Utilizing Javascript in Qualtrics for Survey Experimental Designs

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1 Introduction

Experiments have undeniably increased in their use within political science in the last twenty years (Druckman et al., 2006). Especially frequent in this rise of experimental research is the survey experiment. Survey experiments are an effective method for exploiting random assignment to determine accurate causal effects while keeping the costs of research low and the speed with which data can be collected short (Mullinix et al., 2015). Moreover, survey experiments are a research methodology that can be accessible and open to many: students and faculty with varying degrees of resources can often use convenience samples to assess experimental treatment effects without great cost.

Yet while survey experiments, and in particular the use of convenience samples such as Amazon.com's Mechanical Turk (MTurk), can make causal inference cheap and fast, sometimes the hurdles associated with designing and implementing the actual experiment can stymie researchers. Accomplishing basic randomization is not always easy within standard survey software platforms, and less basic randomization can be even more difficult (or impossible). In particular, complex randomization, such as assigning multiple options from a larger set of options — n choose p — and block randomization are not easy to implement using off-the-shelf survey software.

Moreover, standard survey practices such as presenting different information to respondents based on their answers earlier in a survey using a "lookup table" can be difficult to implement. Yet practices such as blocked randomization are standard in experimental research more broadly and can help researchers to improve statistical efficiency (e.g., Horiuchi, Imai, and Taniguchi, 2007; Imai, King, and Stuart, 2008; Moore, 2012). Ensuring access for all types of researchers conducting survey experiments to these experimental practices is therefore important for political science as a discipline more generally to produce better experimental results.

In this short post, I walk through several examples of how survey researchers can use Javascript to accomplish commonly needed survey tasks without advanced knowledge of the Javascript language. Much of this more complex functionality can be accomplished via Javascript embedded into the survey questions in Qualtrics, a common survey software platform.[1]

The first of these is simply randomization: picking one option out of many options, which can be time-consuming and difficult to implement using the built-in Qualtrics randomization functionality when the potential options are very numerous. This method can be extended to accomplish n choose p randomization – that is, choosing a set number of options from a larger set of many options — which is not possible via built-in Qualtrics randomization features. Third, I show how to accomplish block randomization among blocks created by respondent-entered characteristics. Finally, I demonstrate a technique useful for survey researchers in both experimental and non-experimental settings: using a lookup table to present certain information based on a unique identifier, respondents' panel characteristics, or respondents' answers.

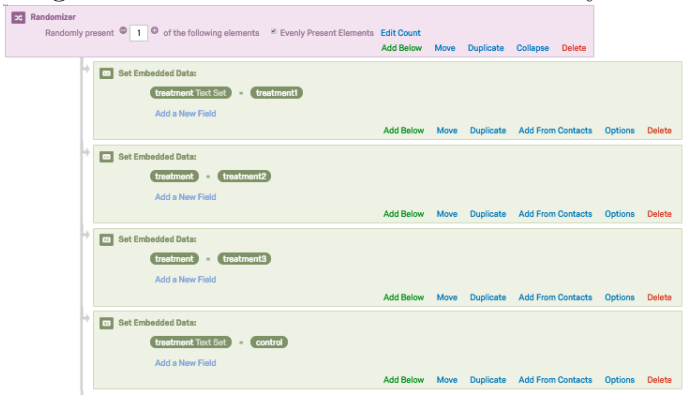
[1]The Qualtrics platform is an industry-standard for running online public opinion, marketing, and experimental survey research. Researchers — in academia and elsewhere — rely on the platform to host their surveys usually because they are at institutions or companies that have site licenses, eliminating the cost for individual researchers to use the platform. The platform makes question layout and basic experimental designs easy to implement via a WYSIWYG user interface.

2 Applications of Javascript in Qualtrics

2.1 Randomization by picking one option from many options

Basic randomization can easily be accomplished in Qualtrics via the "Survey Flow" tool of any survey project, which has a built-in "Randomizer" element that allows the researcher to assign p number of n choices to the respondent. Using embedded data elements, the researcher can then assign a respondent to one of n treatment groups randomly. If the research would like complete randomization (e.g. in cases of smaller sample sizes), they should check the "evenly present elements" option (Figure1).

Figure 1: Basic Randomization via Survey Flow



This is a simple and easily-implemented solution for the researcher, yet it becomes much more difficult as the number of experimental treatments (n) increases. For instance, a researcher might want to present many different campaign ads to respondents, or vary a treatment along multiple dimensions. In this world of larger n treatments options, using the built-in survey flow randomizer to add options becomes tedious and prone to human error. In contrast, this sample functionality can be easily accomplished by embedding Javascript in the question text of the survey prior to when the experimental treatments are to appear. Simply put, this allows the user to paste a longer list of n treatment options into a Javascript array which is then randomly shuffled, and then one p option chosen and assigned as the treatment

condition.[2] The Javascript code for this simple randomization is below, and is also available publicly on GitHub: "Randomize_QT_pickone.js."

```
Qualtrics.SurveyEngine.addOnload(function(){
    function shuffle(array){
        var counter = array.length,
            temp, index;
        while (counter > 0){
            index = Math.floor(Math.random() * counter);
            counter = counter-1;
            temp = array[counter];
            array[counter] = array[index];
            array[index] = temp;
        }
        return array;
    }
    var myArray=["treatment1", "treatment2", "treatment3",
        "treatment4", "treatment5", "treatment6", "treatment7",
        "treatment8", "treatment9", "treatment10", "treatment11",
        "treatment12", "treatment13", "treatment14", "control"];
    shuffle(myArray);
    Qualtrics.SurveyEngine.setEmbeddedData("treatment",myArray[0]);
});
```

2.2 Randomization by picking more than one option from many options

Sometimes, a researcher might wish to randomize each respondent into more than one condition — for instance, when having respondents view multiple articles to ascertain the effects of media on political preferences. In this case, the researcher

[2]To accomplish randomization this method uses what is called a Fisher-Yates shuffle.

would want to use an n choose p technique to assign possible options to a respondent. The Javascript used in the first example above can be easily adapted to serve this purpose. In this instance, I use the hypothetical example of a researcher wishing to assign a respondent five media articles from a list of fifteen. The Javascript code for this is below, and is also available on GitHub: "Randomize_QT_pickmany.js."

```
Qualtrics.SurveyEngine.addOnload(function(){
    function shuffle(array){
        var counter = array.length,
            temp, index;
        while (counter > 0){
            index = Math.floor(Math.random() * counter);
            counter = counter-1;
            temp = array[counter];
            array[counter] = array[index];
            array[index] = temp;
        }
        return array;
    }
    var myArray=["treatment1", "treatment2", "treatment3",
        "treatment4", "treatment5", "treatment6", "treatment7",
        "treatment8", "treatment9", "treatment10", "treatment11",
        "treatment12", "treatment13", "treatment14", "treatment15"];
    shuffle(myArray);
    Qualtrics.SurveyEngine.setEmbeddedData("first_article",myArray[0]);
    Qualtrics.SurveyEngine.setEmbeddedData("second_article",myArray[1]);
    Qualtrics.SurveyEngine.setEmbeddedData("third_article",myArray[2]);
    Qualtrics.SurveyEngine.setEmbeddedData("fourth_article",myArray[3]);
    Qualtrics.SurveyEngine.setEmbeddedData("fifth_article",myArray[4]);
});
```

2.3 Block Randomization

This Javascript can also be adapted and combined with the Qualtrics Web Service feature to accomplish block randomization, a useful practice for increasing statistical efficiency in experiments. For instance, a researcher might want to block-randomize a treatment condition within different categories of respondents — usually a characteristic that the researcher believes will induce variation in the outcome. To block-randomize within a respondent characteristic, the researcher simply needs to create a question measuring that characteristic, and then randomize within values of that characteristic. For a limited number of characteristics or a small number of experimental conditions, this is easily accomplished with built-in branching based on respondent characteristics and completely randomizing within branches.

However, for a large number of options or background characteristics, adding these elements to survey flow becomes tedious. Using the Qualtrics "Web Service" feature, however, then pull that respondent-entered value into the Javascript, and assign treatments within different categories, balancing assignment across conditions. In this case, I wanted to block randomize the treatment used in the first example here by respondents' eye color, which I asked about on my Qualtrics survey (Q56). Javascript code that can be adapted for this purposed is below, and is also available on GitHub: "Randomize_QT_byblock.js."

```
Qualtrics.SurveyEngine.addOnload(function(){
    var eyecolor = "${q://QID56/ChoiceGroup/SelectedChoices}";

    // replace these values with your unique name + name for survey:
    var myname = "justindbk";
    var mysurvey = "sample_block_randomize";

    var myArray=["treatment1", "treatment2", "treatment3",
        "treatment4", "treatment5", "treatment6", "treatment7",
        "treatment8", "treatment9", "treatment10", "treatment11",
        "treatment12", "treatment13", "treatment14", "treatment15"];
```

```
    /* Next, send request to a hit-counter based on your individual survey
    and the blocking characteristic (here, eye color) */

    let xmlHttp = new XMLHttpRequest();
    xmlHttp.open('GET', 'https://hitcounter.pythonanywhere.com/count?url='+
        myname + '_' + mysurvey + '_' + 'eyes=' + eyecolor, false);

    xmlHttp.send(null);

    // get count of participants w/ value of blocking characteristic:
    count = xmlHttp.responseText;

    /* Next, get treatment condition by counting up within vector of
    potential conditions by the number of previous respondents in
    that blocking category */

    var thisindex = count - +Math.floor(count/myArray.length)*myArray.length ;

    Qualtrics.SurveyEngine.setEmbeddedData("treatment",myArray[thisindex]);
});
```

2.4 Lookup tables

Finally, researchers sometimes wish to look up information about respondents based on previous panel information (for instance, information that corresponds to an ID number). Or perhaps a researcher wanted to present certain information to respondents based on their location and saved information about their representatives in that location. Doing so would require the use of a lookup table — that is, a table with information that can be queried with a key. Doing this is common in data analysis but is a less common (though still useful) practice in survey research. It

can, however, be easily implemented in Qualtrics using a custom Javascript function and a user-inputted set of vectors corresponding to the matched information. Sample code that accomplishes this is below and also on GitHub: "Lookup_QT.js."

```
Qualtrics.SurveyEngine.addOnload(function()
{
var ID_block_table = {
  ID: ['1', '2', '3', '4', '5'],
  block: ['a', 'b', 'c', 'd', 'e']
};

function getLookupTableByID(mytable, IDfield, ID, returnfield) {
  matchindex = null;
  try {
    var matchindex = mytable[IDfield].indexOf(ID);
var matchreturn = mytable[returnfield][matchindex];
  } catch (ex) {
    console.log(ex);
  }
  return matchreturn;
}

var MID = Qualtrics.SurveyEngine.getEmbeddedData("MID");

var blockmatch = getLookupTableByID(ID_block_table, "ID", MID, "block");
Qualtrics.SurveyEngine.setEmbeddedData('block',blockmatch);
});
```

References

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Imai, Kosuke, Gary King, and Elizabeth A Stuart. 2008. "Misunderstandings Between Experimentalists and Observationalists about Causal Inference." *Journal of the Royal Statistical Society: Series A* 171(2): 481–502.

Moore, Ryan T. 2012. "Multivariate Continuous Blocking to Improve Political Science Experiments." *Political Analysis* 20(4): 460–479.

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