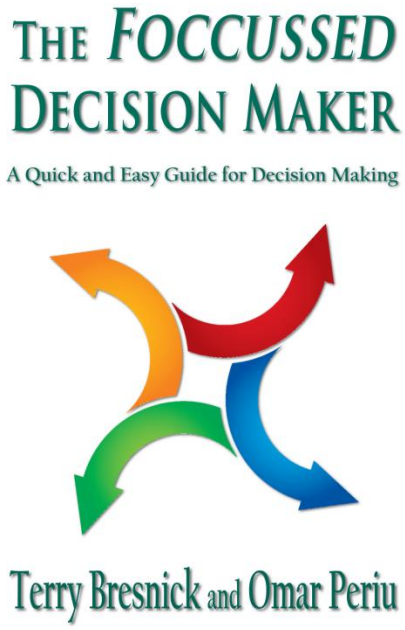
Decision Analysis for the "Masses"



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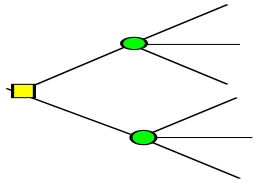
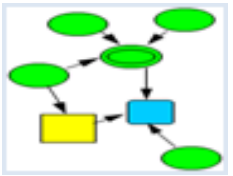


Basic Premises



- Decision Analysis is growing at a much slower pace than the DA community had hoped.
- Most DA is done at a level required by highly sophisticated users.
- DA has not expanded greatly to the small entrepreneur and average decision maker – "the masses"
- For "the masses", it is harder to balance practicality with technical sophistication
- It is harder to reach "the masses" with DA training and consulting

The Opportunity and Challenge

- Customize an approach to effective decision making that meets the needs of the “average” decision maker who may not be mathematically sophisticated

- Find a better way to engage these decision makers so they can be helped in their decision-making skills

We Have Different Attitudes Towards Decision Making

"Nothing is more difficult, and therefore more precious, than to be able to decide."

- French Emperor Napoleon, *Maxims* of 1804

"Nothing good ever came from a management decision. Avoid making decisions whenever possible. They can only get you in trouble."

- Dogbert, Top Secret Management Handbook

Decision Making is Difficult

- **The cost of a making a bad decision might be professionally, monetarily, and personally very high.**
- **More than one person may have a stake in the decision, and their respective goals and values may conflict with each other.**
- **When we make a decision in the present, we are uncertain about how events will unfold in the future – we don't have the luxury of knowing what will happen with certainty.**
- **We also must recognize and learn to work with people who have different attitudes towards decision making.**

What Is a Decision?

A **decision** is the choice among alternatives, based on how we value and trade-off their pros and cons, made in the face of uncertainty about what will actually happen.

The decision-making process has three pillars :

- **preferences**–what we prefer, what meets our goals and objectives, and the recognition that preferences are personal to the one making the decision
- **alternatives** – the choices, options, or courses of action that we have, and over which we have some degree of control
- **information** – what we know about the situation, what we don't know, how we connect choices to outcomes, and how we deal with uncertainty.

Good Decisions Versus Good Outcomes

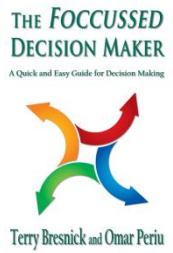
- A ***good outcome*** is one that "feels good"

- A ***good decision*** which is a choice that is consistent with the three pillars: the preferences that we are trying to achieve, the alternatives that we face, and the information that we know and don't know about the decision situation.

Three DA Paradigms

FOCCUSSED Decision Making

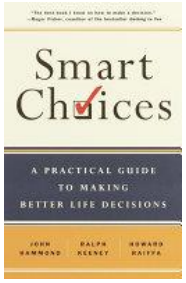
Frame the problem
Objectives
Choices
Consequences
Swaps
Solutions
Elicitation of data
Dissemination



Smart Choices - PrOACT

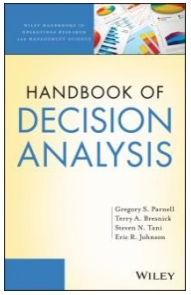
Problem
Objectives
Alternatives
Consequences
Tradeoffs

Uncertainty
Risk tolerance
Linked Decisions



Handbook of Decision Analysis

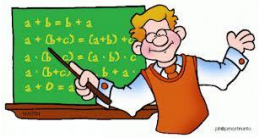
Frame the opportunity
Decision Objectives and Value Measures
Creative Alternatives
Deterministic Analysis
Uncertainty and probabilistic analysis
Communicating
Implementation



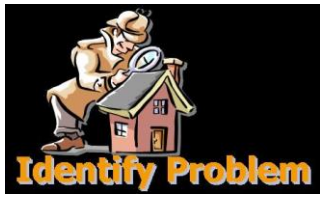
FOCCUSSED Decision Making

- **F**rame the problem - make sure that you are addressing the right problem and that you understand the scope of the decision.
- **O**bjectives – know and understand the objectives and values.
- **C**hoices - develop creative, meaningful alternatives to address the decision.
- **C**onsequences - identify the possible outcomes, good and bad, that may happen after you make the decision.
- **U**ncertainty - think about how likely it is that events could happen that can determine the pros and cons of the future consequences.
- **S**waps - consider your willingness to trade one objective for another.
- **S**olutions - develop a plan to implement your solution/decision.
- **E**licitation of data - make your decision-making processes more meaningful and productive with strong inputs to the decision.
- **D**issemination - communicate decisions to others clearly and effectively.

Frame the Problem



- Define the problem or opportunity
- Identify the constraints that limit your choices
- Identify the stakeholders
- Lay out the assumptions that you are making in your analysis and,
- Set the stage for making a quality decision.



Frame the problem

Sophisticated DA

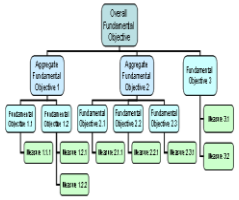
- Not always covered in DA coursework
  - Often, an emphasis on solving the problem quickly may result in solving the wrong problem
- Far less use of formal tools
  - Decision Dialogue Process
  - Vision statement
  - Decision hierarchy
  - Stakeholder Issue Identification Matrix

FOCCUSSED DM

- Emphasis on solving the right problem
  - Identify and challenge boundaries
  - What should we do?
  - Why are we doing this?
- Basic tools
  - Problem/vision statement
  - Stakeholder Issue Identification Matrix
  - Simple examples of framing
  - Kepner-Tregoe Problem Analysis

Sample of a Simple Stakeholders Issue Identification Matrix

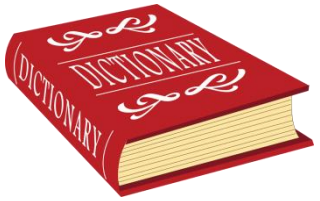
Issues	Decision Maker/Stakeholders			
	Mike	Maddie	Franchisor	Bank
Financial	Net income	Net income	Mike's finances	Mike's finances
	Initial investment	Impact on savings	Collateral	Interest rates
Economic	Competition		Location availability	The economy
			Impact of other franchisees	
	Availability of qualified staff			
Social		Leaving friends		
		Change kids' schools		
Organizational			Mike's skill set	
	Management role - hands on?		Mike's managerial commitment	
Legal	Type of corporation			Type of corporation



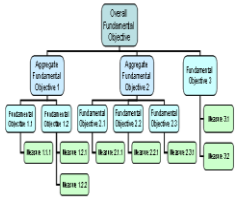
Objectives – Know and Understand the Objectives and Values

- **Alternatives-Focused Thinking (the wrong way to think)**
  - start by identifying a set of alternatives that will be considered
  - then figure out what criteria can be used to decide among the alternatives.
- **Value-Focused Thinking (the right way to think)**
  - start with the objectives and values that we are trying to satisfy
  - then use them to develop more creative alternatives
  - later evaluate and improve those alternatives or to develop new ones.

Key Terms



- **Fundamental objectives**
  - represent the most basic values that we are trying to achieve.
  - typically answer the question of "why am I making the decision?"
- **Means Objectives**
  - describe the way that we can accomplish fundamental objectives.
  - typically answer the question of "***how*** can I best achieve my fundamental objective?"
- **Screening Criteria**
  - absolute must haves that are non-negotiable.
  - any alternative that didn't meet all of these objectives wouldn't be considered, no matter how well it met other objectives.
- **Value or Objectives Hierarchy**
  - an outline framework for representing objectives



Objectives – know and understand the objectives and values

Sophisticated DA

- Emphasis on VFT
  - Fundamental objectives
  - Means objectives
  - Means- ends hierarchies
- Formal tools
  - Complex value hierarchy
  - Additive or multiplicative models
  - Sophisticated value curves, e.g., joint value functions

FOCCUSSED DM

- Emphasis on VFT, but recognize that AFT is the norm
  - Emphasis on requisite modeling
- Basic tools
  - Screening criteria
  - Additive models
  - Simple value hierarchies or value matrices
  - Simple value curves/scales, adjectival scales

Value Hierarchy for Buying a New Laptop

Maximize effective computing capability

1. Maximize computing performance levels
   - Provide sufficient processing capability to run graphics -intensive applications, mathematical simulation applications, and database queries
   - Provide a minimum of 126 Gigabytes of internal storage with capability for adding external storage devices
   - Provide an extremely high resolution display
2. Provide for interface with numerous devices
   - Provide capability for wireless connectivity
   - Provide capability for hard-wired Ethernet capability
   - Provide for both read/write record and play capabilities
   - Provide capability with all connectors currently in use (e.g., USB, HDMI, mini-HDMI)
3. Provide systems characteristics that meet mobile computing needs
   - Minimize carrying weight to include peripherals and cords
   - Maximize battery life
   - Provide durability required for heavy travel use
   - Provide availability of an on-site 24/7 repair and servicing capability

Minimize life-cycle costs

4. Minimize acquisition cost (maximum of $4,000)
5. Minimize maintenance and repair costs (e.g., warranties)

Sample of a Simple Value Hierarchy

- **Maximize long-term wealth from franchise ownership**
  - Maximize the track record of success
  - Maximize opportunities for membership growth
- **Maximize the enjoyment of the franchisee experience**
  - Provide a franchise that will be enjoyable to own and operate
  - Maximize time spent with family without sacrificing performance
- **Provide an economically viable business opportunity**
  - Minimize difference between owner's net worth/liquid cash available and franchise's required net worth/liquid cash available
  - Optimize investment costs
  - Maximize long-term job stability

Choices - Develop Creative, Meaningful Alternatives to Address the Decision

Alternatives

- It is hard to make an optimal decision if all of our choices are bad choices.
- Our set of choices should be:
  - *Feasible*
  - *Complete*
  - *Compelling*
  - *Diverse*
- Use a 2-stage process to generate choices
  - *Divergent phase*
  - *Convergent phase*

Choices - develop creative, meaningful alternatives to address the decision

Alternatives

Sophisticated DA

- Not emphasized in most DA training
- Formal tools
  - Strategy table
  - Morphological cube
  - Brainstorming
  - Brain-writing
  - Scenario planning

FOCCUSSED DM

- Emphasizes creative thinking
  - Choices that are feasible, complete, compelling, and diverse
- Basic tools
  - Strategy table
  - Divergent -> convergent thinking
  - Simple examples

The Strategy Table – a Tool for Generating Good Alternatives

	Decision Components				
Strategies	Soups	Appetizers	Entrees	Desserts	Beverage
Low budget	None	None	Chicken lo mein	None	Water
Low calorie	Wonton	Fried wontons	Beef and broccoli	Fortune cookies	Iced tea
Regular dinner	Eggdrop	Dumplings	Mongolian lamb	Fried ice cream	Soda
Special occasion	Hot and sour	Lettuce wraps	Steamed vegetables		Wine
		Lobster rolls	Peking duck		Champagne

Fitness Franchise Strategy Components

Components of the Decision					
Nature of franchise	Size of the franchise chain	Size of the facility	Exercise offerings	Non-exercise facilities	
Existing	Less than ten locations	Small	Basic exercise facility	None	
New	Hundreds of locations	Medium	Basic + a few classes	Juice bar	
	More than 1000 locations	Large	Basic + many varied classes	Snack bar	. . .
		Mega	Basic plus other sports	Restaurant	
			Full scope club		
		⋮			

Fitness Franchise Strategy Table

	Components of the Decision				
Strategy	Nature of franchise	Size of the franchise chain	Size of the facility	Exercise offerings	Non-exercise facilities
1. Crawl, walk, run	New	< 10	Small	Basic exercise	None
2. Steady as she goes	Existing	Dozens of locations	Small to Medium	Basic + a few classes	None
3. Nothing ventured, nothing gained	Existing	100s of locations	Large	Basic + many varied classes	Juice bar
4. Go for the gold	Existing or new	> 1000 locations	Mega	Basic plus other sports	Juice/ snack bar
			⋮		

Consequences - Identify the Possible Outcomes and Impacts

Illustrative decision: Call a coin flip. If you are correct, you win $10; if incorrect, you win $0

Outcomes: the possibilities that may occur: for the coin flip, the outcomes are “heads” or “tails”.

Consequence: what will happen if an outcome occurs. The consequence of calling the coin correctly is “win $10,” and the consequence of calling it incorrectly is “win $0.”

Value of the consequence: a personal issue and is highly dependent upon context; values express our preferences.

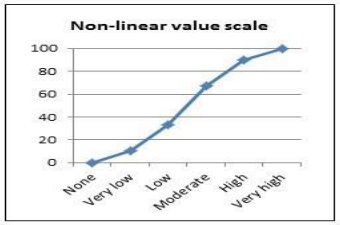
Consequence table: A summary of the characteristics that describe levels of performance on an objective.

Consequences - identify the possible outcomes and impacts

Sophisticated DA

- Emphasizes value hierarchies that are complete, unbiased,
- non-redundant, understandable
- Formal tools
  - Additive or multiplicative models
  - MODA hierarchy, MACBETH
  - Spreadsheet value models
  - Custom commercial off-the-shelf tools (can be expensive)

Word scoring scale	Nonlinear value scale
None	0
Very low	10
Low	33
Moderate	67
High	90
Very high	100



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- Emphasizes smaller hierarchies, “requisite” modeling; Pareto (80/20 rule)
- Basic tools
  - Simple scales, Linear additive models
  - Flatter spreadsheet models
  - Inexpensive COTS tools

Word scoring scale
None
Very low
Low
Moderate
High
Very high

Star scoring scale
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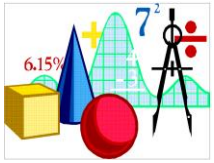


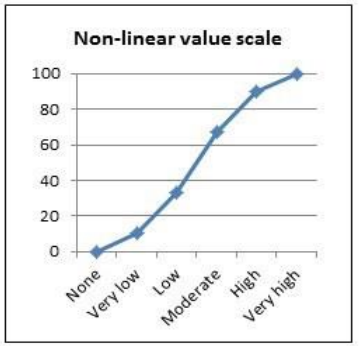
Measuring Value

- **Relative approach:** we directly compare things to each other
- **Absolute approach:** **w**e define a specific measurement scale that can be used to get a consistent measure from one consequence to another
- **Ranking** – ordering alternatives (e.g., best to worst, first to last)
- **Scaling** – specific measurement of performance of the alternatives

Word scoring scale
None
Very low
Low
Moderate
High
Very high

Star scoring scale
*
**
***
****
*****

Word scoring scale	Nonlinear value scale
None	0
Very low	10
Low	33
Moderate	67
High	90
Very high	100



Value Scales

Track Record				Competition			
Average same-chain annual return on investment		Franchise 500 ranking		Miles to nearest same-chain competition		# of competing fitness franchises in zip code	
Score	Value	Score	Value	Score	Value	Score	Value
< 20%	0	Bottom 50%	0	<3	0	>10	0
20-29.9%	20	51-75%	30	3-5	33	6-10	20
30-39.9%	40	76-90%	60	6-10	67	3-5	50
40-49.9%	60	91-98%	90	>10	100	1-2	90
50-75%	80	99-100%	100			None	100
>75%	100						

Partial Consequence Table

Value measures	Average same-chain annual return on investment	Franchise 500 ranking	Average same chain turnover rate	Financial Requirements vs. financial situation	Level of corporate incentives
Choices	Score	Score	Score	Score	Score
For Your Health	52%	None	12%	Within financial resources	Very high
Fit To Be Tied	65%	60	<10%	Doable, but will require financing	Low
Better Bodies Gym	77%	92	15%	Borderline qualify	Low
Fitness Focus	48%	85	27%	Doable, but will require financing	High

...

Part of the Value Table

Value measures	Average same-chain annual return on investment	Franchise 500 ranking	Miles to nearest same-chain competition	# of competing fitness franchises in zip code	Level of corporate incentives		
Choices	Value	Value	Value	Value	Value		Total Value
For Your Health	80	0	100	20	100		1012
Fit To Be Tied	80	30	67	20	35	• • •	1247
Better Bodies Gym	100	90	100	20	35		1257
Fitness Focus	60	60	100	50	90		1358

Uncertainty - How Likely Is It That Events Could Happen

"The 50-50-90 rule: anytime you have a 50-50 chance of getting something right, there's a 90% probability you'll get it wrong."

Andy Rooney , *60 Minutes TV Commentator*

Uncertainty - think about how likely it is that events could happen

Sophisticated DA

- Emphasis of formal probability modeling
  - Bayesian approach
- Formal tools
  - Decision trees
  - Bayes nets
  - Influence diagrams
  - Simulations
  - Formal probability encoding

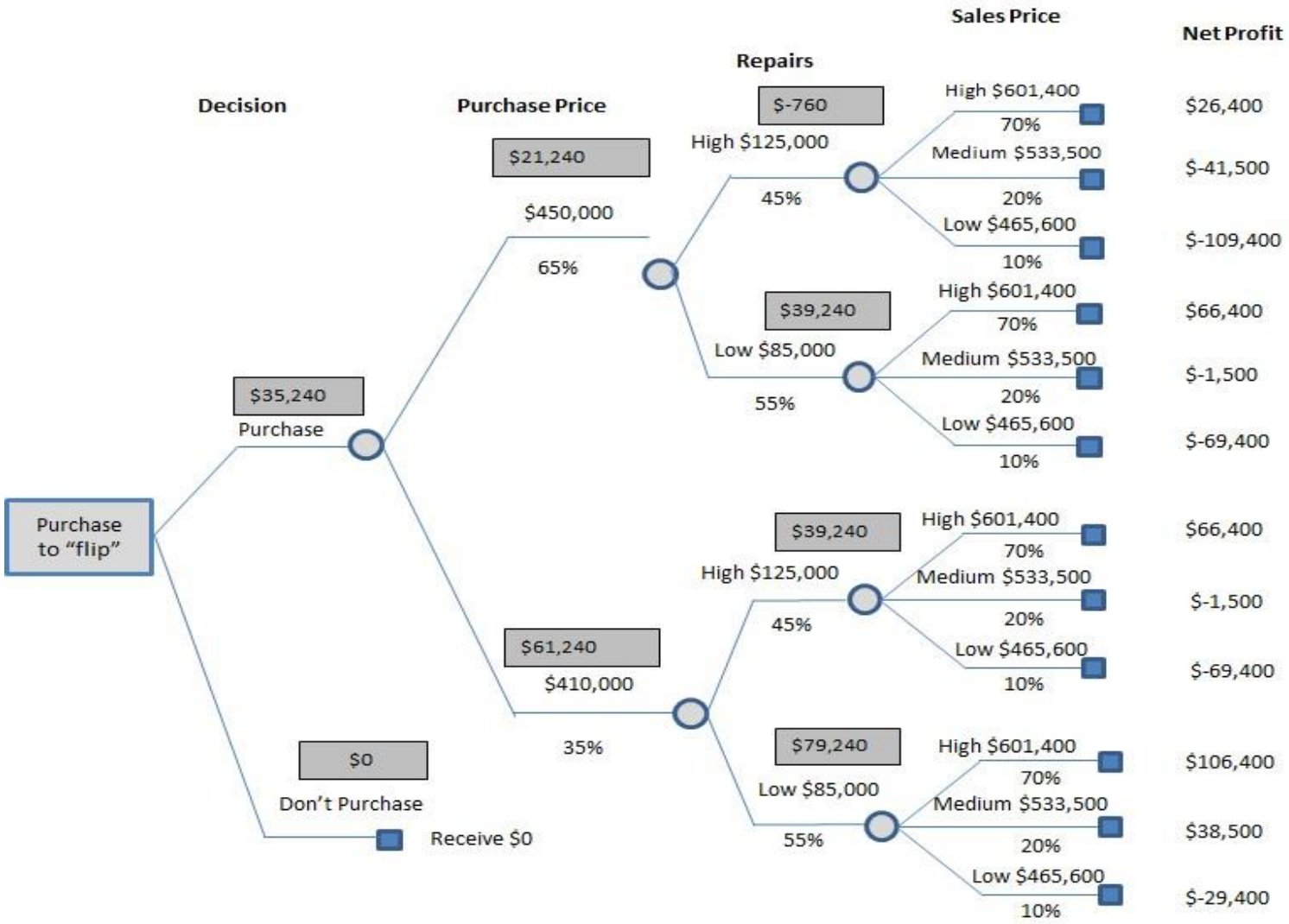
FOCCUSSED DM

- Emphasis about thinking about uncertainty, simple modeling
  - Probability as a state of information
- Basic tools
  - Very simple examples
  - Decision trees
  - Spreadsheet Monte Carlo modeling
  - Use of simpler encoding tools
    - Reference processes
    - Selection from known distributions
    - Predetermined adjectival descriptions

Sherman Kent Scale for Probability Assessments

Almost no chance	Very unlikely	Unlikely	Roughly even chance	Likely	Very likely	Almost certain
Remote	Highly improbable	Improbable	Roughly even odds	Probable	Highly probable	Nearly certain
01-05%	05-20%	20-45%	45-55%	55-80%	80-95%	95-99%

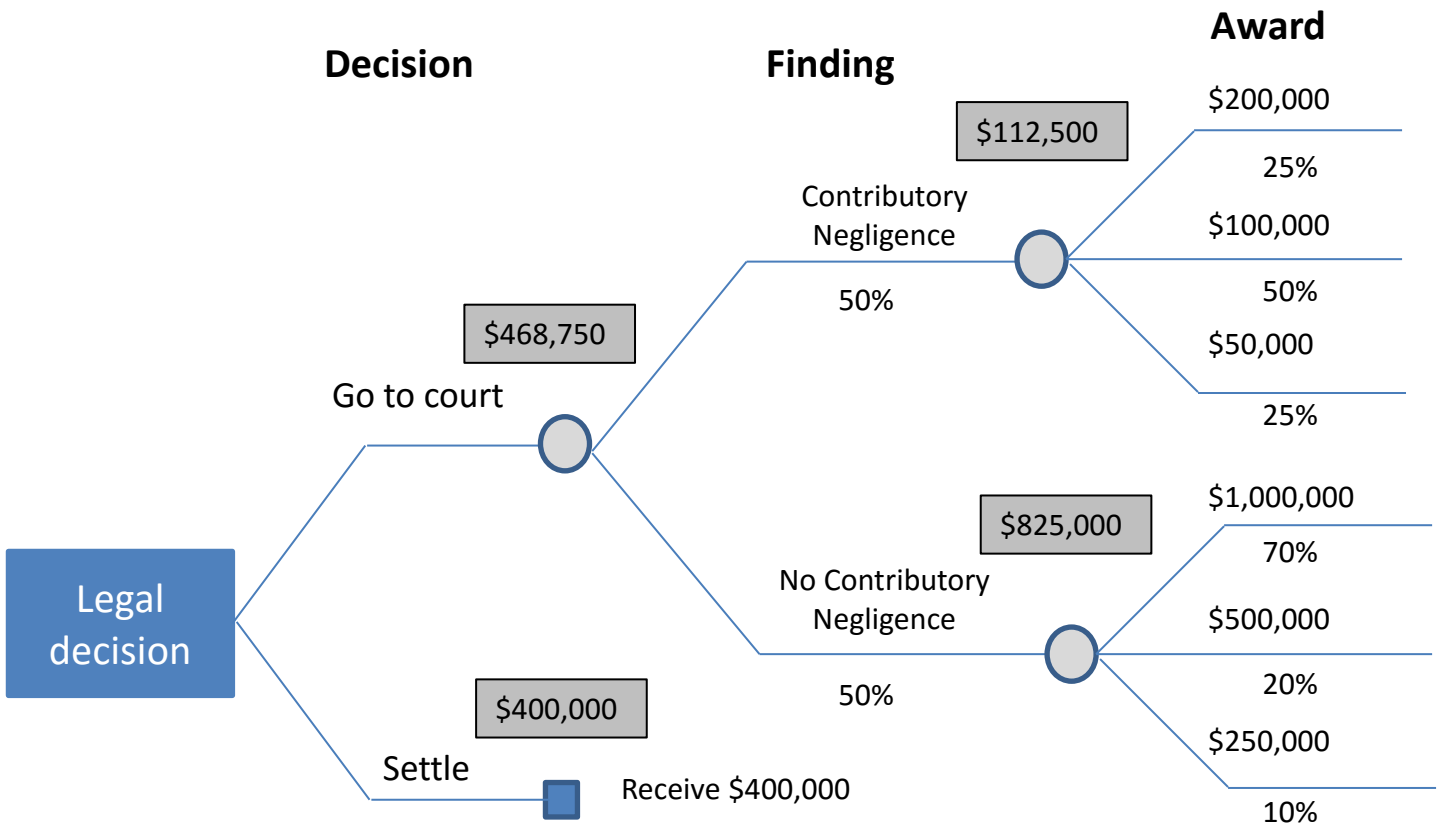
Simple Decision Tree for Investment Property Purchase



Simple Decision Matrix for Investment Property Purchase

Decision Matrix for House Flip									
Possible outcome #	(A) Purchase Price	(B) Probability of purchase price	(C) Repairs	(D) Probability of repairs	(E) Sale price	(F) Probability of sale price		(G) Net Profit for the outcome Columns E - (C + A)	(H) Probability of the outcome Columns B x D x F
1	$ 450,000	65%	$ 85,000	55%	$ 601,400	70%		$ 66,400	25.0%
2	$ 450,000	65%	$ 85,000	55%	$ 533,500	20%		$ (1,500)	7.2%
3	$ 450,000	65%	$ 85,000	55%	$ 465,600	10%		$ (69,400)	3.6%
4	$ 450,000	65%	$ 125,000	45%	$ 601,400	70%		$ 26,400	20.5%
5	$ 450,000	65%	$ 125,000	45%	$ 533,500	20%		$ (41,500)	5.9%
6	$ 450,000	65%	$ 125,000	45%	$ 465,600	10%		$ (109,400)	2.9%
7	$ 410,000	35%	$ 85,000	55%	$ 601,400	70%		$ 106,400	13.5%
8	$ 410,000	35%	$ 85,000	55%	$ 533,500	20%		$ 38,500	3.9%
9	$ 410,000	35%	$ 85,000	55%	$ 465,600	10%		$ (29,400)	1.9%
10	$ 410,000	35%	$ 125,000	45%	$ 601,400	70%		$ 66,400	11.0%
11	$ 410,000	35%	$ 125,000	45%	$ 533,500	20%		$ (1,500)	3.2%
12	$ 410,000	35%	$ 125,000	45%	$ 465,600	10%		$ (69,400)	1.6%
						Expected Profit			

Simple Decision Tree for Going to Court vs. Settling



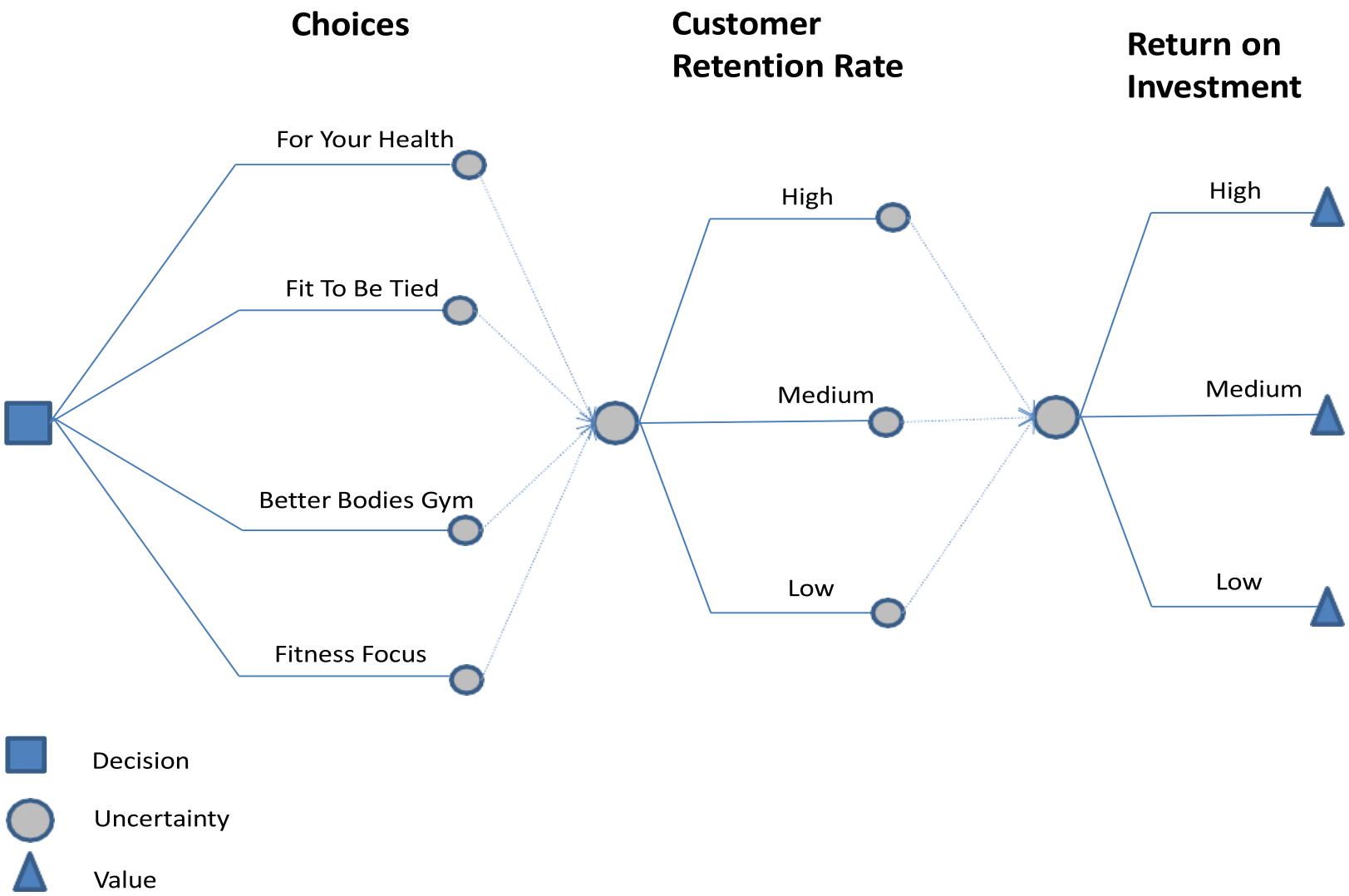
Go to court has maximum award of $1,000,000, a minimum award of $50,000, and an expected value of $468,750

Settle has a value of $400,000 for certain

Simple Decision Matrix for Legal Decision

Decision Matrix for the Attorney's Client									
Path #	(A) Choice	(B) Contributory negligence finding	(C) Award		(D) Probability of contributory negligence finding	(E) Probability of Award	(F) Probability of path = Column D x E		(G) Expected Award = Column C x F
1	Settle	-	$ 400,000		-	100%	100%		$ 400,000
2	Court	Yes	$ 200,000		50%	25%	12.5%		$ 25,000
3	Court	Yes	$ 100,000		50%	50%	25.0%		$ 25,000
4	Court	Yes	$ 50,000		50%	25%	12.5%		$ 6,250
5	Court	No	$ 1,000,000		50%	70%	35.0%		$ 350,000
6	Court	No	$ 500,000		50%	20%	10.0%		$ 50,000
7	Court	No	$ 250,000		50%	10%	5.0%		$ 12,500
					Expected value of settling				**$ 400,000**
					Expected value of going to court				**$ 468,750**

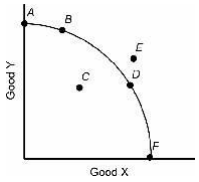
Partial Decision Tree for Franchise decision



Partial Expected Value Matrix

	Value measures	Customer Retention	Customer Retention Probability	Return on Investment Score	Return on Investmentn Probability	Value associated with this outcome	Probability of this Outcome	Expected Value of this Outcome	Expected Value of Return on Investment
Outcome	Choices								
1	For Your Health	High	45%	High	85%	100	38%	38	
2	For Your Health	High	45%	Med	10%	80	5%	4	
3	For Your Health	High	45%	Low	5%	20	2%	0	
4	For Your Health	Med	35%	High	40%	100	14%	14	
5	For Your Health	Med	35%	Med	50%	80	18%	14	78
6	For Your Health	Med	35%	Low	10%	20	4%	1	
7	For Your Health	Low	20%	High	5%	100	1%	1	
8	For Your Health	Low	20%	Med	15%	80	3%	2	
9	For Your Health	Low	20%	Low	80%	20	16%	3	
10	Fit To Be Tied	High	85%	High	85%	100	72%	72	
11	Fit To Be Tied	High	85%	Med	10%	80	9%	7	
12	Fit To Be Tied	High	85%	Low	5%	20	4%	1	
13	Fit To Be Tied	Med	10%	High	40%	100	4%	4	
14	Fit To Be Tied	Med	10%	Med	50%	80	5%	4	90
15	Fit To Be Tied	Med	10%	Low	10%	20	1%	0	
16	Fit To Be Tied	Low	5%	High	5%	100	0%	0	
17	Fit To Be Tied	Low	5%	Med	15%	80	1%	1	
18	Fit To Be Tied	Low	5%	Low	80%	20	4%	1	

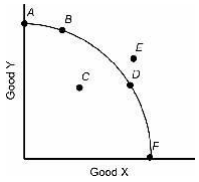
Swaps - Consider Your Willingness To Trade One Objective For Another



Three basic truths about decision making:

- *Some things are more important than others*
- *We usually can't get everything we want*
- *We often have to give up one thing to get another.*

Swaps - consider your willingness to trade one objective for another



Sophisticated DA

- Formal weighting processes, highly mathematical approaches
- Formal tools
  - Direct assessment
  - 100 coin drill
  - Swing weight matrix
  - Even trade-offs
  - Balance beam
  - Iso-value curves

FOCCUSSED DM

- Simple weighting approaches, but emphasis on swing weights
- Basic tools
  - Relative ranking (ordinal)
  - 100 coin drill
  - Swing weight matrix
  - Balance beam relative weighting

Importance Weights vs. Swing Weights

- **Importance weights**
  - Answer the question "How important is measure A versus measure B?"
  - Very commonly used, but it is the wrong approach!
- **Swing weights**
  - Have two components
    - the importance of the value measure *and*
    - the size of the gap between the top and the bottom of the value scale.
  - Produce much more accurate results

Sample of a Swing Weight Matrix

Mike's Swing Weight Matrix				
		Importance of the Value Measure		
		High	Medium	Low
Size of the Swing	High	Average same-chain annual ROI Average same-chain annual staff turnover rate	Franchise 500 ranking Level of corporate incentives Initial capital contribution Breadth of services provided	Length of lease (years) Miles to nearest same-chain competition
	Medium	Requirements vs. Mike's financial situation Variety and quantity of equipment	Likelihood of obtaining required financing Annual royalty fee percentage	Competitive compensation package
	Low	Amount of state-of-the-art equipment Quality of services provided	Availability of affordable housing within 20 minutes	Average hours per day spent at facility by same-chain franchisees # of competing fitness franchises in zip code

Sample of Swing Weights

Value Measure	Coins add to 100
Expected ROI	29
Average same-chain staff turnover rate	20
Financial requirements vs. financial situation	14
Initial capital contribution	10
Franchise 500 ranking	7
Likelihood of obtaining financing	6
Annual royalty percentage fee	4
Length of lease	3
Level of corporate incentives	3
Competitive compensation package	2
Availability of affordable housing within 20 minutes	2

Sample of Weighted Values

Value measures	Average same-chain annual return on investment	Franchise 500 ranking	Average same chain turnover rate	Financial Requirements vs. financial situation	Level of corporate incentives		
Swing Weights	29	7	20	14	3		
Choices	Value	Value	Value	Value	Value		Total Value
For Your Health	80	0	100	20	100		75
Fit To Be Tied	80	30	67	20	35	...	84
Better Bodies Gym	100	90	100	20	35		67
Fitness Focus	60	60	100	50	90		61

Solutions - develop a plan to implement your solution/decision

Sophisticated DA

- Often stops at the analytical solution
  - doesn't consider "socio" aspects enough
  - Focus on quality decisions
- Formal tools
  - Gantt charts or PERT charts
  - Implementer involvement at the end
  - DA Quality chain

FOCCUSSED DM

- Emphasis on DA as a socio-technical process
  - Focus on better decisions
  - Barriers to problem solving and decision making
- Basic tools
  - Think about implementation as part of framing
  - Implementation issues considered throughout
  - No formal tools

Topics Not Covered Today

Elicitation of data - make your decision-making processes more meaningful and productive with strong inputs to the decision.

- Interviews
- Surveys
- Focus Groups
- Decision Conferences

Dissemination - communicate decisions to others clearly and effectively.

Conclusions

- There is a significant difference in “selling” and conducting DA for large sophisticated organizations vs. small, “everyday” decision makers.
- The FOCCUSSED decision making process balances the practicality of conducting a DA for mathematically unsophisticated decision makers, with the sophistication needed to make credible, quality decisions.
- We can spread DA to the “masses” by partnering with others that attract the “masses”.

Questions?