Tutorial on using the MATLAB SVO_Slider function

An addition to the paper
"Measuring Social Value Orientation"

by

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Contents

1   General information

- The function *SVO_Slider.m* evaluates data gained by using the SVO Slider Measure (Murphy et al., 2011).

- In order to use the function, the program *Matlab* has to be installed on your computer and basic knowledge about Matlab is required.

- In order to check for transitivity and produce rank orders of preferences, the *Bioinformatics Toolbox* has to be installed. If this toolbox is not installed, the function works as well, but will not check for transitivity and will not produce rank orders of preferences (see section 3.1.4).

2   Input arguments

The function *SVO_Slider.m* accepts several input argument constellations:

2.1   Data only

This input format is appropriate if raw data was gained by the Online Slider Measure or if only **version A** of the paper based Slider Measure was used.

For example:

- output = SVO_Slider(Data), or

- [output, ips] = SVO_Slider(Data)

IMPORTANT: If only data is used as input argument, the function evaluates the data according to the item order of **version A** of the paper based version of the Slider Measure (see paper based versions of the Slider Measure)

The function accepts several forms of the variable *Data*:

2.1.1   Option variant

Data in option variant contains the number of the option (1-9) that was chosen in a respective item (columns) by the subjects (rows). For example, if the first subject chose the third option in item 1 (according to **version A**), which is (85,68), the entry in the first row (subject 1) and first column (Item 1) would be 3 (3rd option).

Examples of input variable *Data* in option variant[1]:

Figure 1: All items: In this example, Slider Measure data (primary and secondary items) of 5 subjects in option variant is shown.

```
Data = [
    1    9    9    1    1    9    9    9    1    9    9    9    9    1    1
    9    5    4    9    9    1    2    3    5    8    5    7    4    5    6
    1    9    9    9    1    1    6    5    4    7    5    8    5    3    2
    1    1    9    9    9    1    1    1    9    9    9    9    1    9    9
    1    1    9    9    1    9    9    1    9    9    9    1    1    9    1
];
```

Figure 2: Primary items: In this example, Slider Measure data (primary items) of 5 subjects in option variant is shown.

```
Data = [
    1    9    9    1    1    9
    9    5    4    9    9    1
    1    9    9    9    1    1
    1    1    9    9    9    1
    1    1    9    9    1    9
];
```

Figure 3: Secondary items: In this example, Slider Measure data (secondary items) of 5 subjects in option variant is shown.

```
Data = [
    9    9    1    9    9    9    9    1    1
    2    3    5    8    5    7    4    5    6
    6    5    4    7    5    8    5    3    2
    1    1    9    9    9    9    1    9    9
    9    1    9    9    9    1    1    9    1
];
```

---

[1]In these examples, data of both versions A and B of the paper based Slider Measure are shown. If input is data only, then the item order of the input variable has to be conform with the item order of **version A** of the paper based Slider Measure. The examples here should only give an impression of the general form of the input variable *Data*.

2.1.2 Fine-grained option variant

If desired, decimals are allowed in option variant for the case were subjects made fine-grained choices, i.e. marking intermediate positions between options. For example, if a subject marked a position right between option 1 (85,85) and option 2 (85,76) in item 1 (according to **version A**), the entry would be 1.5.

Example of input variable *Data* in fine-grained option variant:

Figure 4: Primary items: In this example, Slider Measure data (primary items) of 5 subjects in fine-grained option variant is shown.

```
Data = [
    1.4     8.1     7.6     1.5     1.7     8.3
    8.5     5       4       7.2     8.1     2.5
    2       8.9     9       9       1.5     1
    1.2     1.8     9       9       9       1
    1       1       9       9       1       9
];
```

2.1.3 Full payoff variant

Data in full payoff variant contains the payoffs a subject allocated to the self and to the other in one row per subject. For example, if the first subject chose the third option in item 1 (according to **version A**), which is (85,68), the entry in the first row (subject 1) would be 85 in the first column and 68 in the second column, and so forth.

Examples of input variable *Data* in full payoff variant[2]:

Figure 5: All items: In this example, Slider Measure data (primary and secondary items) of 5 subjects in full payoff variant is shown.

```
Data = [
85   85 100 50 85 85 50 100 100 50 85   85 70 100 100 90 100 70 90 100 100 70 100 90 100 50 100 90 90 100
85   85 75   75 63 68 85 85   100 50 85   85 91 94   93   93 75   75 94 91   85   85 93   93 81   81 95   95 81 81
85   85 100 50 85 85 85 15   100 50 100 50 81 81   95   95 81   81 93 93   85   85 94   91 75   75 93   93 91 94
100 50 100 50 85 15 85 85   100 50 85 85 90 100 100 90 100 50 100 90 100 70 90 100 100 70 100 90 70 100
100 50 100 50 85 15 85 85   85   15 85 15 100 50 100 90 100 50 100 90 100 70 100 70 100 70 100 90 100 50
]
```

Figure 6: Primary items: In this example, Slider Measure data (primary items) of 5 subjects in full payoff variant is shown.

```
Data = [
85   85 100 50 85 85 50 100 100 50 85   85
85   85 75   75 63 68 85 85   100 50 85   85
85   85 100 50 85 85 85 15   100 50 100 50
100 50 100 50 85 15 85 85   100 50 85   85
100 50 100 50 85 15 85 85   85   15 85   15
]
```

[2]In these examples, data of both versions A and B of the paper based Slider Measure are shown. If input is data only, then the item order of the input variable has to be conform with the item order of **version A** of the paper based Slider Measure. The examples here should only give an impression of the general form of the input variable *Data*.

Figure 7: Secondary items: In this example, Slider Measure data (secondary items) of 5 subjects in full payoff variant is shown.

```
Data = [
70 100 100 90 100 70 90 100 100 70 100 90 100 50 100 90 90 100
91 94  93  93 75  75 94 91  85  85 93  93 81  81 95  95 81 81
81 81  95  95 81  81 93 93  85  85 94  91 75  75 93  93 91 94
90 100 100 90 100 50 100 90 100 70 90 100 100 70 100 90 70 100
100 50 100 90 100 50 100 90 100 70 100 70 100 70 100 90 100 50
]
```

2.1.4 Own payoff variant

Data in own payoff variant contains only the payoffs a subject allocated to the self in one row per subject.

IMPORTANT: For the item with undefined slope, that is the item with endpoints [(85,85)(85,15)] (which is **item 1 in version A** and **item 6 in version B** of the paper based Slider Measure), the payoff allocated *to the other* has to be entered for that item. This has to be done because the payoff to the self is 85 in all options of that item, and therefore the payoff allocated to the other in that item cannot be determined by the payoff to the self.

For example, if the first subject chose the third option in item 1 (according to **version A**), which is (85,68) and the second option in item 2, which is (87,19), the entry in the first row (subject 1) would be 68[3] in the first column and 87 in the second column.

Examples of input variable *Data* in own payoff variant[4]:

---

[3]The payoff to the other has to be inserted for the item with an undefinded slope, that is the item with endpoints [(85,85)(85,15)] (which is **item 1 in version A** and **item 6 in version B** of the paper based Slider Measure).

[4]In these examples, data of both versions A and B of the paper based Slider Measure are shown. If input is data only, then the item order of the input variable has to be conform with the item order of **version A** of the paper based Slider Measure. The examples here should only give an impression of the general form of the input variable *Data*.

Figure 8: All items: In this example, Slider Measure data (primary and secondary items) of 5 subjects in own payoff variant is shown.

```
Data = [
    85   100    85    50   100    85    70   100   100    90   100   100   100   100    90
    85    75    63    85   100    85    91    93    75    94    85    93    81    95    81
    85   100    85    85   100   100    81    95    81    93    85    94    75    93    91
   100   100    85    85   100    85    90   100   100   100   100    90   100   100    70
   100   100    85    85    85    15   100   100   100   100   100   100   100   100   100
   ];
```

Figure 9: Primary items: In this example, Slider Measure data (primary items) of 5 subjects in own payoff variant is shown.

```
Data = [
    85   100    85    50   100    85
    85    75    63    85   100    85
    85   100    85    85   100   100
   100   100    85    85   100    85
   100   100    85    85    85    15
   ];
```

Figure 10: Secondary items: In this example, Slider Measure data (secondary items) of 5 subjects in own payoff variant is shown.

```
Data = [
    70   100   100    90   100   100   100   100    90
    91    93    75    94    85    93    81    95    81
    81    95    81    93    85    94    75    93    91
    90   100   100   100   100    90   100   100    70
   100   100   100   100   100   100   100   100   100
   ];
```

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2.2 Version and Data

If both **versions A and B** of the paper based Slider Measure were used, an additional input argument is required for indexing which subject completed which version of the Slider Measure.

For example:

- output = SVO_Slider(Versions, Data), or

- [output, ips] = SVO_Slider(Versions, Data)

The variable *Versions* is just a column vector (row vector is possible as well), which contains a 1 for each subject who completed version A, and a 2 for each subject who completed version B of the paper based Slider Measure. The variable *Data* can be of any format discussed in section 2.1.

IMPORTANT: The variable *Versions* has to be inserted as the **first input argument**.

Example:

Figure 11: Versions and Data: In this example, Slider Measure data (primary items) of 5 subjects in option variant is shown together with a column vector indicating which versions (1 = A, 2 = B) were completed by the subjects.

```
Versions = [          Data = [
    1                     1     9     9     1     1     9
    2                     9     5     4     9     9     1
    1                     1     9     9     9     1     1
    2                     1     1     9     9     9     1
    2                     1     1     9     9     1     9
];                    ];
```

2.3 Missing values

IMPORTANT: Missing values have to be represented as **NaN**s in any of the input variants discussed in section 2.1.

Example:

Figure 12: Versions and Data: Indicate missing values as **NaN**s.

```
Versions = [      Data = [
     1                 1    NaN    9    1    1    9
    NaN               NaN   NaN   NaN  NaN  NaN  NaN
     1                 1     9     9    9    1    1
     2                 1     1     9    9    9    1
     2                 1     1    NaN   9    1    9
    ];                ];
```

3   Output arguments

There are two output arguments which can be called from the *SVO_Slider.m* function. The first output argument contains the results from the Slider Measure evaluation and the second -optional- output argument contains the raw data in IPS format.

3.1   One output argument: Slider Measure results

If only one (or no) output argument is called, this will yield a variable containing the results from the Slider Measure evaluation.

For example:

- output = SVO_Slider(Data), or

- output = SVO_Slider(Versions, Data)

Depending on whether all items, only the primary items, or only the secondary items were inserted as input argument, the output variable contains 14, or 7 columns respectively.

3.1.1   Input is all items (primary & secondary items)

The output contains 14 columns which are summarized in table 1.

3.1.2   Input is primary items only

The output contains 7 columns which are columns 1 to 7 as summarized in table 1.

Table 1: Summary of output colums

Column	Variable	Key
1	SVO Angle	-
2	SVO Category	1=Altruistic, 2=Prosocial, 3=Individualistic, 4= Competitive
3	Transitivity	0=Intransitive, 1=Transitive
4	Most preferred SVO	1=Altruistic, 2=Prosocial, 3=Individualistic, 4= Competitive
5	2nd preferred SVO	1=Altruistic, 2=Prosocial, 3=Individualistic, 4= Competitive
6	3rd preferred SVO	1=Altruistic, 2=Prosocial, 3=Individualistic, 4= Competitive
7	Least preferred SVO	1=Altruistic, 2=Prosocial, 3=Individualistic, 4= Competitive
8	Prosocial Type	1=Inequality averse, 2=Joint gain maximizing, 0.5=indifferent
9	Δ inequality aversion	0=perfect inequality aversion - 1=perfect joint gain maximizing
10	Δ joint gain maximizing	0=perfect joint gain maximizing - 1=perfect inequality aversion
11	Most preferred SVO	1=Inequality aversion, 2=Joint gain maximization, 3=Individualistic, 4= Altruistic
12	2nd preferred SVO	1=Inequality aversion, 2=Joint gain maximization, 3=Individualistic, 4= Altruistic
13	3rd preferred SVO	1=Inequality aversion, 2=Joint gain maximization, 3=Individualistic, 4= Altruistic
14	Least preferred SVO	1=Inequality aversion, 2=Joint gain maximization, 3=Individualistic, 4= Altruistic

3.1.3 Input is secondary items only

The output contains 7 columns which are columns 8 to 14 as summarized in table 1.

3.1.4 NaNs in the output

If the output contains **NaN**s, this can have several reasons depending on the column containing the **NaN**. In general, evaluating Slider Measure data for any given subject requires that there is no single missing value in that subject's data. If there is at least one missing value in the primary items of a subject, the first 7 columns of the output will be **NaN**s for that subject. Likewise, if there is at least one missing value in the secondary items of a subject, columns 8-14 of the output will be **NaN**s for that subject. The reason for this rigorousness is that the results of the Slider Measure evaluation strongly depend on the values of every single item. However, missing values in the primary items do not affect the evaluation of the secondary items, and vice versa.

For the following columns (according to table 1), **NaN**s in the output can also have further causes in addition to missing values in the input:

- Columns 3-7:
  If the *Bioinformatics Toolbox* is not installed on your computer, a check for transitivity and the rank ordering of preferences can not be performed and therefore columns 3-7 will contain **NaN**s for all subjects.

- Columns 4-7 (Rank order of preferences):
  If a subject's choice pattern is intransitive (i.e. if column 3 shows a value of 0), the rank order of preferences will not be calculated for that subject, yielding **NaN**s in columns 4-7.

- Columns 8-10:
  If a subject does not prefer both inequality aversion and joint gain maximization over both individualism and altruism in the secondary items (i.e. column 11 = 1 AND column 12 = 2, or column 11 = 2 AND column 12 = 1), the following variables are not evaluated and will therefore all contain **NaN**s for that subject:

  - Prosocial Type (column 8)
  - Normalized mean distance from perfect inequality aversion (column 9)
  - Normalized mean distance from perfect joint gain maximization (column 10)

3.2 Two output arguments

If two output arguments are called, this will yield one variable containing the results from the Slider Measure evaluation as discussed in section 3.1, and one variable containing the raw data in IPS format.

For example:

- [output, ips] = SVO_Slider(Data), or

- [output, ips] = SVO_Slider(Versions, Data)

3.2.1 The IPS format

The abbreviation *IPS* stands for *I*tems - *P*ayoffs - *S*ubjecs. This second output argument yields a 3-dimensional matrix (IxPxS), where the rows indicate the items, the columns indicate the payoffs chosen for the self (column 1) and the payoffs chosen for the other (column 2), and the third dimension indicates the subjects. For example, entering *ips(1,2,3)* would yield the payoff that the 3rd subject has chosen for the other (2nd column) in the first item (1st column). Depending on whether the input was all items, primary items only, or secondary items only, the ips output will consist of 15, 6, or 9 rows, respectively. This output format facilitates a quick look at the payoffs that were actually chosen for the self and for the other by a certain subject in a certain item.
IMPORTANT: The item order of the output variable in IPS format is made conform with the item order of **version A** of the paper based Slider Measure for all subjects.

4   Using raw data from online version as input

Since the online version of the Slider Measure has a higher resolution than the paper based version, the outputs these two versions produce may differ slightly in some rare instances. It is important to note, that differences can only occur with respect to the results as derived from the secondary items, and are due to rounding error only. That is, due to rounding errors, subjects' rank orders of secondary item preferences (Inequality aversion, Joint gain maximization, Altruism, and Individualism / Competitiveness) in the output of the online version may differ from those in the output of the paper

based version in some rare corner cases[5].

However, the Matlab function *SVO_Slider.m* was programmed so that it can produce an output that is 100% consistent with the output of the online version by eliminating differences in secondary preferences rank orders that are due to rounding error. In order to produce this output -which is recommended if raw data as produced by the online version is inserted into the Matlab function- the following procedure has to be applied:

1. Use *full payoff variant* (see section 2.1.3) as INPUT

2. If all data is consistent with the item order of version A of the paper based version, apply:
   $[output, ips] = SVO\_Slider(INPUT,' online')$

3. If data is mixed versions, apply:
   $[output, ips] = SVO\_Slider(VERSION, INPUT,' online')$

---

[5]We conducted a monte carlo analysis with random choice patterns (options in the items were drawn from a uniform distribution) 30 trials with 10'000 cases revealed that differences in rank orders occurred only 5.26% of the time.