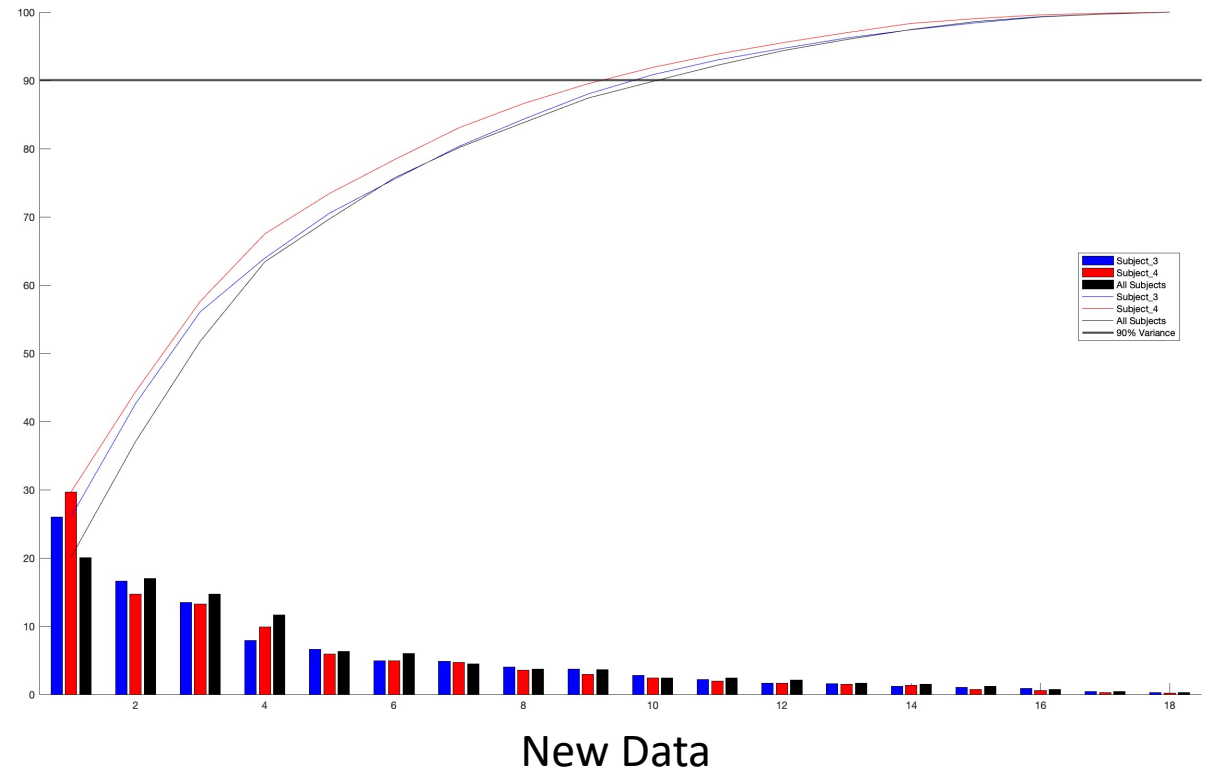
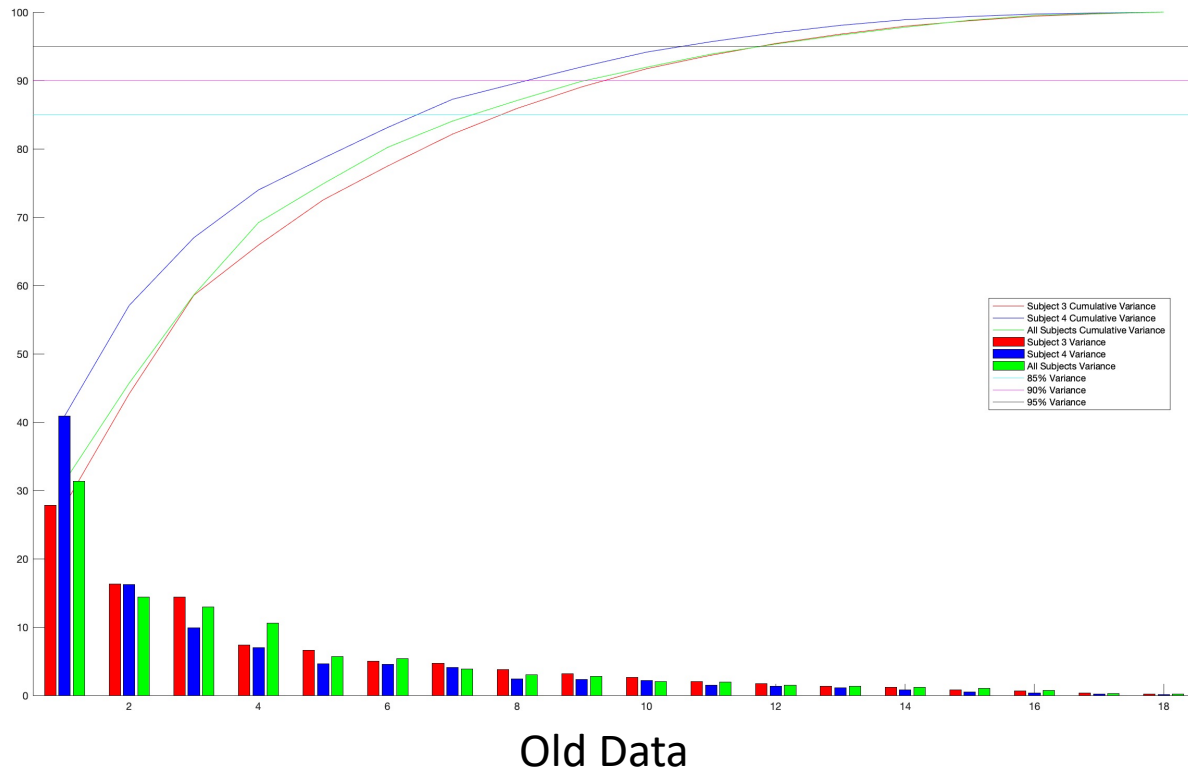


# Synergy Matching

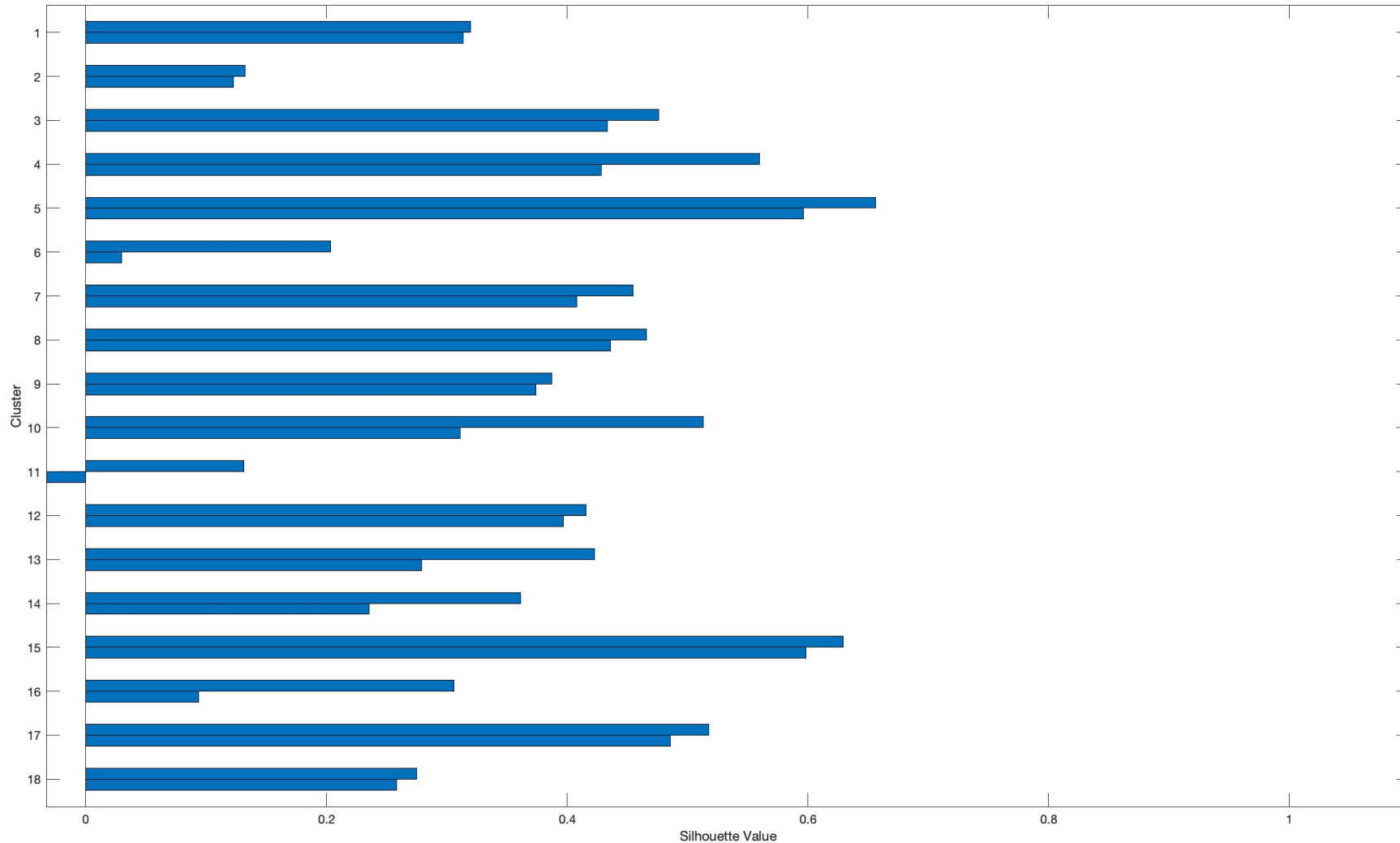
23/07/2021

# Variance comparison



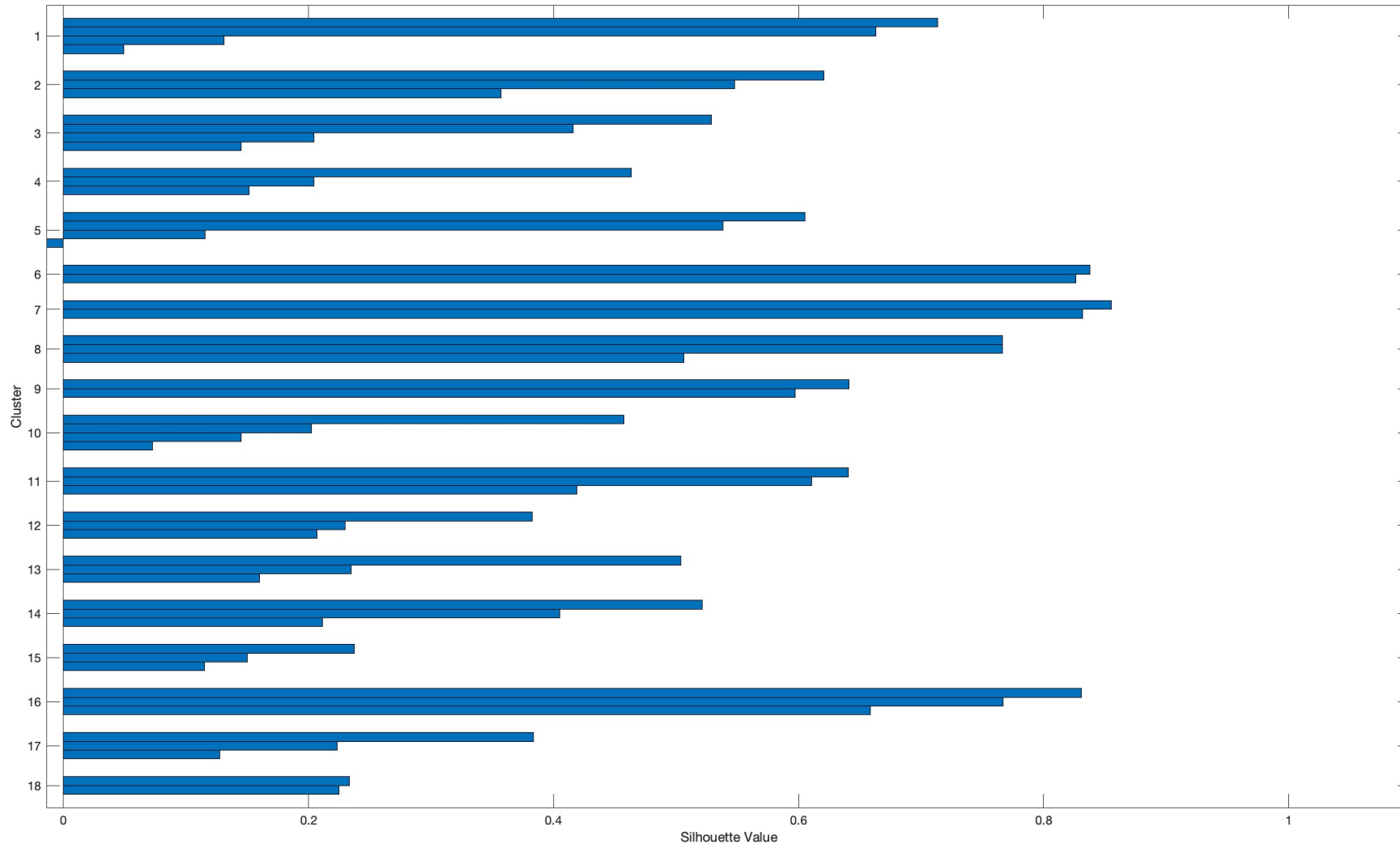
Even when the new data accomplishes for less variance in the first PC (particularly for Subject 4 and All Subjects), both datasets achieves more than 90% of the variance after 10 PCs.

# Silhouette values for clusters with two subjects



A silhouette value measures how similar a point is to points in its own cluster, when compared to points in other clusters. Values range from  $-1$  to  $1$ . A high silhouette value indicates that a point is well matched to its own cluster, and poorly matched to other clusters.

# Silhouette values for clusters including all subjects



If we include the data corresponding to both subjects together the results are not so good. Some clusters include only 2 PCs (like 6 and 7) while some other clusters (like 1, 3 or 10) include 4 PCs.

# Two different approaches to solve this

## 1. Modified Traditional Clustering:

- If we find a cluster with more than one PC per subject we select the PC with the higher silhouette value and discard the other(s).
- That discarded PC will not appear in any other synergy.
- The clustering algorithm is executed only once.

## 2. Recursive Clustering:

- First we find the cluster with higher score using the Matlab function '*evalclusters*'. If that cluster has more than one PC per subject we select the PC with the higher silhouette value.
- We replace the selected PCs with *NaNs*.
- We call again to the clustering function with one cluster less.
- In this case, those PCs discarded from one synergy could be matched with the remaining PCs in another synergy.
- The clustering algorithm is executed until we only have 2 clusters (base case).

# Synergies for two subjects

Synergy	PC Subject 3	PC Subject 4
1	PC 2	PC 1
2	PC 1	PC 4
3	PC 3	PC 2
4	PC 4	PC 3
5	PC 7	PC 5
6	PC 5	PC 8
7	PC 6	PC 6
8	PC 8	PC 7
9	PC 9	PC 12
10	PC 11	PC 10
11	PC 10	PC 13
12	PC 15	PC 9
13	PC 13	PC 11
14	PC 14	PC 14
15	PC 12	PC 15
16	PC 16	PC 16
17	PC 17	PC 18
18	PC 18	PC 17

Traditional Clustering

Synergy	PC Subject 3	PC Subject 4
1	PC 2	PC 1
2	PC 1	PC 4
3	PC 3	PC 2
4	PC 4	PC 3
5	PC 7	PC 5
6	PC 5	PC 8
7	PC 6	PC 6
8	PC 8	PC 7
9	PC 9	PC 12
10	PC 11	PC 10
11	PC 10	PC 13
12	PC 15	PC 9
13	PC 13	PC 11
14	PC 14	PC 14
15	PC 12	PC 15
16	PC 16	PC 16
17	PC 17	PC 18
18	PC 18	PC 17

Recursive Clustering

# Synergies for two subjects

Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 1
2	PC 2		PC 3
3	PC 1	PC 4	PC 5
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 4	PC 12	
7	PC 7	PC 6	PC 7
8	PC 5	PC 8	PC 8
9	PC 6	PC 7	PC 9
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Traditional Clustering

Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 2
2	PC 1	PC 4	PC 1
3	PC 2		PC 3
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 7	PC 6	PC 7
7	PC 5	PC 8	PC 8
8	PC 6	PC 7	PC 9
9	PC 9	PC 12	PC 5
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Recursive Clustering

# Synergies for two subjects

Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 1
2	PC 2		PC 3
3	PC 1	PC 4	PC 5
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 4	PC 12	
7	PC 7	PC 6	PC 7
8	PC 5	PC 8	PC 8
9	PC 6	PC 7	PC 9
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Modified Traditional Clustering

Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 2
2	PC 1	PC 4	PC 1
3	PC 2		PC 3
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 7	PC 6	PC 7
7	PC 5	PC 8	PC 8
8	PC 6	PC 7	PC 9
9	PC 9	PC 12	PC 5
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Recursive Clustering



# Synergies for two subjects

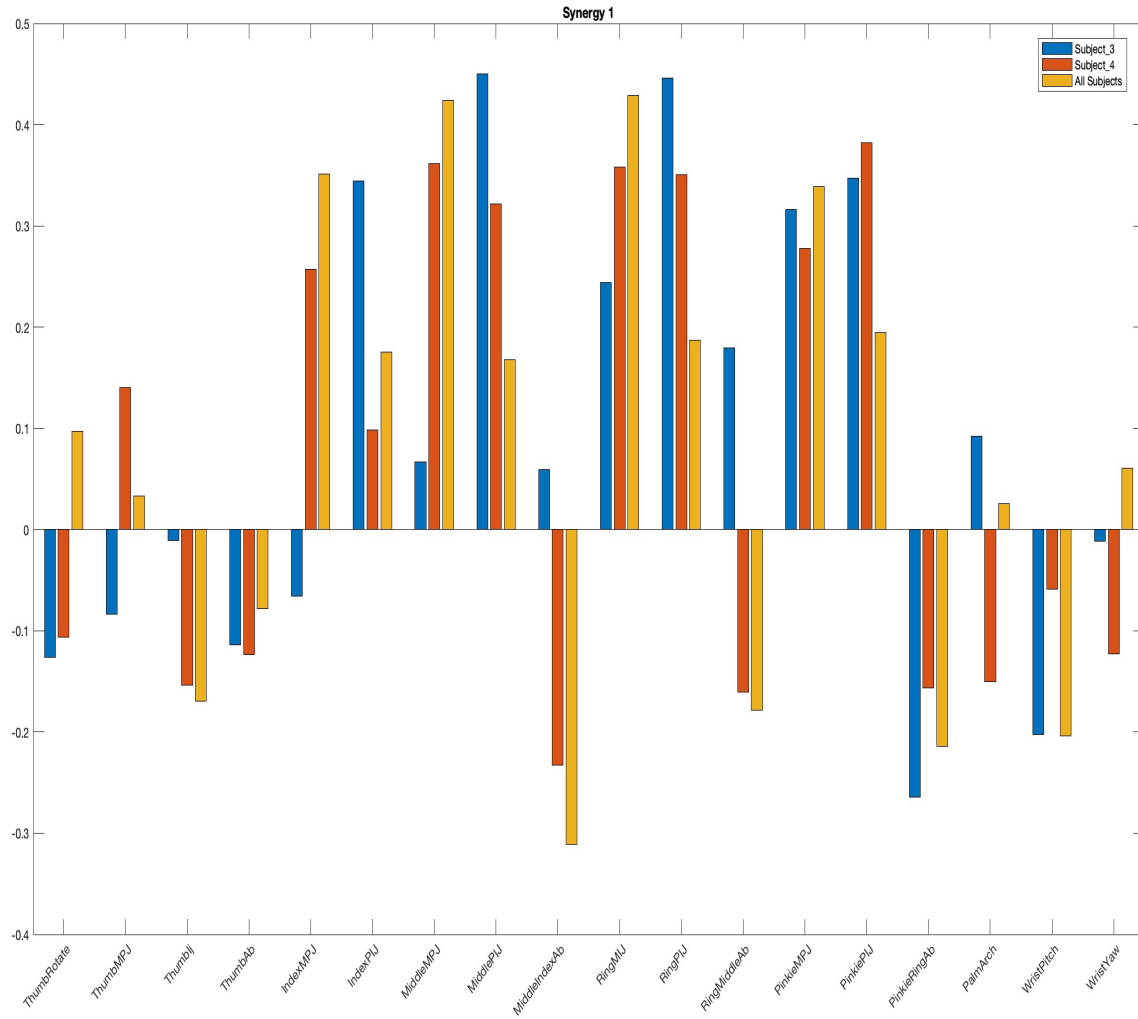
Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 1
2	PC 2		PC 3
3	PC 1	PC 4	PC 5
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 4	PC 12	
7	PC 7	PC 6	PC 7
8	PC 5	PC 8	PC 8
9	PC 6	PC 7	PC 9
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Traditional Clustering

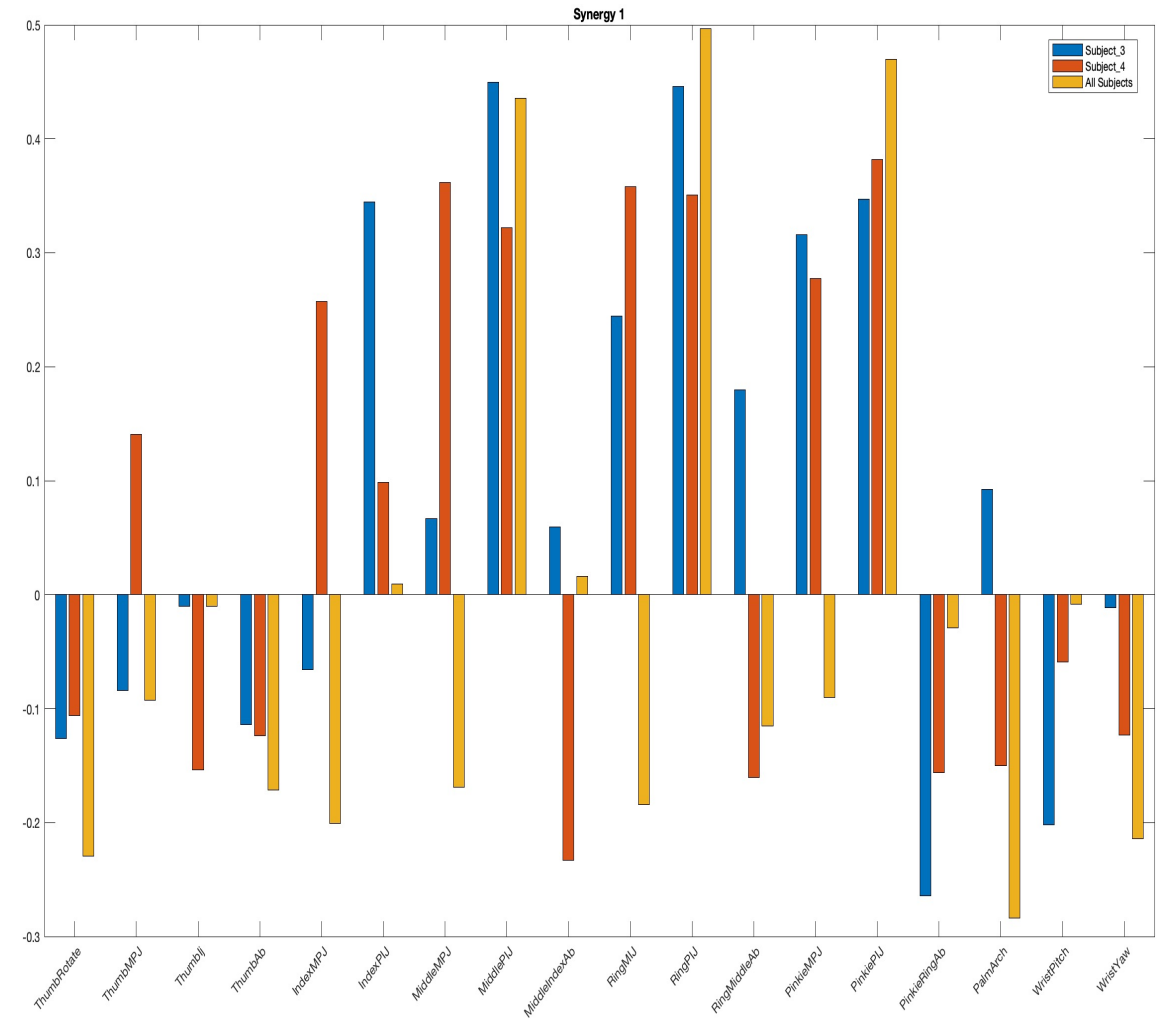
Synergy	PC Subject 3	PC Subject 4	PC All Subjects
1	PC 3	PC 1	PC 2
2	PC 1	PC 4	PC 1
3	PC 2		PC 3
4	PC 14	PC 3	PC 4
5		PC 5	PC 6
6	PC 7	PC 6	PC 7
7	PC 5	PC 8	PC 8
8	PC 6	PC 7	PC 9
9	PC 9	PC 12	PC 5
10	PC 8	PC 11	PC 12
11	PC 11	PC 10	PC 11
12	PC 15	PC 9	PC 10
13	PC 10	PC 13	PC 13
14	PC 13	PC 14	PC 14
15	PC 12	PC 15	PC 15
16	PC 16	PC 16	PC 16
17	PC 17		PC 17
18	PC 18	PC 18	PC 18

Recursive Clustering

# Synergies comparison

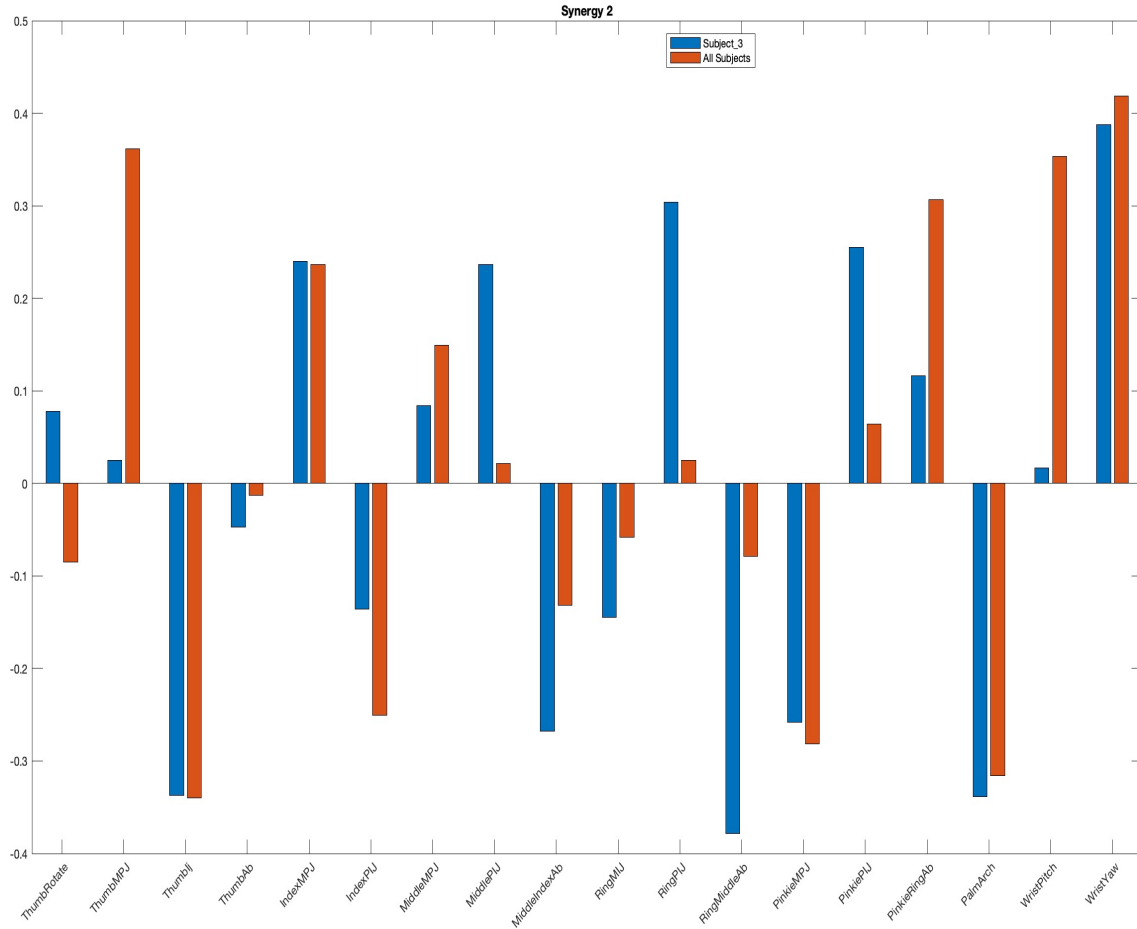


Modified Traditional Clustering

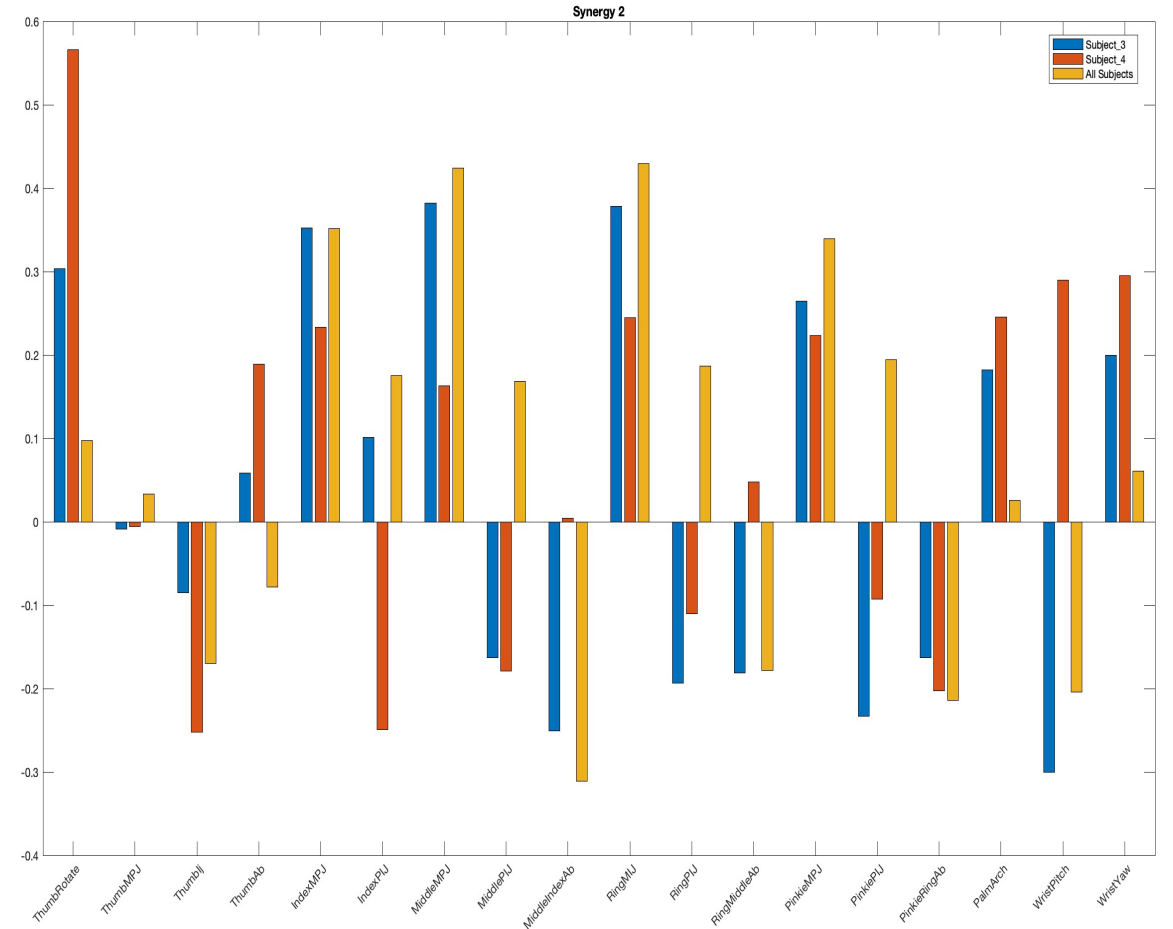


Recursive Clustering

# Synergies comparison

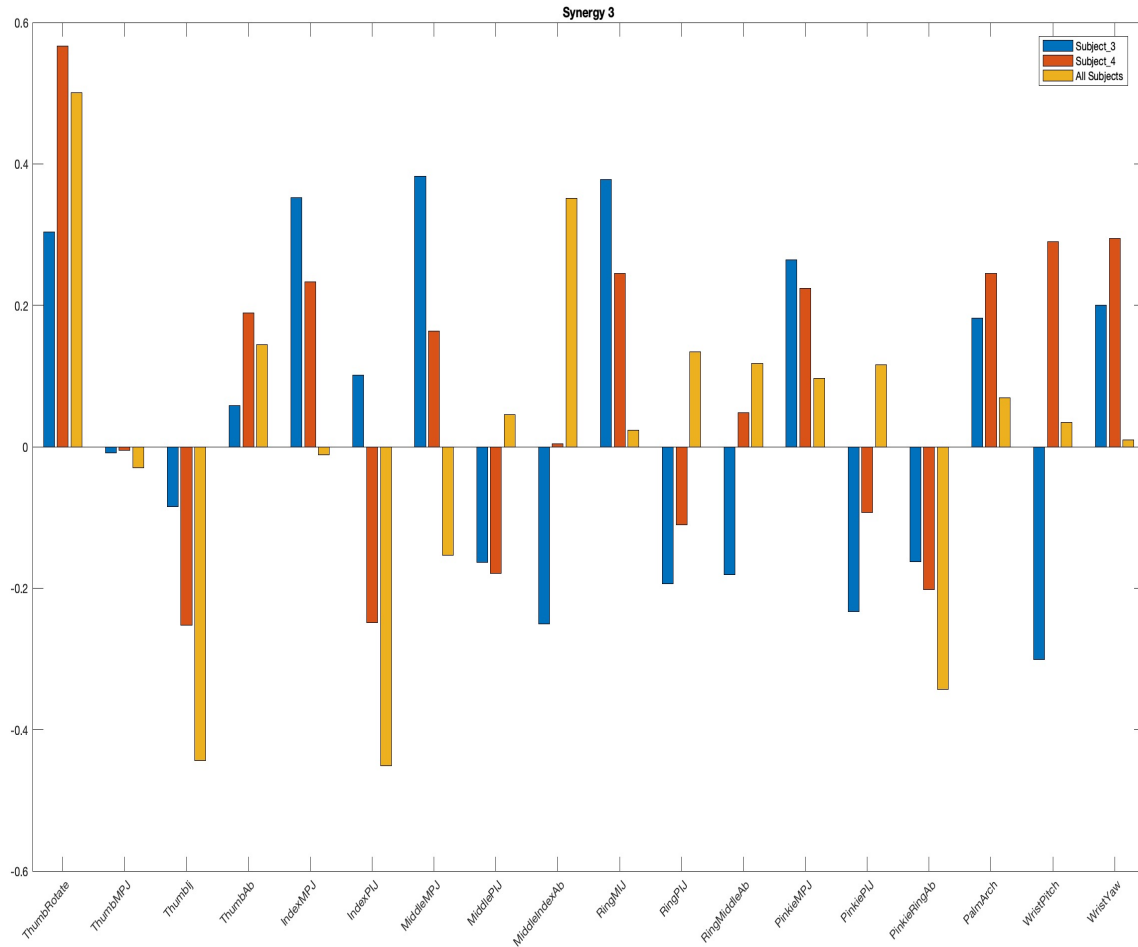


Modified Traditional Clustering

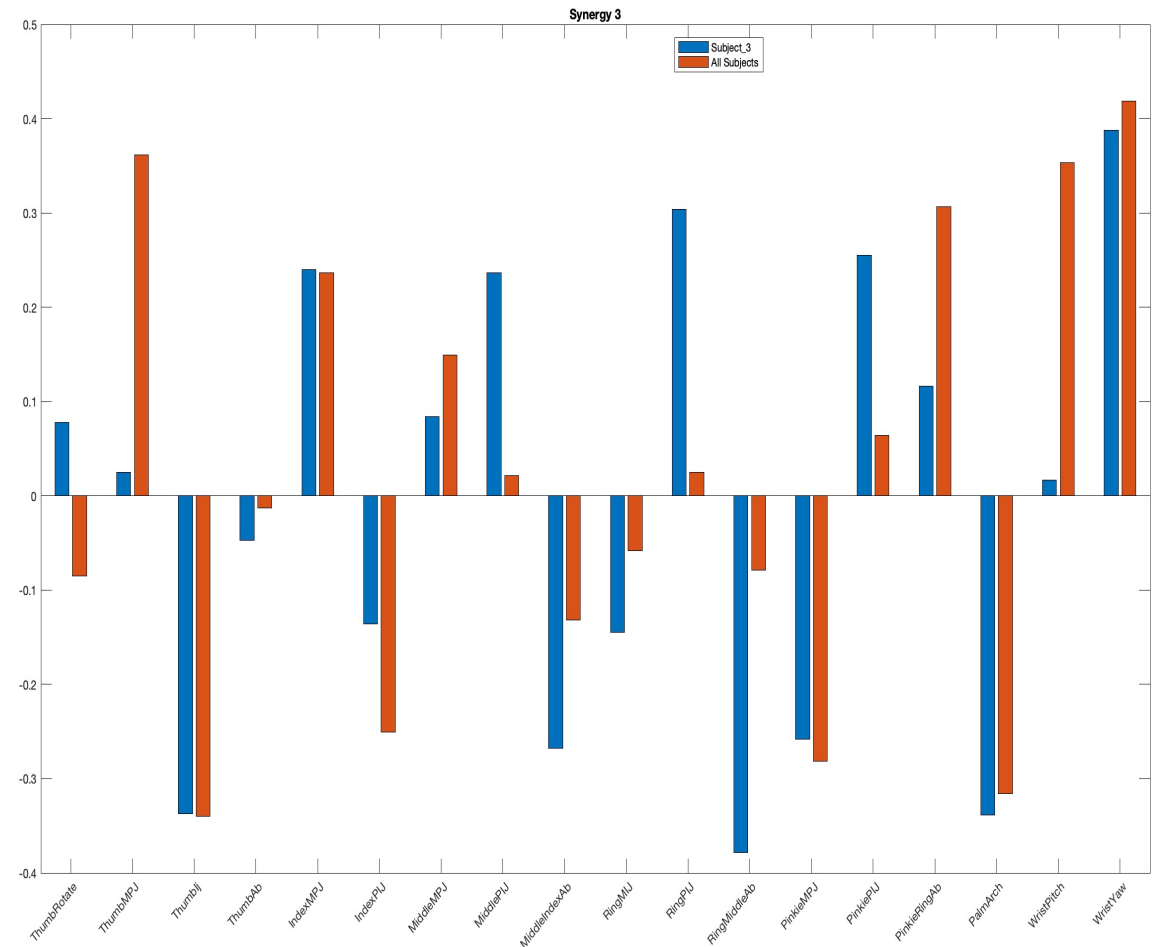


Recursive Clustering

# Synergies comparison



Modified Traditional Clustering



Recursive Clustering

## Next steps

- Evaluate the results of both clustering methods using *evalclusters* and *silhouette*.
- Calculate dynamic synergies (how synergies evolve during time).
- Synergies representations.

## Items to comment

- Mendeley.