DESIGN OF FACTORIAL SURVEY EXPERIMENTS IN STATA

Maurizio Pisati and Livia Ridolfi
maurizio.pisati@unimib.it
l.ridolfi@campus.unimib.it

Department of Sociology and Social Research
University of Milano-Bicocca (Italy)

2015 Italian Stata Users Group meeting
Firenze, November 12-13, 2015
1. Factorial survey experiments

2. fsdesign

3. Example

4. Conclusions

5. References
FACTORIAL SURVEY EXPERIMENTS
Factorial survey experiments (FSEs) are multifactorial experiments conducted within sample surveys of individuals based on manipulated descriptions of some objects of interest (people, institutions, policies, goods, services, events, …). The basic purpose of a FSE is to investigate the judgment principles that underlie respondents’ values, attitudes or preferences toward the objects of study (Auspurg and Hinz 2014; Jasso 2006; Rossi and Nock 1982). FSEs belong in the family of methods for stated preference analysis and, therefore, are closely related to such techniques as conjoint analysis, discrete choice experiments and best-worst scaling (Aizaki et al. 2015; Louviere et al. 2000).
• In a FSE, sample respondents are asked to carry out a task or sequence of tasks
• Within each task, every respondent is presented with a set of objects, each described by a given profile – i.e., by a given combination of levels of a predefined set of attributes (factors)
• Respondents are then asked to choose among, rank or rate the objects in the set
• By varying the profiles of the objects presented to respondents according to a given experimental design, it is possible to estimate the impact of each attribute and its levels on respondents’ preferences
In a study considering $d$ attributes $A_j$ ($j = 1, \ldots, d$), each taking $k_j$ levels, the size of the profile population is:

$$N_p = \prod_{j=1}^{d} k_j$$

When the size of the profile population is smaller than the planned number of respondents $n$ – i.e., $N_p < n$ – a full factorial design can be used.

Often, however, $N_p \gg n$, so that one is forced to use a fractional factorial design, i.e., a subset of the full factorial design.
fsdesign
• **fsdesign** is a novel user-written Stata command for designing both full and fractional FSEs

• The user is first required to specify each attribute’s name and levels, and optionally its label and randomization weights

• Four additional options are required:
  • the number of tasks per respondent
  • the number of profiles per task
  • the number of unique blocks in the design (a block is the whole set of profiles evaluated by a respondent)
  • the number of respondents (must be a multiple of the number of unique blocks)
Optionally, the user can request that:

- profile duplicates be avoided (within task, block, or design)
- profile restrictions be imposed (typically, to avoid illogical profiles)
- the generated design be saved to a Stata dataset

For fractional designs, profiles are selected using simple random selection (alternative selection methods might be added in future versions).

Although it is not guaranteed to always generate a “good” fractional design (Mee and Dean 2015), simple random selection is fast, easy to implement, and works well when the number of selected profiles is sufficiently large.
fsdesign attribute_definition [|| attribute_definition] [|| attribute_definition ...], tasks(#) profiles(#) blocks(#) respondents(#) [nodups(string) restrictions(string) saving(filename [, replace])]

where the syntax for attribute_definition is

name(newvarname) levels(string) [label(string) rweights(string)]
EXAMPLE
Between January and June 2015, we conducted an exploratory FSE aimed at analyzing Italian young women’s mating preferences. The study population was defined as Italian heterosexual women, aged 23-25, unmarried, living, working or studying in Milano (Italy), with a high-school diploma or a university degree. The study sample (n = 100) was a quota sample selected using random criteria.
The objects of evaluation were written descriptions of potential male partners, each defined by a combination of 11 three-level traits. Given the small sample size, the $3^{11}$ full factorial design was clearly impracticable ($N_p = 177, 147$). Thus we opted for a fractional design where each respondent was asked to evaluate a unique set of 12 profiles, so that altogether we tested a fraction of $100 \times 12 = 1,200$ profiles. The evaluation task consisted in first ranking and then rating – on a $[0, 10]$ scale – the 12 profiles (ties allowed).
A STUDY OF WOMEN’S MATING PREFERENCES

Stata code for generating the experimental design

```stata
set seed 432183764

fsdesign 
    name(age)
    levels("25" "30" "35")
    label("Age")
    ||
    name(origin)
    levels("Lower class" "Middle class" "Upper class")
    label("Origin class")
    ||
    name(educ)
    levels("Middle school" "High school" "University degree")
    label("Level of education")
    ||
    [...]
    ,
    tasks(1) profiles(12) blocks(100) respondents(100)
    nodups(wd) saving("Design.dta", replace)
```
A STUDY OF WOMEN’S MATING PREFERENCES

First 24 rows and selected columns of the **Design.dta** dataset

<table>
<thead>
<tr>
<th>fs_rid</th>
<th>fs_bid</th>
<th>fs_tid</th>
<th>fs_pid</th>
<th>age</th>
<th>origin</th>
<th>educ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>30</td>
<td>Middle class</td>
<td>University degree</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>30</td>
<td>Middle class</td>
<td>University degree</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>30</td>
<td>Lower class</td>
<td>Middle school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>25</td>
<td>Middle class</td>
<td>Middle school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>30</td>
<td>Upper class</td>
<td>High school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>35</td>
<td>Lower class</td>
<td>High school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>35</td>
<td>Upper class</td>
<td>High school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>35</td>
<td>Lower class</td>
<td>University degree</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>35</td>
<td>Middle class</td>
<td>High school</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>30</td>
<td>Middle class</td>
<td>University degree</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>30</td>
<td>Lower class</td>
<td>University degree</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>25</td>
<td>Lower class</td>
<td>University degree</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>25</td>
<td>Upper class</td>
<td>University degree</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>35</td>
<td>Upper class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>35</td>
<td>Middle class</td>
<td>University degree</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>25</td>
<td>Upper class</td>
<td>Middle school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>25</td>
<td>Middle class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>25</td>
<td>Middle class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>25</td>
<td>Middle class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>25</td>
<td>Upper class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td>35</td>
<td>Middle class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>10</td>
<td>25</td>
<td>Lower class</td>
<td>University degree</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>25</td>
<td>Upper class</td>
<td>High school</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>25</td>
<td>Lower class</td>
<td>Middle school</td>
</tr>
</tbody>
</table>
After generating the experimental design, we wrote a Stata do-file for composing – via \LaTeX – the verbal descriptions of the 1,200 profiles.

The do-file takes the Design.dta dataset generated by fsdesign as input and outputs a PDF file containing the verbal descriptions of the 1,200 profiles, ready to be printed and submitted to respondents.

Profile descriptions were composed using between-respondent randomization of trait presentation order, so as to minimize carry-over and primacy effects (Auspurg and Hinz 2014).
P.F. è circa 5 cm più basso di te e, secondo la maggior parte delle tue amiche, ha un aspetto fisico molto attraente. Tende a essere dominante con le altre persone, ma non lo è con la propria compagna; inoltre è ugualmente premuroso e leale con la propria compagna e con le altre persone. Per quanto riguarda la sua vita sentimentale, finora si è difficilmente lasciato coinvolgere in relazioni di qualsiasi tipo. Le sue credenze religiose sono molto simili alle tue, mentre la sua posizione politica è un po’ diversa dalla tua. È laureato e, attualmente, svolge un lavoro di basso livello socioeconomico. È nato nel 1985 da una famiglia di classe media.
CONCLUSIONS
• **fsdesign** is still at alpha stage:
  • option `restrictions(string)` has yet to be implemented
  • further options might be added
  • the help file has to be written
  • more testing needs to be done

• We are also working on a companion command (**fsdiag**) aimed at carrying out several kinds of diagnostics on the designs generated by **fsdesign**

• A longer-term project would be to extend **fsdesign**’s capabilities by adding alternative methods for generating fractional designs


