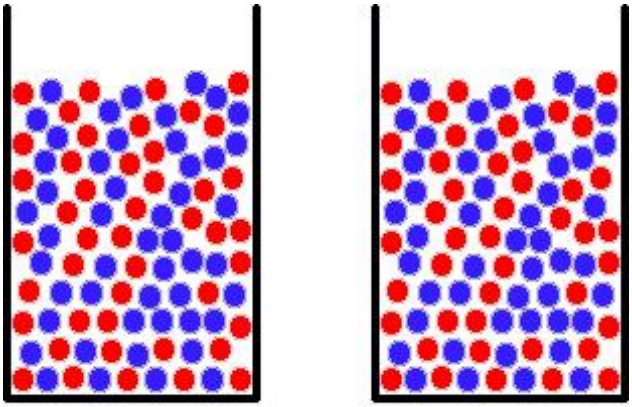
Assignment 2



Note: this image is for illustration purposes only. Critically, the colours of the marbles were not visible during the experiment

Your task is to replicate the experiment reported by Pulford & Collman (2008) showing the persistence of the ambiguity aversion effect.

The ambiguity aversion effect, first discussed by Ellsberg (1961), consists in people's tendency to prefer risky choices when the outcome is 50:50, over choices with unknown outcomes. Imagine you are standing in front of two urns, one containing 50 red and 50 blue marbles and another urn containing 100 red and blue marbles in unknown proportions. You are asked to blindly draw a marble from one of the urns and you will win a prize if that marble is red. In such scenario, most people prefer the 50:50 urn and according to utility theory (and intuition perhaps), this means that they deem (a) the chance of drawing a red marble from the ambiguous urn to be less than 0.5, and consequently (b) the chance of drawing a blue marble from the ambiguous urn to be more than 0.5.

The paradox arises when the same decision maker that chose the 50:50 urn is asked to choose an urn for the second time, this time aiming to get a blue marble. It has been shown in multiple studies that the aversion towards unknown outcomes remains, with the majority of people still picking the 50:50 urn, even though according to (b) there's a higher chance of drawing a blue marble from the ambiguous urn.

In the experiment that you are asked to replicate, the researchers investigated the extent to which the aversion to unknown outcomes is dependent on the urn size, i.e. the number of marbles in the urns. Therefore, they asked three groups of participants to make a <u>single</u> choice between the 50:50 and the ambiguous urn, while varying the number of marbles in each urn between the groups (2,10 and 100). That experiment was conducted by asking participants to physically draw marbles from actual urns and to note down their choices on paper. Your task is to transfer this experiment to a computer program, while trying to replicate the original conditions **as close as possible**.

Specification

Your program should display (at the minimum*) the following screens to each participant:

1. <u>Consent page</u>: The experiment should not continue until the participant has expressed his/her agreement - ideally through a checkbox (any reasonable text will be fine for the consent form)
2. <u>Demographics page</u> consisting at least of age, gender and education level. The program must verify that the participant has provided appropriate values for each field. Otherwise it must display error message(s) – the more precise these messages are relative to the type of error(s) the better.
3. <u>Experiment page (s)</u>: See more information below
4. <u>Debrief page</u>: A few words about the point of the experiment.

* You are free to include more pages in the experiment.

Regarding the main experiment page(s), you are free to implement it/them in any way you deem appropriate. In particular, you are free to choose things such as if/how the urns are displayed, how the participant expresses his/her choice and how the result is shown (red marble – lose, blue marble– win).

There are a few requirements however:

1. The positions of the two urns must be randomized in each trial. While the left urn must always be called "urn A" and the right one "urn B" as in the original experiment, whether it is A (left) that contains the 50:50 or the unknown distribution should be randomly decided every time the experiment runs. Of course, the instructions should also be changing to reflect this.
2. You should be adapting aspects of the experiment (e.g. the instructions) described in the paper to fit the computer-based version that you will be developing. For example, the last part of the instructions found in the paper which reads "You will draw a marble from your chosen urn straight afterwards. I prefer to draw a marble from Urn A/Urn B . . . . . ." should be altered to reflect the fact that in the computer based version, a participant chooses the urn through some software means instead of writing something on paper.

   However, any changes you make must be **minimal**, since the aim is to replicate the experiment as closely as possible. Critically, the description of the process based on which the marbles are placed in the ambiguous urn must stay the same (i.e "….The mixture of red and blue marbles has been decided by writing the numbers 0, 1, 2, . . ., 100 on separate slips of paper….").
3. Ideally, the processes that (a) compute the distribution in the ambiguous urn and (b) pick a marble from the selected urn must mirror the original experiment. For example, although, of course, you won't be writing numbers on papers, you should be deciding the number of marbles by drawing a sample from an appropriate distribution.
   Note: regarding the ambiguous urn you may (a) hand-code the distribution of red and blue marbles based on the numbers reported in the paper (2:0, 8:2, 53:47), or (b) produce a different distribution for each participant.

You must write one program (comprising of one or more files) for all 3 conditions. As described in the paper, the only difference between the conditions is the number of marbles in each urn (2, 10 or 100).

You should not assume a specific number of participants. In addition, we'd ideally want an equal number of participants in each condition. So, if there are 12 participants, there should be 4 in each condition. Note that you can't assume that the program will be running on the computer continuously until all subjects have participated. In fact, as is typical in experiments, you should anticipate that your program will be terminated after each participant and will be restarted when the next participant arrives.

Your experiment must also record each participant's results to a csv file (common for all participants):

- the demographics
- the condition in which he/she participated, i.e. the number of balls in each urn (2, 10 or 100)
- the positions of the urns i.e. 0 if the random urn was on the right – urn B as was in the paper, and 1 if the random urn was on the left – urn A (0 or 1)

- the selected urn, i.e. 0 if the participant chose the random urn and 1 if he/she chose the 50:50 urn (0 or 1)
- whether they got a red or a blue marble (red or blue)

Note: In the resulting csv, each line should correspond to one participant and the various fields will be separated by commas.

Notes:

- As always, a working program is not enough to give you top marks. The efficiency, readability and code organization of your program are equally important, as is the ability to easily extend/adapt your program. For example, adding a condition with 200 marbles should ideally require as few changes as possible.
- Extra marks will be awarded to programs that go beyond the stated requirements either in terms of functionality or in terms of presentation. In other words, you should consider how you can make your program more flexible (e.g. more conditions, within or between participants, more/variable number of urns) or more visually pleasing (e.g. animation, layouts).
- As in assignment 1, you are not allowed to use code not discussed in class, **with one exception**: you can use any class, property or method in the PyQt library, whether we discussed it or not. In fact, you're encouraged to explore the library.
- You should submit a single zip file named after your candidate code containing the python file(s), the ui file(s) and any other resources (e.g. images) required.

Tips:

- Before you start writing code, make sure you plan your program carefully, e.g. think about the steps you're going to take, the requirements in each step etc. The more time you spend planning, the easier it will be to code the experiment, and the better the quality of the code.
- Start simple and expand: First write the simplest version of the experiment possible and then try to implement the more complicated bits
- Make sure that you test your final program exhaustively. If you were to actually run the experiment, a small mistake could result in a great loss in time and possibly money.

References

Ellsberg, D. (1961). Risk, ambiguity, and the Savage axioms. The quarterly journal of economics, 643-669.

Pulford, B. D., & Colman, A. M. (2008). Size doesn't really matter: Ambiguity aversion in Ellsberg urns with few balls. Experimental Psychology, 55(1), 31-37.