Visualization of Team Profiles with the Use of Indirect Sociomaps

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Abstract: Team profiles are usually visualized by line graphs where each individual profile is displayed as a polyline. We propose a method for calculating similarity between two individual profiles and we also propose a method for visualization of the entire team profile. Team members are visualized in a landscape-like picture called Sociomap. Sociomap constructed in this way can also serve as a platform for further statistical testing of the sub-team differences.

Key words: Sociomapping, Sociomap, Team profiles, Team Profile Analyzer, Team Analysis

1. Introduction

In psychology, an *Individual profile* is usually a set of characteristics of some person (Fig. 1). One challenge is to visualize such set in the way that can be easily readable by a human expert. The common way to display an individual profile is a line-graph where the x-axis stands for test dimensions and y-axis shows the value of each dimension (Fig. 2).

A *Team profile* is a set of individual profiles. Usually, these T*eam profiles* are visualized as a set of individual profiles, many line graphs displayed one over another (Fig. 2).

Cohen (1966) introduced and modified the correlation coefficient for the calculation of similarities between two profiles and the same author (1988) proposed a metric known as *Cohen's d* for the calculation of the difference between averages of two sub-teams.

In this paper we propose a method which visualizes the team profiles according to the similarity of individual profiles in the team. As we will explain further in more details, we calculate the similarity of two profiles as a probability of their distance in general population.

The presented visual form of presenting the data is more intuitive for the human expert to read (Bahbouh, 2004) and it also provides more information about the team individuals than we can receive from the commonly used line-graphs (Höschl, 2010).

Team Members	Test Dimensions				Non-test dimension
	Ambition	Orderliness	Sensitivity	Creativity	KPI
Ronald	15	37	73	84	38
Chris	88	94	0	28	87
Donna	87	99	35	69	85
Brian	89	48	0	69	47
Laura	96	43	25	97	89
Kenneth	83	7	26	93	95
Charles	38	40	7	57	53
Michelle	38	58	56	66	48
Mary	35	54	41	13	39
Carol	94	1	47	97	98
Edward	49	21	18	32	46
Helen	61	59	89	38	72
Barbara	31	48	54	1	52

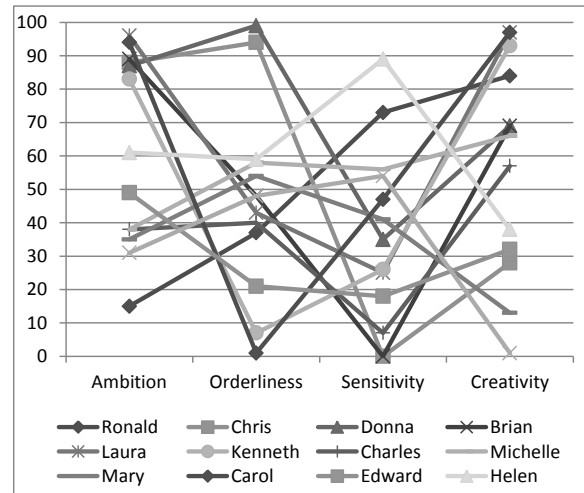**Figure 1**: Example of data input

Figure 2: Example of polyline representation of a team profile. Each line shows an individual profile.

	Ronald	Chris	Donna	Brian	Laura	Kenneth	Charles	Michelle	Mary	Carol	Edward	Helen	Barbara
Ronald	1,00	0,81	0,63	0,93	0,57	0,30	0,57	0,60	0,51	0,44	0,27	0,41	0,22
Chris	0,81	1,00	0,99	0,76	0,88	0,41	0,30	0,11	0,70	0,35	0,08	0,20	0,27
Donna	0,63	0,99	1,00	0,57	0,83	0,51	0,16	0,05	0,63	0,14	0,05	0,09	0,11
Brian	0,93	0,76	0,57	1,00	0,88	0,57	0,86	0,47	0,38	0,41	0,18	0,57	0,35
Laura	0,57	0,88	0,83	0,88	1,00	0,86	0,57	0,32	0,83	0,16	0,32	0,44	0,63
Kenneth	0,30	0,41	0,51	0,57	0,86	1,00	0,20	0,32	0,51	0,01	0,32	0,35	0,12
Charles	0,57	0,30	0,16	0,86	0,57	0,20	1,00	0,76	0,27	0,81	0,51	0,93	0,81
Michelle	0,60	0,11	0,05	0,47	0,32	0,32	0,76	1,00	0,11	0,14	0,98	0,95	0,51
Mary	0,51	0,70	0,63	0,38	0,83	0,51	0,27	0,11	1,00	0,27	0,11	0,18	0,32
Carol	0,44	0,35	0,14	0,41	0,16	0,01	0,81	0,14	0,27	1,00	0,05	0,32	0,86
Edward	0,27	0,08	0,05	0,18	0,32	0,32	0,51	0,98	0,11	0,05	1,00	0,93	0,38
Helen	0,41	0,20	0,09	0,57	0,44	0,35	0,93	0,95	0,18	0,32	0,93	1,00	0,70
Barbara	0,22	0,27	0,11	0,35	0,63	0,12	0,81	0,51	0,32	0,86	0,38	0,70	1,00

Figure 3: Similarity matrix calculated from the data input by using function ψ_4. The higher is the value the more similar two members are.
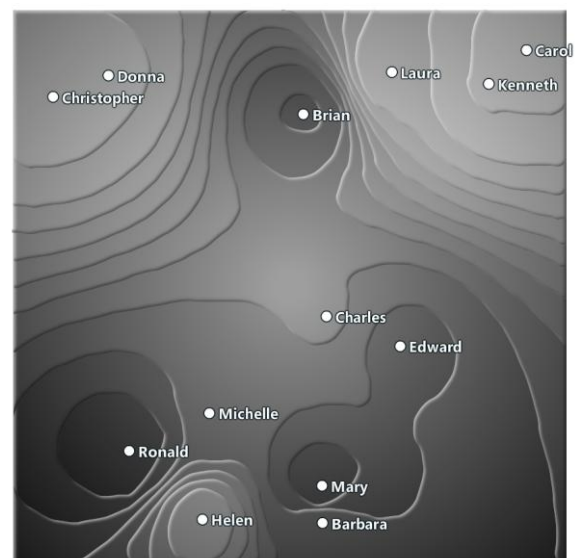

Figure 4: Sociomap of team profile similarities. The closer two members are the more similar their personal profiles are. In this example, height shows "key performance indicator". We can easily discover that sub-teams (Carol, Kenneth, Laura) and (Donna, Christopher) performs well and they have also similar profile. For more interactive testing see (TPA, 2008).

2. Methods

The key element of proposed visualization is *Indirect Sociomapping* (Höschl, 2010) and (Bahbouh 2011). First we need to calculate the similarity between each individual profile and then we visualize these profiles in a two dimensional (2D) plane. Team members are placed to the 2D plane in the manner that the closer the two members are, the more similar their profiles - and vice versa.

Once we have the team members positioned in the plane according to the similarity of their profiles, we construct a landscape-like map by elevating the height of each member (Höschl, 2006), (Fig. 4). We have many options in terms of what variable to use as a height. For instance, the height can be the "team similarity" which shows how similar is the team member's profile and the average team profile. We may also show some test or non-test scores to see the distribution of one particular variable. For example, if we display a variable called „Key Performance Indicator" as a height, we can see whether the well-performing team members are concentrated in one area (i.e. they have similar psychological profiles) or if they are spread among the map (i.e. they probably do not have similar psychological profile). (Fig. 4).

This way of visualization is not only a standalone picture, but it can also be used as a platform for further statistical testing. Using the software *Team Profile Analyzer* (TPA, 2008) we can test the statistical significance of differences between the team members and its subgroups and more.

3. The math behind

To visualize the abovementioned Sociomap, we need to calculate the similarity between each pair of profiles in the team.

Under the term *Standardized individual profile,* we understand a vector of standardized scores that characterizes a person. One such example can be the five dimensions that come as an output from the *Big Five* (*NEO-PI-R*) test where the dimensions are labeled: *Stability*, *Extraversion*, *Conscientiousness*, *Agreeableness*, *Openness to Experience* (Costa & McCrae, 1992). A standardized score in each dimension is usually received in Stens or

Percentiles. However, any standardized score such as IQ score, Sten, Stannine, etc. can be converted to Percentile (Höschl, 2010).

We use the statistical properties of percentiles to calculate the similarity between two percentile vectors (two individual profiles) as follows (Höschl, 2010):

$$\psi_n(d) = P\left(\frac{1}{n}\sum_{i=1}^{n}|x_i - y_i| \leq d\right)$$

where x_i and y_i are the scores of two individual profiles $\boldsymbol{x}$ and $\boldsymbol{y}$ and d is a distance. The function $\psi_n(d)$ tells us how probable it is that two individual profiles of n dimensions has a Manhattan distance of d or less.

We use this measure ψ_n to calculate how probable the measured distance between two profiles in general population is. If it is very unlikely that two randomly selected profiles would have such distance, then their position on the map will be close and vice versa.

4. Sociomap construction

Using function ψ_n we calculate the whole similarity matrix that tells us how close each pair of members should be on the map. The matrix is symmetrical and its values are from interval 0 to 1 where 1 means that two profiles are identical and values close to 0 means that they are completely different. Bahbouh (2004) calls strength of this relation *degree of membership*. (Fig. 3).

The arrangement of objects in the final visualization is a projection of this matrix into the 2D plane. The criterion of this projection is the correlation between mutual positions in the plane and the *degree of membership*.

5. Discussion and Conclusion

We proposed a new method for the visualization of team profiles. The main advantage of the method proposed is that it is able to visualize the similarity of profiles in a way which is more friendly to human perception than when presenting profiles by line-graphs or just through a matrix of numbers. The final visualization through the Sociomap picture provides a general overview of differences between profiles. However, to receive precise

information of statistical significance of differences between two individuals or between two sub-teams, we must further statistically test the difference of the desired sub-teams, which can be performed, that is with the use of the Team Profile Analyzer tool (TPA, 2008).

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