Using the Hippocratic Oath to Provide a Surrogate for Client Utility Functions

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Motivating Problems

- It is often difficult to assess a client's utility function --- especially if that client is a non-quantitative patient, under serious distress, in a medical content

- Many medical practitioners are more oriented toward non-Bayesian approaches to using statistics in medicine

Proposed Solution

- Target-oriented utility theory establishes that any utility function defined over some outcome c is always equivalent to the probability of that outcome c being better than (or just as good as) an outcome randomly chosen from some reference probability distribution

- Thus the utility function for any action d can always be interpreted as the probability of that decision d's outcomes being at least as good as the outcomes of some prespecified gamble

Hippocratic Oath

- Professional ethics in clinical settings require that the patient strive to `help, or at least do no harm.'
- Thus the physician should maximize the probability of making the patient better off, or at least no worse off, than if the patient had been untreated.
- But there's considerable uncertainty about how the patient will have performed in the absence of treatment.   This uncertainty is typically estimated by creating a control sample (or reference sample) of patients subjected to a placebo intervention
- Thus the physician should maximize the probability of making the patient no worse off than a patient randomly draw from the control sample.

Relationship to Non-Bayesian Paradigms

- Pearson and Fisher recognized that tests of statistical significance did not describe the prescribe significance of some proposed intervention
- They proposed effect size measures.
- This is being successfully implemented in the psychological, and, to some extent, in the medical literatures.
- The most popular effect size measures are the probability of the intervention have an outcome which outperforms the outcome experienced by patients from a placebo group (e.g., a group subjected to some placebo treatment)
- This non-Bayesian effect size measure coincides with the Bayesian Hippocratic utility function.
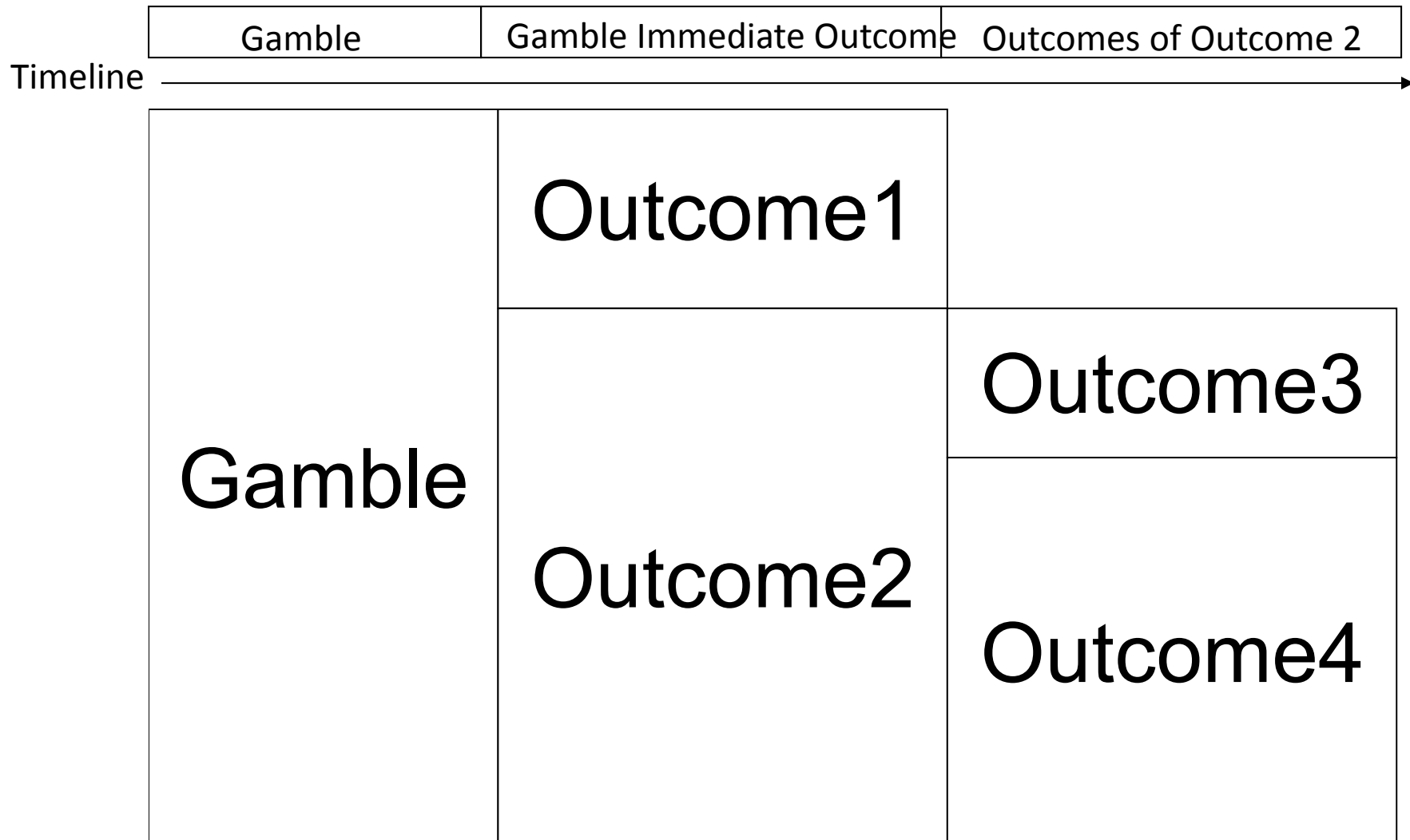
Comments

- Note that this is the utility function the physician assesses on behalf of the patient.
  - In defining this utility function, the physician should consider the patient's health state, other diseases, personal habits etc.
  - From a Bayesian perspective, the physician is free to update this surrogate utility function based on whatever information the patient does provide about the patient's preferences. In the presence of extensive information, this surrogate utility function would be expected to converge to the patient's actual utility function
- Engineering societies also have ethical codes, patterned on the Hippocratic oath. If Decision Analysis every adopts a code of professional ethics (as is being debated), it may want to similarly consider this kind of Hippocratic oath.

Continuing to make things visual

- In those cases, where the patient wants to see the logic which the physician is using in choosing treatments --- or wants to be involved in thinking through that choice --- there is a way of making the entire decision tree process visual

Representing an Uncertainty

| Gamble | Gamble Immediate Outcome | Outcomes of Outcome 2 |

Timeline →

Gamble

Outcome1

Outcome2

Outcome3

Outcome4

Size represents relative probability

Evaluating a Gamble

STEP 1: DRAW

	Best Possible
Risk	
	Worst Possible

STEP 2:COLOR THE ENDS

	Best Possible
Risk	
	Worst Possible

STEP 3:MIX COLORS

	Best Possible
Risk	
	Worst Possible

Draw the Decision Tree based on order in which outcomes occur

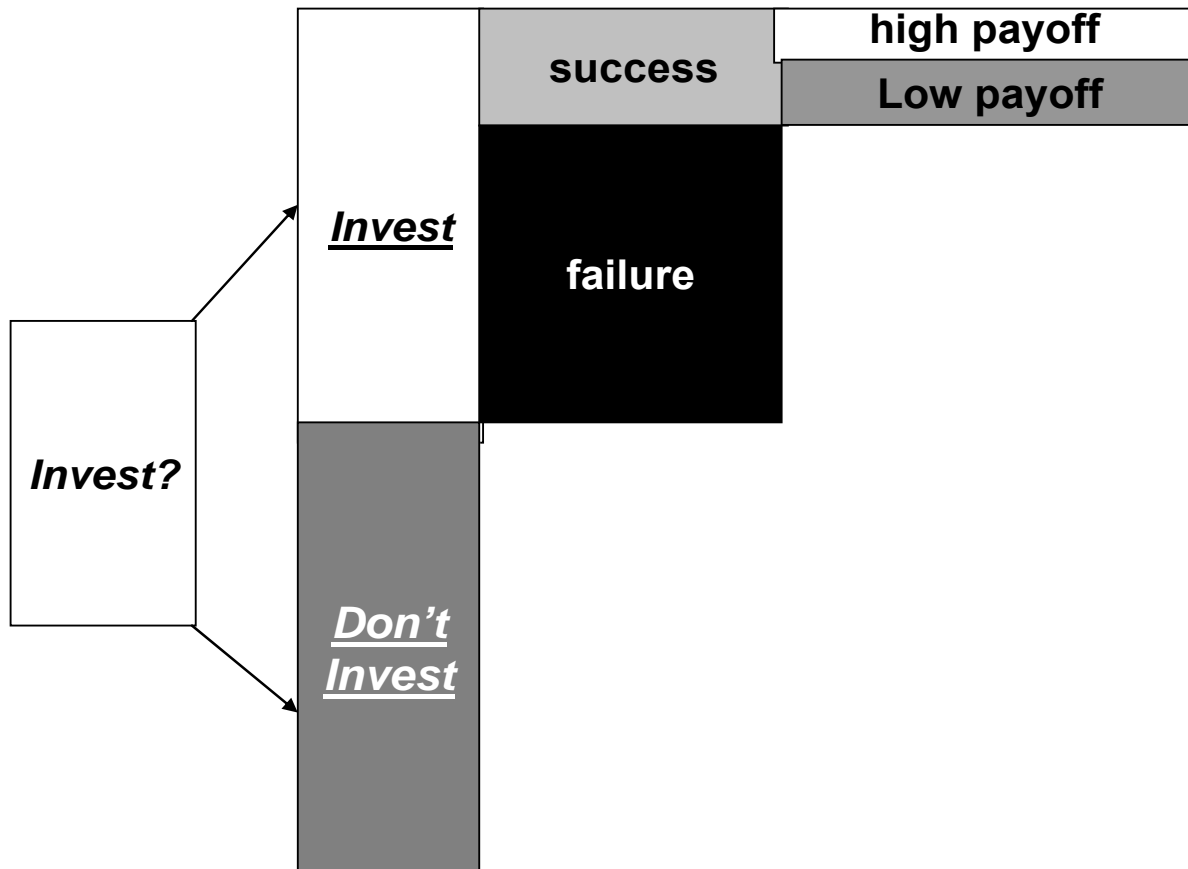|		high payoff
	success	Low payoff
Invest		
	failure	

Invest?

Don't Invest
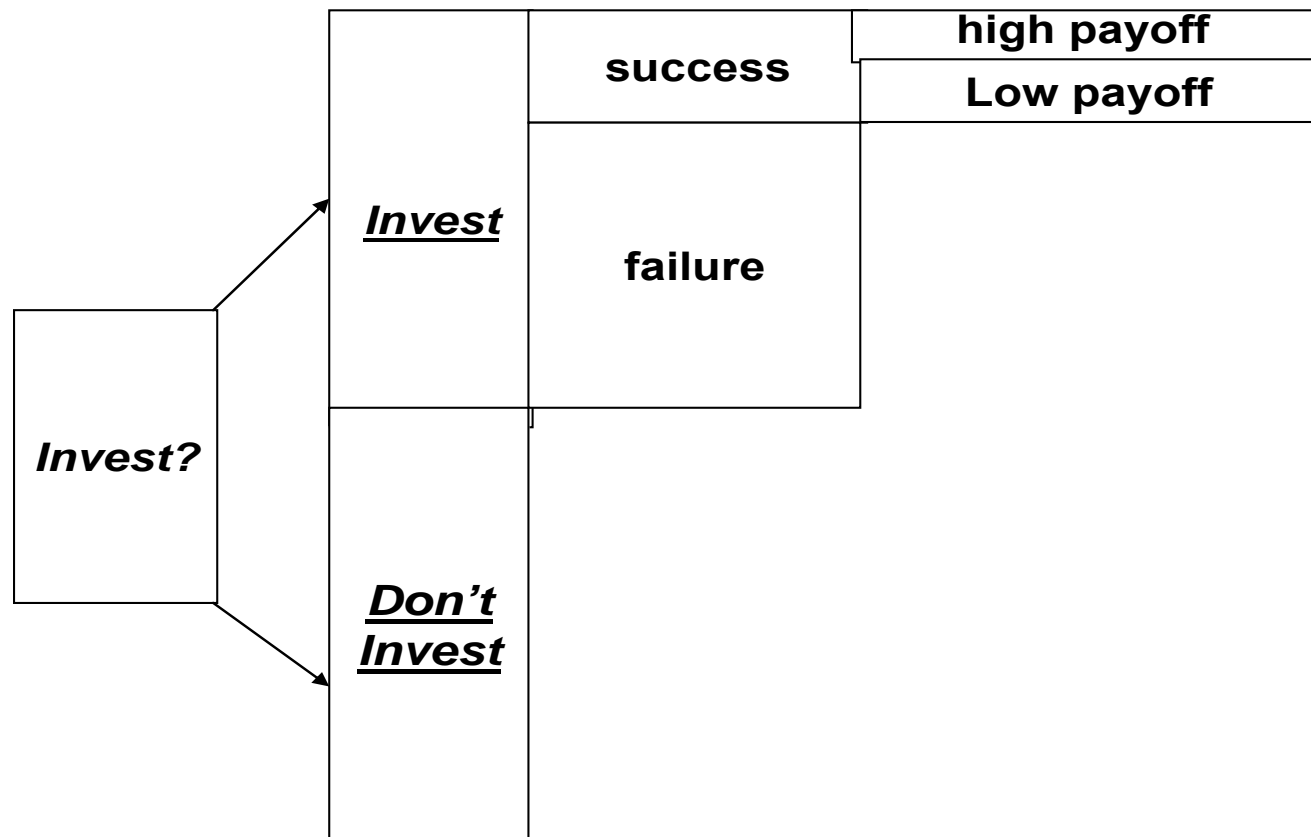
They're really decision blocks

COLOR END BLOCKS based on their relative value
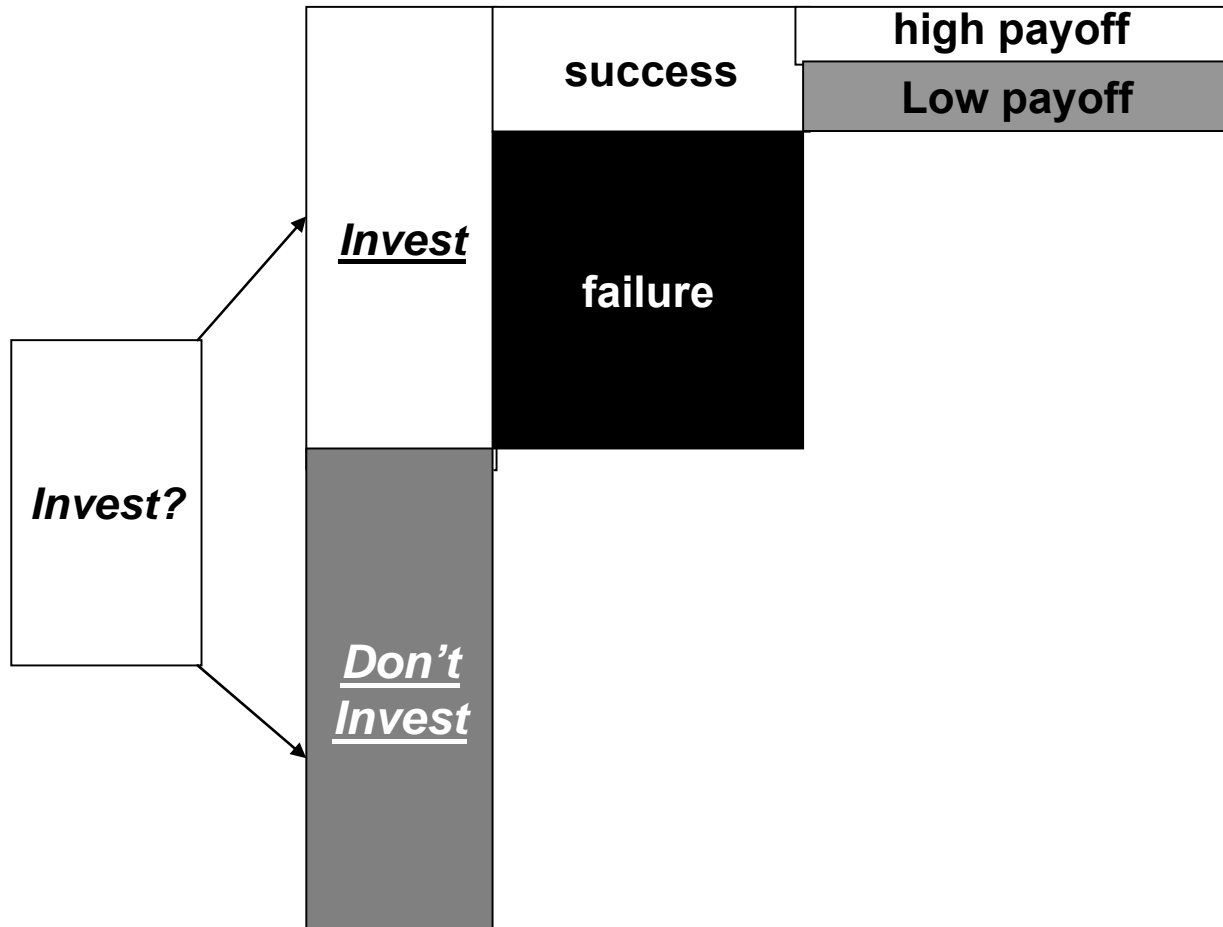
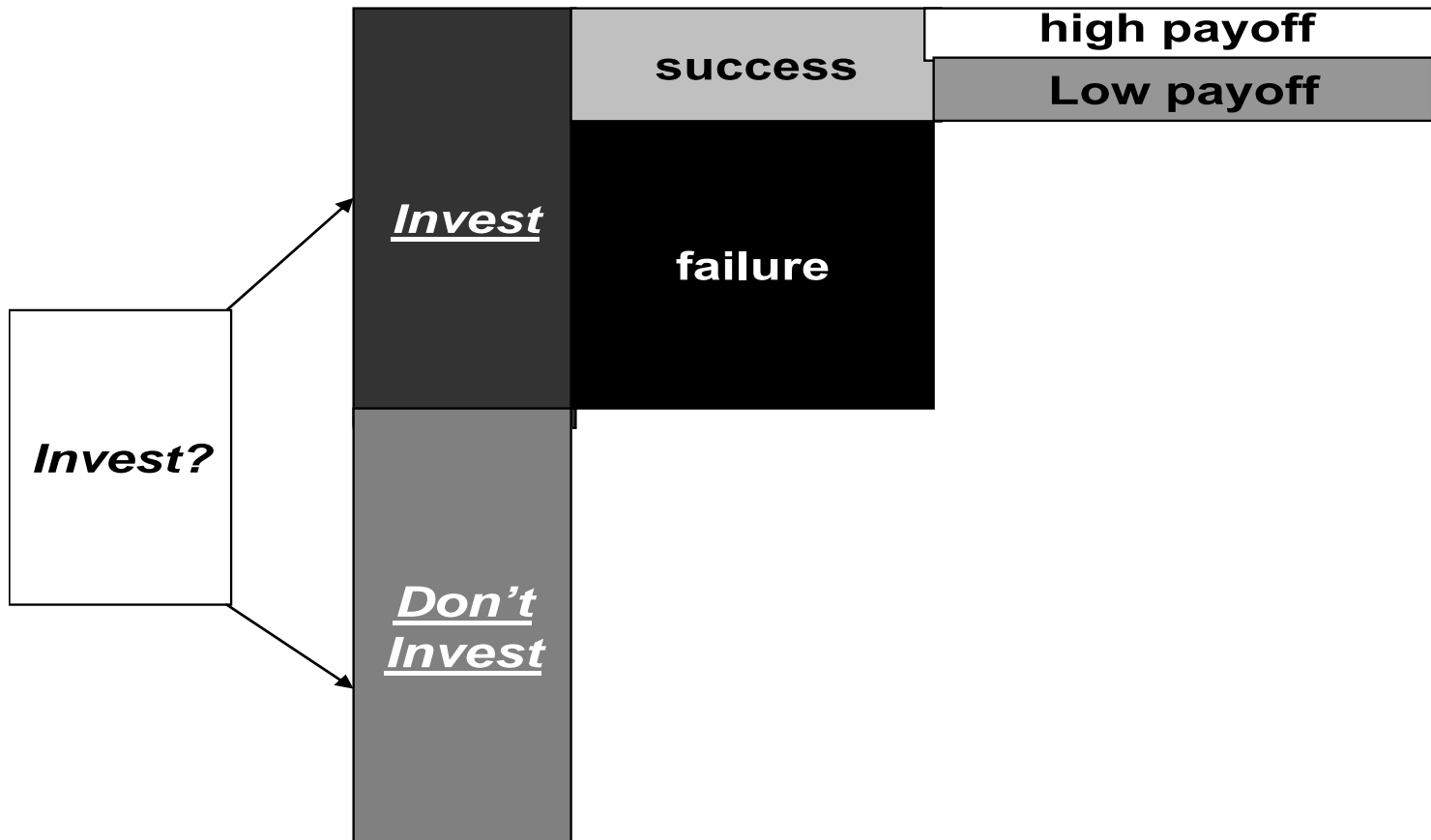
Success is the best outcome. Failure is the worst outcome.
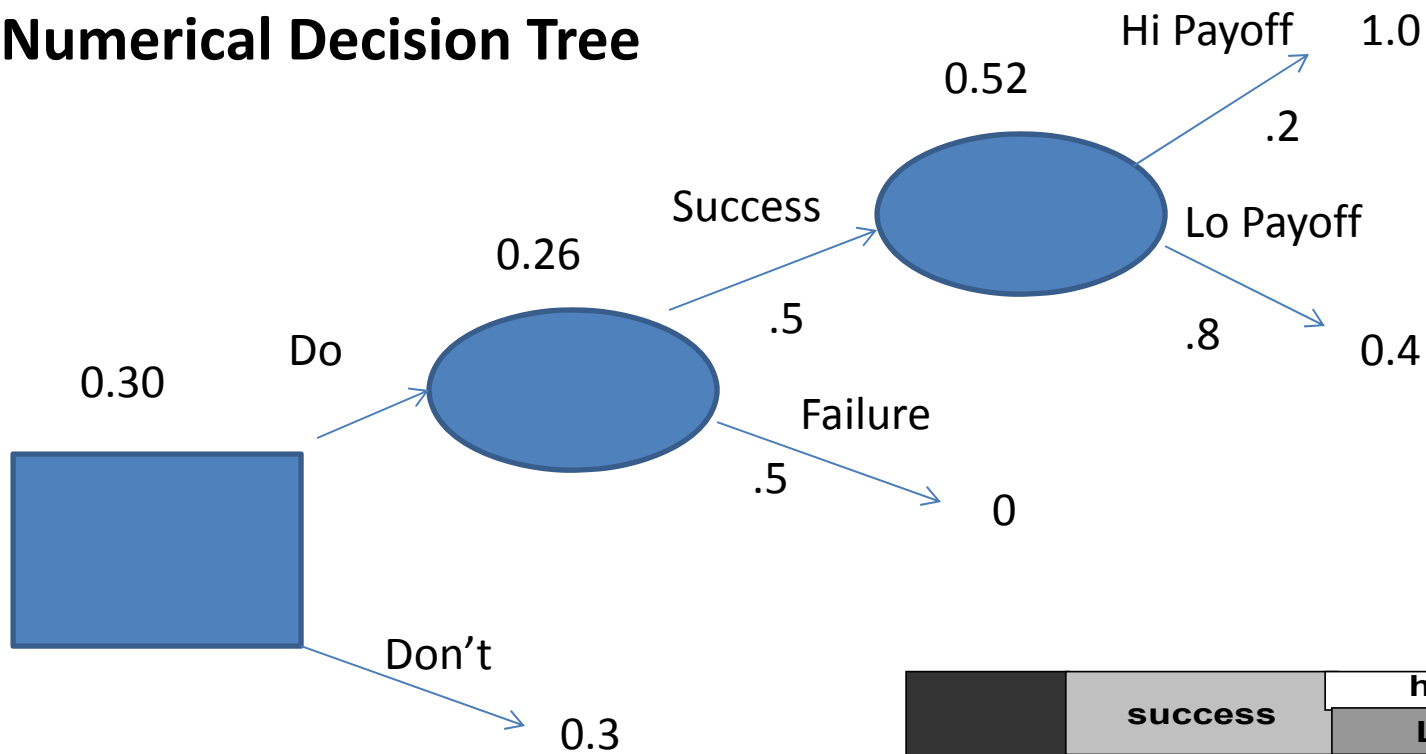All other outcomes are of intermediate value

COLOR THE BLOCKS ADJACENT TO END BLOCKS
by mixing colors like you'd mix cans of paints
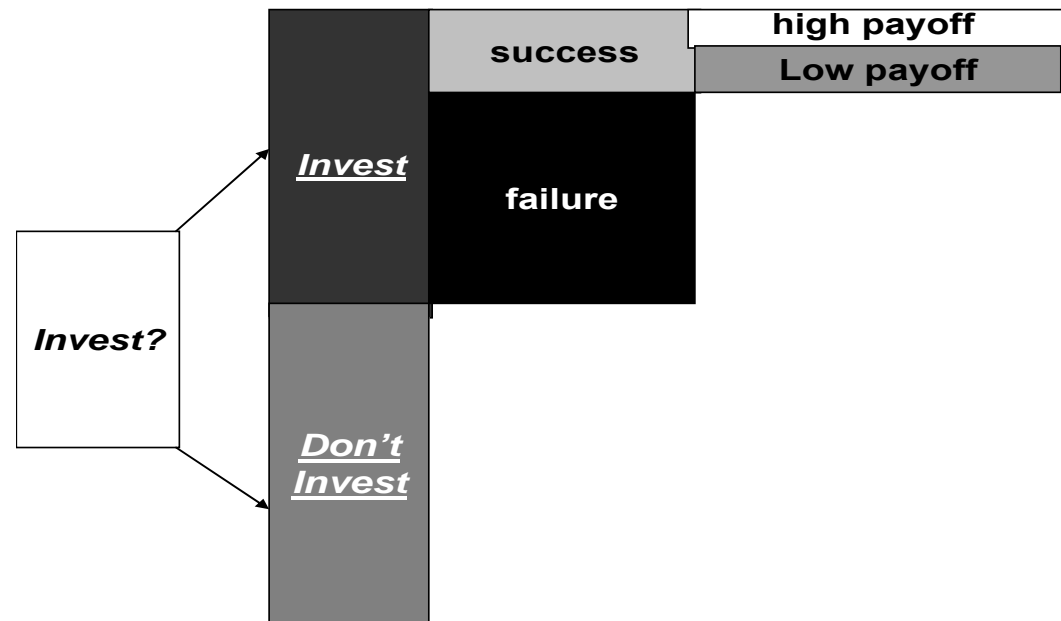
Invest?

Invest

Don't Invest

success

failure

high payoff

Low payoff

COLOR THE NEXT-MOST ADJACENT BLOCKS --- Moving backwards

Invest?

Invest

success

high payoff

Low payoff

failure

Don't Invest

Numerical Decision Tree

Hi Payoff   1.0

0.52

.2

Success

Lo Payoff

0.26

.5

.8   0.4

Do

0.30

Failure

.5   0

Don't

0.3

Visual Tree

high payoff

success

Low payoff

Invest

failure

Invest?

Don't
Invest

Conclusions

- Decision Analysis is based on numerical representations of probability and utility with which some clients and patients are uncomfortable

- This can be replaced by a purely visual representation which, using the Hippocratic oath as a surrogate for the utility function, makes decision analysis accessible to these kinds of clients and patients.