`qfactor`: A new Stata program for Q-methodology analysis

Noori Akhtar-Danesh, PhD
Associate Prof. of Biostatistics
McMaster University
Hamilton, Canada
E-mail: daneshn@mcmaster.ca

Q-methodology (QM): *History*

- QM was introduced by William Stephenson in a letter to *Nature* in 1935
- He defined it as the “objective study of subjectivity” or a person's point of view on any matter of personal or social importance (McKeown and Thomas, 1988)

QM: *Goals*

- To identify different patterns of thought (not their numerical distribution among the larger population)
- In Q-methodology the research emphasis is on the qualitative *how* and *why* people think the way they do, not *how many* people think in a certain way

Four steps in QM

- A Q-study involves four steps:
  1. Developing the concourse
  2. Identifying a sample of representative statements from the concourse (Q-sample) and Q-sort table
  3. Q-sorting activities (Data collection)
  4. Analysis and interpretation

QM: Concourse

- In a Q-study first all possible *statements* on ideas, feelings, and concerns about the topic of interest are collected
- This collection of *statements* is called ***Concourse***
- A concourse can be collected from
  - Interviews, focus groups
  - Commentaries from newspapers
  - Literature review
  - ??????

Example: Marijuana Legalization

Objective: To explore the salient viewpoints of the participants on ML in several workshops

Example: Marijuana Legalization

- Marijuana with Latin name of *Cannabis sativa* is known to most people as grass, pot, or weed, mainly when referring to its recreational use
- It is believed that cannabis could have great potential for the development of new drugs
- The Chinese documented its medicinal value more than 4000 years ago as sedative, painkiller, and treatment for fever, nausea, and ulcers

Example: Marijuana Legalization

- On the other hand, cannabis smoke can
  - induce unpleasant effects such as panic, paranoia, and hallucinations
  - increase heart rate and lower blood pressure
  - lead to amotivational syndrome
  - adversely affects short-term memory and cognitive abilities in long-term users
- **Its growth, possession and consumption have been outlawed in most countries because of its negative aspects, mainly the risk of addiction**

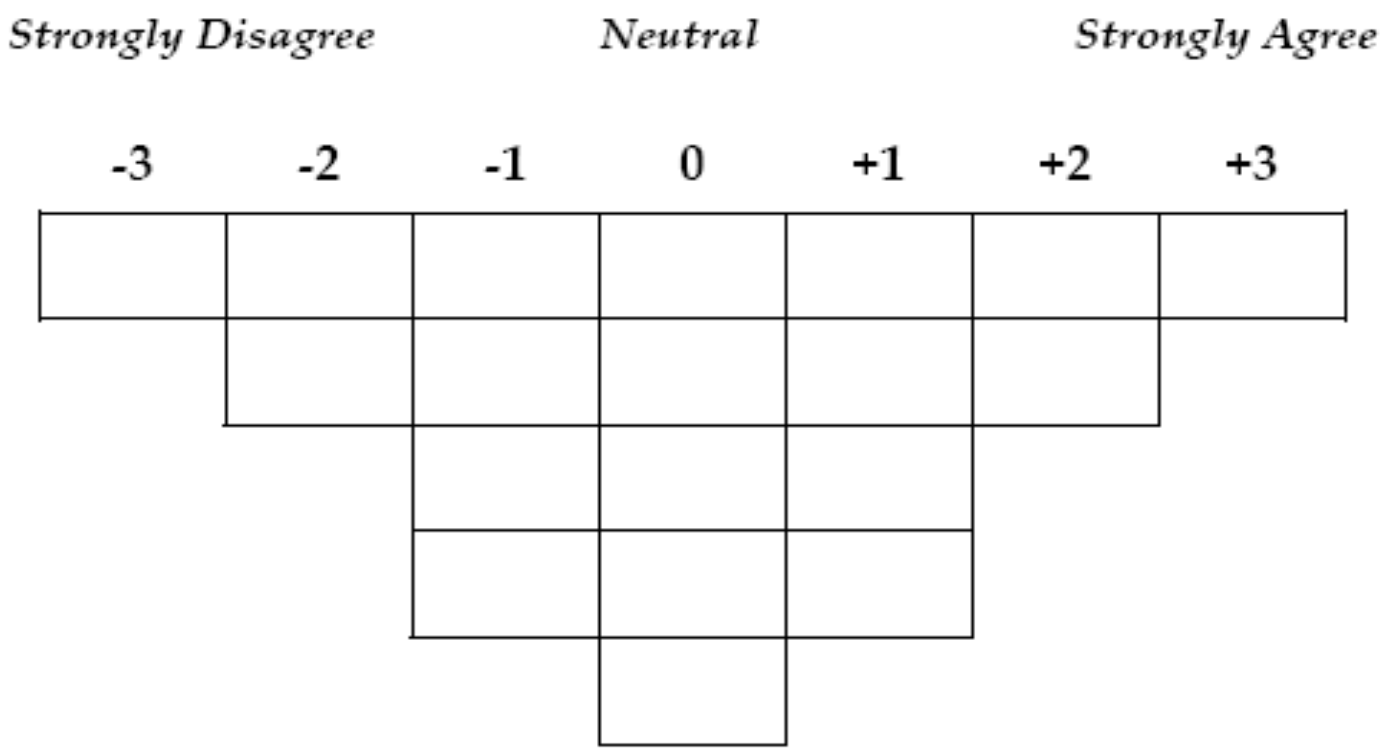
Example: Concourse

- WWW. was searched to find statements about the ML, specifically, to get a sense of supportive and opposing views
- Found > 50 statements
- Statements were reviewed for similarities and differences and repeats were discarded
- The actual language of the statements was used; only edited for grammar

Example: Q-Sample

- 19 representative statements were selected
- The statements were numbered randomly
- Each statement was typed on a piece of paper
- **Data collection instrument:** a quasi-normal distribution table with 19 cells (equal to the # statements) was developed
- Four volunteers were asked to pilot test the statements and Q-sort instruction

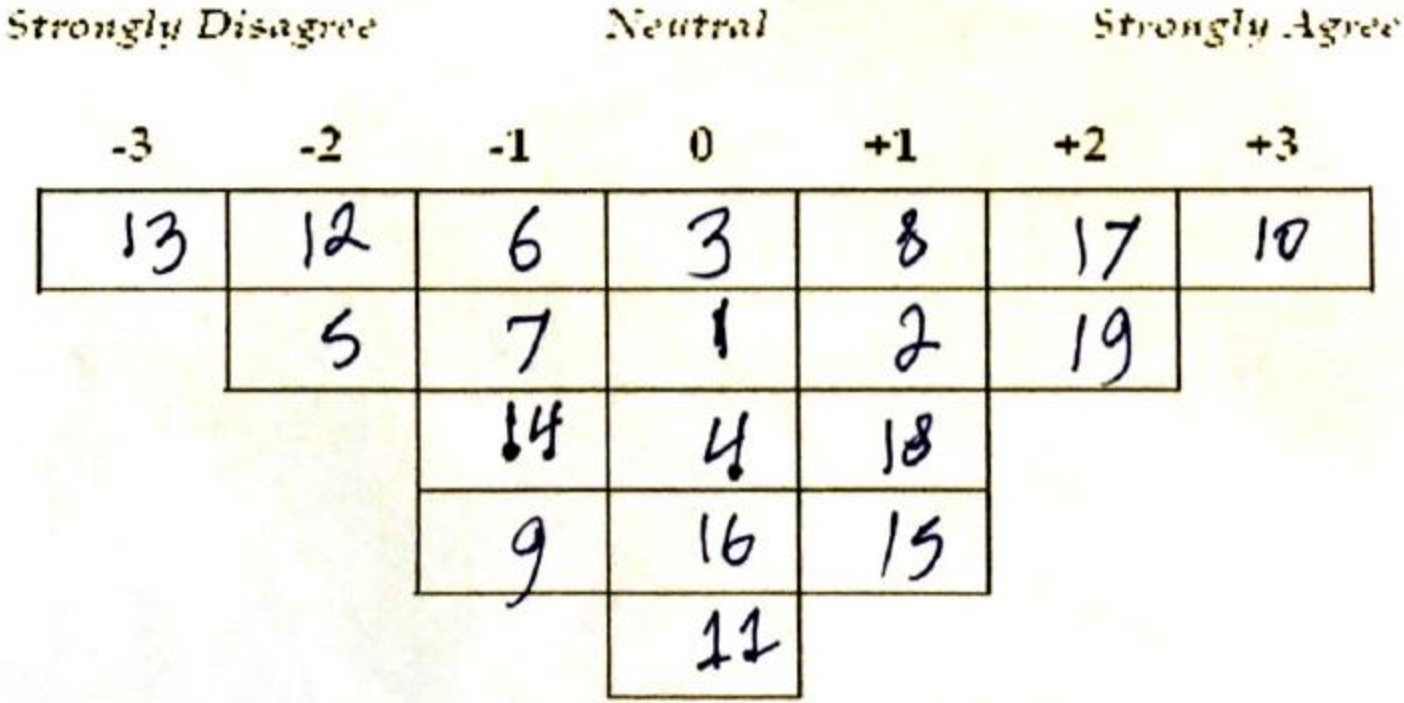
Example: Q-Sort Table



Data collection and data organizaiton

- 40 individuals who participated in different Q-methodology workshops sorted the statements
- The raw data were entered into Stata and **`qconvert`** was used to convert raw data to usable data by **`qfactor`**

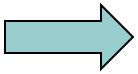
A Completed Q-Sort



qconvert

```
qconvert qsort*, save(mldataset)
```

ranking	qsort1	qsort2	qsort3
-3	2	17	13
-2	6	11	12
-2	13	7	5
-1	1	1	6
-1	7	3	7
-1	8	9	14
-1	11	6	9
0	5	5	3
0	9	2	1
0	10	12	4
0	12	16	16
0	16	19	11
1	3	4	8
1	4	10	2
1	19	8	18
1	17	15	15
2	15	13	17
2	14	18	19
3	18	14	10



v1	v2	v3	statement
-1	-1	0	1- The harms associated with marijuana are less than those a
-3	0	1	2- By legalizing marijuana, doctors may become part of the b
1	-1	0	3- The reason that marijuana poses a health threat is becaus
1	1	0	4- Taxpayers are forced to pay billions of dollars to persec
0	0	-2	5- Marijuana does not cause violence. In fact, people who ar
-2	-1	-1	6- Marijuana legalization insures that people who use the dr
-1	-2	-1	7- Certain people are able to function only with the aid of
-1	1	1	8- Education and regulation are better options than prohibit
0	-1	-1	9- Prohibition is not an effective solution to the problems
0	1	3	10- If we legalize marijuana, we reduce the black market and
-1	-2	0	11- It should become legal for those over the age of eightee
0	0	-2	12- The use of marijuana as a pain control may cause patient
-2	2	-3	13- Marijuana legalization would decrease the likelihood of
2	3	-1	14- By legalizing marijuana, more people will use the drug a
2	1	1	15- By legalizing marijuana, there will be an increase in pe
0	0	0	16- A decrease in the use of marijuana means fewer health ri
1	-3	2	17- Individuals should be allowed to choose whether or not t
3	2	1	18- There is an abundance of anecdotal evidence, as well as
1	0	2	19- If marijuana were legal, steps could be taken to reduce

qfactor syntax

```
qfactor varlist [if] [in] , nfactor(#) [extraction(string) rotation(string)
        transpose(string) statement(string) score(string) es(#) bpolar(#)]
```

options	description
nfactor(#)	maximum number of factors to be retained
extraction(string)	factor extraction method
rotation(string)	factor rotation technique
transpose(string)	whether the data file needs to be transposed
score(string)	identifies factor scores calculation
es(#)	effect size for distinguishing statements
bpolar(#)	identifies the condition for bipolar factors

qfactor: Results

```
. qfactor v*, nfa(3) ext(pcf)

(obs=19)

Factor analysis/correlation                       Number of obs    =         19
    Method: principal-component factors           Retained factors =          3
    Rotation: (unrotated)                         Number of params =        117
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	11.56791	6.49234	0.2892	0.2892
Factor2	5.07557	1.25760	0.1269	0.4161
Factor3	3.81797	0.88536	0.0954	0.5115
Factor4	2.93261	0.52130	0.0733	0.5849
Factor5	2.41131	0.16379	0.0603	0.6451

qfactor: Results

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
qsort1	0.1171	0.6815	-0.1457	0.5006
qsort2	-0.3118	0.5518	-0.2957	0.5109
qsort3	0.4629	0.1219	-0.5333	0.4864
qsort4	0.7004	-0.3046	-0.1696	0.3879
qsort5	0.0180	-0.3651	0.5009	0.6154
qsort6	0.7687	-0.0328	0.0710	0.4030

qfactor: Results

```
*************************************************************************
************** ROTATION TECHNIQUE = varimax **************
*************************************************************************

Factor analysis/correlation                       Number of obs    =         19
    Method: principal-component factors           Retained factors =          3
    Rotation: orthogonal varimax (Kaiser on)      Number of params =        117

    ---------------------------------------------------------------------------
        Factor  |     Variance   Difference        Proportion   Cumulative
    ------------+--------------------------------------------------------------
       Factor1  |      7.85571      1.22530            0.1964       0.1964
       Factor2  |      6.63042      0.65510            0.1658       0.3622
       Factor3  |      5.97532            .            0.1494       0.5115
    ---------------------------------------------------------------------------
```

qfactor: Results

* DIFFERENCES BETWEEN FACTOR SCORES FOR EACH STATEMENT WAS ASSESSED USING STEPHENSON'S FORMULA *

********** z_scores and ranks for all Statments **********

StatNo	zscore1	F_1	zscore2	F_2	zscore3	F_3
1	-.149	0	.819	1	-.183	0
2	-.402	-1	-1.22	-2	-1.86	-3
3	-1.27	-2	.696	1	.813	1
4	.805	1	-.15	0	-.756	-1
5	-.988	-1	.43	0	-.827	-2
6	6.1e-03	0	1.37	2	1.63	2
7	.093	0	-.278	-1	-.728	-1
8	1.34	3	.733	1	.491	1
9	.905	1	.566	1	.732	1
10	1.28	2	-.087	0	-.309	0
11	.212	0	1.35	2	-.546	-1
12	-1.66	-3	-1.4	-2	-1.64	-2
13	-1.47	-2	-.209	0	-.613	-1
14	-1.24	-1	-2.17	-3	.356	1
15	-.483	-1	-1.19	-1	.334	0
16	-.176	0	-.323	-1	.821	2
17	.744	1	1.44	3	.116	0
18	1.27	2	-.472	-1	2.06	3
19	1.18	1	.1	0	.117	0

qfactor: Results

********* Distinguishing Statements for Factor 1 **********

Number of Q-sorts loaded on Factor 1= 13

StatNo	statement	F_1	F_2	F_3
8	Education and regulation are better options than prohibit	3	1	1
10	If we legalize marijuana, we reduce the black market and	2	0	0
18	There is an abundance of anecdotal evidence, as well as	2	-1	3
17	Individuals should be allowed to choose whether or not t	1	3	0
19	If marijuana were legal, steps could be taken to reduce	1	0	0
4	Taxpayers are forced to pay billions of dollars to persec	1	0	-1
6	Marijuana legalization ensures that people who use the dr	0	2	2
11	It should become legal for those over the age of eightee	0	2	-1
14	By legalizing marijuana, more people will use the drug a	-1	-3	1
15	By legalizing marijuana, there will be an increase in pe	-1	-1	0
2	By legalizing marijuana, doctors may become part of the b	-1	-2	-3
13	Marijuana legalization would decrease the likelihood of	-2	0	-1
3	The reason that marijuana poses a health threat is becaus	-2	1	1

qfactor: Results

********** Consensus Statements **********

StatNo	statement	F_1	F_2	F_3
9	Prohibition is not an effective solution to the problems	1	1	1
12	The use of marijuana as a pain control may cause patient	-3	-2	-2

Saved files

- **FactorLoadings**: this file includes Qsort number, unrotated factor loadings, uniqueness of each Qsort, communality of the extracted factors, Factor (to indicate which Q-sort was loaded on what factor)

Saved files

- **FactorScores**: this file includes StatNo (statement number), statement, zscore (composite zscores of statements for each factor), and rank (composite ranking of statements for each factor)
- Besides, all stored results for **`factor`** command will be stored for **`qfactor`** too.

Conclusions

- There are only a few programs for Q-methodology
- **`qfactor`** is the first program written in Stata
- By far, **`qfactor`** is the most capable program in Q-methodology

References

- McKeown, B. & Thomas, D. (1988). *Q Methodology*. Newbury Park, CA: Sage Publications.
- Stephenson, W. (1935a). Correlating persons instead of tests. *Character and Personality, 4,* 17-24.
- Stephenson, W. (1935b). Technique of factor analysis. *Nature, 136,* 297.