1 ❑ Dealing with Uncertainty

2 ❑ Uncertainty as a negative

✓People apparently want to know the future with certainty.
- Tarot cards, psychic reading, astrology, palm reading.

3 ❑ There's a dread of uncertainty

✓"What if..." games.
- What if I don't get a job or even graduate?
- What if she doesn't want to get married?
- What if I get pregnant?

✓These uncertainties produce STRESS.

4 ❑ We also want to control our futures

✓Control removes uncertainty – it seems to give us hope of avoiding future negatives.

✓Unfortunately, an illusion of control pervades our lives, too.
- Superstitious behavior.
- Perceived control over chance events.

5 ❑ Consequences of our abhorrence of uncertainty

✓Because of our hatred of uncertainty, we strive mightily to avoid it, downplay it, or deny it.
- Overconfidence abhors uncertainty!!!
- We don't want to accept the known shortcomings of a statistical model.
  - We can do better!!! (or so we deceive ourselves)

6 ❑ Paradox

✓Although we strive to reduce uncertainty, total certainty is undesirable.
- For example, although genetic tests are available for a host of genetic defects, most people prefer to not to know (unless they're at high risk).
- (relationships….for later…. Norton, Frost & Ariely, 2007)

7 ❑ Living with uncertainty

✓Without uncertainty, there would be no hope, no ethics, and no freedom of choice.

✓We can either accept uncertainty or deny it.
- Denying it doesn't make it go away.

8 ❑ The consequences of uncertainty

✓We will make mistakes
- But, we can choose which types of mistakes we are most willing to make.

✓Misses vs. False alarms
- Miss - failing to predict that something will happen (or is true).
  - AKA False Negative
- False alarm - predicting something will happen and then it doesn't (or is true when it isn't).
  - AKA False positive

9

10 Accept error?

✓Pick your poison
- You will make errors, but you can pick the proportion of errors - mostly FP, mostly Misses, or some compromise.

✓The only way to reduce error of one type without increasing error of the other type is to reduce the overall uncertainty.
- For example, through statistical prediction models.

11 Signal Detection Theory (SDT)

✓SDT is a method for analyzing the relationship between a predictor or diagnostic criterion and an outcome likelihood.
- Most often used to discriminate between two outcomes (e.g., diseased/normal, succeed/fail, buy/don't buy, tumor present/absent) because many decisions are binary.
- I'll limit discussion to binary situations because of simplicity, but method can be applied to more complex situations (MacMillan & Creelman, 2004).

12 Accuracy (d')

13 Decision Criterion (c and S)

14 ROC ("receiver operator characteristic") curve

15 Courtesy of Michigan State U.

16 An aside for grad students: z-transform => Linear ROCs

✓Note that you can plot z(TP) vs. z(FP) and should get straight lines.
- If the slope is 1, then standard deviations of two curves is equal.
- If slope is not 1, then s.d.s are not equal and really should use more sophisticated SDT analysis (see MacMillan & Creelman, 2004).

17 How do you pick a criterion?

✓See Equation on p. 9 of Swets et al.

✓The equation balances the benefits of TP and TN with the costs of FP and FN.
- If FP are extremely costly and FN are less so (e.g., accusing someone of cheating), then err on the side of conservativeness - move criterion up.
- If FN are extremely costly and FP are not (e.g., tornado sirens), then err on the liberal side - move criterion down.

18 Examples…

✓Read Swets et al.
- Lots of excellent examples of analyzing various situations using SDT.

19 Uncertainty produces errors

✓You must accept that you will make mistakes.

✓You can pick which types of mistakes are more acceptable and/or least costly.
- *Plan* for your errors - to maximize your outcomes (maximal benefits and minimal costs).