Decision Making Lab
Background

Note: Read this material *after* running the experiment.

This experiment examines response mode preference reversals. That means that the preference order a decision maker assigned to two things can vary with the response mode. In this experiment there were two response modes: choice and selling price.

Consider these two example lotteries:

L. 3/36 chance to win $16.50
H. 35/36 chance to win $1.50

I use the letter L to label a lottery that has a **low** chance of winning but a large amount to win. I use the letter H to label a lottery that has a **high** chance of winning but a small amount to win.

Suppose that when faced with a choice between these two, the decision maker chose H. When asked to give a minimum selling price for each, the decision maker gave a price of $2.50 for L and a price of $1.25 for H. This gives the pattern:

$H \succ L$ (H is preferred to L from choice)
price(L) > price(H)

The choice indicates that the person values H more, but the prices indicate that the person values L more. The preference orders are inconsistent for the two response modes. This pattern is irrational – it violated normative decision theory. One way to describe why this is irrational is to say that it violates the normative principle of procedural invariance. Procedural invariance says that the preference order should be invariant regardless of what procedure (choice vs. selling) is used to elicit the preferences. The preference reversal violates this principle because the two response modes give different preference orderings.

Another way to see why preference reversals are irrational is to notice that the preferences imply intransitivity. Transitivity is a normative principle that means that if $X \succ Y$ and $Y \succ Z$, then $X \succ Z$. The choice and prices above violate this pattern and gives an intransitive or circular pattern like this:

$$L = \$2.50 > \$1.25 = H \succ L$$

You might also think of it like this:

$$H \succ L \succ \$2 \succ H$$

Since the minimum selling price for L is $2.50, presumably the decision maker would prefer to get L rather than $2. Since the minimum selling price for H is $1.25, presumably the decision maker would prefer to get $2 rather than H. L $\succ$ $2 and $2 $\succ$ H implies L $\succ$ H according to transitivity, but the choice shows just the opposite: H $\succ$ L.

Tversky, Slovic, and Kahneman, (1990) conducted a famous study to determine whether preference reversal were caused by intransitivity or by violations of procedural invariance. They asked subjects for a couple of additional choices to see if their preferences were really intransitive. They also asked subjects to choose between H and a certain amount, like $2, and to choose between L and the certain amount. Instead of inferring what these choices would be form the prices, they actually asked subjects. Let's call the certain amount X.

Tversky, Slovic, and Kahneman, (1990) looked at cases where subjects showed a preference reversal – that is, where Price(L) > Price(H) and choice showed H $\succ$ L. In addition, they narrowed down these cases to those where Price(L) > X > Price(H). If subjects were being intransitive, their response pattern would look like this:

Intransitive: Price(L) > Price(H), Choice: H$\succ$L, L$\succ$X, X$\succ$H

Notice that the choices show intransitivity –L$\succ$X and X$\succ$H imply L$\succ$H, but in fact the choice between H and L shows H$\succ$L. Only 10% of the preference reversals showed this pattern, indicating that intransitivity is not the main cause of preference reversals. The other 90% of the preference reversals followed one of these patterns:

Over-pricing of L	Price(L) > Price(H), Choice: H$\succ$L, X$\succ$L, X$\succ$H
Under-pricing of H	Price(L) > Price(H), Choice: H$\succ$L, L$\succ$X, H$\succ$X
Both OL and OH	Price(L) > Price(H), Choice: H$\succ$L, H$\succ$X, X$\succ$L

In each of these cases, the pricing and the choice are inconsistent. Consider the "overpricing of L" case. The price of L is, say, $2.50 which is larger than the price of H, which is $1.25. When faced with a choice between L and $2.00, however, the decision maker prefers the $2.00. It's inconsistent to say that $2.50 is the smallest amount of money you would accept instead of L and then alter accept $2.00 rather than L. This shows violation of procedural invariance – the choice and pricing response modes are giving different answers to what is essentially the same question. In the "underpricing of H" case, the decision maker set the price of H at $1.25. When later faced with a choice between H and $2.00, however, the person chose H, implying that H is better than $2.00 (and that the $1.25 price for H is thus too low). Most of the preference reversals fell in the category of "overpricing of L".

<u>Experimental Design & Methods</u>.

<u>Stimuli</u>: The stimuli were 18 "triplets." Each triplet contains an H-bet (high probability of winning a small amount) and L-bet (low probability of winning a large amount) and an X-bet (certain small amount). Each bet has a chance of winning expressed as number of chances out of 36. This can be interpreted with reference to a roulette wheel with 36 numbered sectors. If a lottery has, say, an 11/36 chance to win $16.00 that implies a 26/36 chance of winning $0.

<u>Design</u>: Each subject evaluated each lottery in two response modes: choice and pricing. The exception to this is that the X-bet (which is not really a bet, as it's a certain amount) gets evaluated only in the choice response mode.

<u>Choice response mode</u>: For each triplet each subject made 3 choices: H vs. L, H vs. X, and X vs. L. This makes for 54 total choice pairs. These 54 choice pairs were presented in random order. The left/right position of the two lotteries in each choice pair was also randomized. For each pair, the subject simply indicated the bet she would prefer to have.

<u>Pricing response mode</u>: For each H-bet and each L-bet subjects provided a selling price. Thus there were thus 36 selling price questions presented in random order. A selling price means the smallest (certain) amount the subject would accept in exchange for giving up the lottery. Prices had to be at least $0.01 in value and they had to be at least $0.01 less than the amount that could be won. That is, the price could not be equal to or greater than the winning payout. For example, if the lottery is a 11/36 chance to win $16.00 I must give a price somewhere between $0.01 and $15.99.

<u>Counterbalancing</u>: Half the subjects did the choice response mode before the pricing response mode, and the other half did them in the reverse order.

<u>Data analysis</u>.
We want the choices and prices to be arranged according to triplet – some thing like this:

Triplet	H vs. L choice	H vs. X choice	L vs. X choice	H price	L price
1	H	X	X	1.50	7.78
2	H	H	X	2.25	4.37
3	L	X	X	1.92	5.19
4	H	X	X	3.75	2.88

Reference:
Tversky, A., Slovic, P., and Kahneman, D. (1990). The causes of preference reversals. *The American Economic Review, 80*, 204-217.