

Using Dematel Method for Cause-Effect Relationship among Various Types of Personality Disorder

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Abstract—The main objective of this paper is to develop a strategy about the effect relationship among various types of personality disorder. People with personality disorder suffer from stress and problems every-day. This involves long term patterns of thoughts and behaviours that are unhealthy and inflexible. In this paper Decision Making Trial and Evaluation Laboratory (DEMATEL) method and maximum mean de-entropy (MMDE) algorithm is used to analyse the effect and cause relationship of the P.Ds. DEMATEL method is a methodology which effectively solves the issues of complexity and dependency among the criteria. It provides an opportunity to the decision makers to determine main criteria for effect evaluation, and conduct effective evaluation based on well-defined criteria. The end product of this method is visual representation of the impact relations map by which respondent organize their own actions in the world.

Keywords: personality disorder, DEMATEL, cause-effect

1. INTRODUCTION

A personality disorder is a type of mental disorder in which one has a rigid and unhealthy pattern of thinking, functioning and behaving. A person suffering with a personality disorder has trouble perceiving and relating to situations and people. This causes significant problems and limitations in relationships, social activities, and work. Personality disorders usually begin in the teenage years or early adulthood. There are many types of personality disorders. Personality in general is formed in childhood as a result of the interactions between genetic (inherited) and early environmental factors. Multiple genes are involved for personality disorders, Nearly 10% of people in the general population suffer from personality disorders (PDs) (Samuels, 2011). The high rates of co-occurrence between PDs and other disorders, such as depression, eating disorders, anxiety and substance use behaviors has been highlighted by Samuels, 2011. PDs are also associated with medical health problems such as cardiovascular disease (Powers & Oltmanns, 2013), arthritis, obesity (Powers & Oltmanns, 2013).

Reviews emphasize the association of borderline

2. METHODOLOGY

In this study first the clusters are identified on the basis of similar properties. The identified clusters are shown in the Table-1 along with criteria and explanation.

Step-1- Identifying factors and clusters: First all the factors responsible for P.Ds are identified and clustered. These clustered are then used to define the type of P.Ds.

Step 2- Generating Average Matrix: From the n criteria an n x n matrix A_k is generated on the basis of kth expert's response. The $a_{ij}(k)$ represents the degree of influence of criterion E_i to E_j which forms the influence matrix A_k .

The pair-wise comparison scale defines five levels with the scores of 0, 1, 2, 3 and 4 representing "No influence", "Low influence", "Middle influence", "High influence", and "Very High influence", respectively.

$$A_k = \begin{matrix} & \begin{matrix} E_1 & \dots & E_i & \dots & E_n \end{matrix} \\ \begin{matrix} E_1 \\ \vdots \\ E_i \\ \vdots \\ E_n \end{matrix} & \begin{bmatrix} 0 & \dots & a_{1j(k)} & \dots & a_{1n(k)} \\ \vdots & & \vdots & & \vdots \\ a_{i1(k)} & \dots & a_{ij(k)} & \dots & a_{in(k)} \\ \vdots & & \vdots & & \vdots \\ a_{n1(k)} & \dots & a_{nj(k)} & \dots & 0 \end{bmatrix} \end{matrix}$$

personality disorder (BPD) with sleep disturbance (Hafizi, 2013). Researchers have also identified consistent, robust relations between chronic pain conditions and PDs (Conrad, Wegener, Geiser, & Kleiman, 2015). This paper is an effect in developing a framework for analyzing the co-occurrence

between the P.Ds by using the DEMATEL (decision making trial and evaluation laboratory) method. Tzeng, and (Chang, 2007) used the fundamentals of DEMATEL method to transform the attributes of an application into a non-independent multi-criteria evaluation of problems.

Next the average matrix Z is determine

$$Z = \begin{bmatrix} 0 \dots & z_{1j(k)} & z_{1n(k)} \\ z_{i1(k)} \dots & z_{ij(k)} & z_{in(k)} \\ \vdots & \vdots & \vdots \\ z_{n1(k)} \dots & z_{nj(k)} & 0 \end{bmatrix}$$

Next the average matrix Z is determined by taking

average of all the experts scores:

$$z_{ij} = (a_{ij(1)} + a_{ij(2)} + \dots + a_{ij(m)}) / m. \text{ (Where m is the no. of expert consulted).}$$

Table-2 shows the matrix Z.

Step 3- Normalizing the initial direct-relation matrix X:

Let $S = \max(\sum_{j=1}^n z_{ij}, \sum_{i=1}^n z_{ij})$ Divide the matrix Z with S to obtain the equation $X = Z/S$, where X is normalized initial direct-relation matrix X. In this study $S=20.50$ the matrix X is shown in Table- 3.

Step 4- Determining Total relation Matrix T: Matrix X indicates only direct relations. A continuous decrease of the indirect effects of problems along the powers of matrix X, $X^2, X^3, \dots, X^\infty$, guarantees convergent solutions to the matrix inversion, similar to an absorbing Markov chain matrix (Li & Tzeng, 2009). The total relation matrix T is an n x n matrix as follows:

$$T = \sum_{q=1}^{\infty} X^q = X + X^2 + X^3 + \dots + X^\infty$$

$$= X(I - X)^{-1} \lim_{q \rightarrow \infty} X^q = [0]_{n \times n}$$

Where is the $[0]_{n \times n}$ null matrix, I is the identity matrix. Matrix T is defined in Table- 4

Table 1: Personality Disorders

Cluster	Criteria	Explanation
[A] odd, eccentric thinking or behaviour	A1. Paranoid personality disorder	Pervasive distrust and suspicion of others and their motives.
	A2. Schizoid personality disorder	Lack of interest in social or personal relationships, preferring to be alone.
	A3. Schizotypal personality disorder	Peculiar dress, thinking, beliefs, speech or behaviour.
[B] Dramatic, overly emotional or unpredictable thinking or behaviour	B1. Antisocial personality disorder	Aggressive, often violent behaviour.
	B2. Borderline personality disorder	Unstable and intense relationships, up and down moods, often as a reaction to interpersonal stress.
	B3. Histrionic personality disorder	Constantly seeking attention and excessively emotional, dramatic or sexually provocative to gain attention.
	B4. Narcissistic personality disorder	Belief that you're special and more important than others Fantasies about power, success and attractiveness
[C] Anxious, fearful thinking or behaviour	C1. Avoidant personality disorder	Too sensitive to criticism or rejection feeling inadequate, inferior or unattractive.
	C2. Dependent personality disorder	Excessive dependence on others and feeling the need to be taken care of submissive or clingy behaviour toward others.
	C3. Obsessive-compulsive personality disorder	Preoccupation with details, orderliness and rules

Table 2: Average matrix Z

	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	Σ
A1	0.00	2.50	1.00	3.00	3.50	3.00	2.00	1.50	2.00	2.00	20.50
A2	0.41	0.00	2.50	2.50	2.00	2.00	3.50	2.50	2.00	2.50	19.91
A3	1.00	0.41	0.00	3.50	2.50	1.50	3.00	2.50	3.00	2.50	19.91
B1	0.33	0.41	0.29	0.00	3.00	2.00	4.00	2.00	2.00	0.41	14.44
B2	0.29	0.75	0.41	0.33	0.00	2.00	1.00	3.00	3.00	3.00	13.78
B3	0.33	0.66	0.75	0.50	0.50	0.00	3.00	2.00	2.00	1.00	10.74
B4	0.66	0.29	0.33	0.25	0.66	0.33	0.00	3.00	1.50	2.50	9.52
C1	0.75	0.41	0.41	0.50	0.33	0.50	0.33	0.00	1.50	3.50	8.23
C2	0.75	0.66	0.33	0.50	0.33	0.50	0.75	1.00	0.00	1.50	6.32
C3	0.625	0.41	3.00	0.33	0.33	1.00	0.41	0.33	0.41	0.00	6.84
Σ	5.14	6.5	9.02	13.33	13.15	12.83	17.99	17.83	17.41	18.91	

Table 3: Normalized initial direct-relation matrix X

	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3
A1	0.00	0.121	0.048	0.146	0.170	0.007	0.097	0.073	0.097	0.097
A2	0.020	0.00	0.121	0.121	0.097	0.097	0.170	0.121	0.097	0.121
A3	0.048	0.020	0.00	0.170	0.121	0.073	0.146	0.121	0.146	0.121
B1	0.016	0.020	0.014	0.00	0.146	0.097	0.195	0.097	0.097	0.020
B2	0.014	0.036	0.020	0.016	0.00	0.097	0.048	0.146	0.146	0.146
B3	0.016	0.032	0.036	0.024	0.024	0.00	0.146	0.097	0.097	0.048
B4	0.032	0.014	0.016	0.012	0.321	0.016	0.00	0.146	0.073	0.121
C1	0.036	0.020	0.020	0.024	0.016	0.024	0.016	0.00	0.073	0.170
C2	0.036	0.032	0.016	0.024	0.016	0.024	0.036	0.048	0.00	0.0731
C3	0.030	0.020	0.146	0.016	0.016	0.048	0.020	0.016	0.020	0.00

Table 4: Total relation Matrix T

	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	D
A1	0.057	0.175	0.143	0.228	0.344	0.122	0.253	0.255	0.268	0.296	2.143
A2	0.084	0.062	0.213	0.313	0.299	0.205	0.328	0.312	0.281	0.334	2.332
A3	0.107	0.083	0.094	0.244	0.309	0.178	0.297	0.300	0.314	0.321	2.250
B1	0.060	0.065	0.078	0.056	0.287	0.168	0.289	0.239	0.227	0.187	1.661
B2	0.055	0.075	0.091	0.071	0.099	0.155	0.140	0.243	0.242	0.271	1.444
B3	0.051	0.065	0.088	0.073	0.140	0.055	0.217	0.196	0.188	0.170	1.247
B4	0.076	0.064	0.093	0.073	0.409	0.104	0.099	0.277	0.210	0.288	2.533
C1	0.061	0.046	0.072	0.063	0.082	0.066	0.077	0.065	0.134	0.237	0.907
C2	0.056	0.046	0.055	0.058	0.081	0.060	0.090	0.107	0.059	0.141	0.765
C3	0.057	0.054	0.179	0.072	0.101	0.094	0.100	0.099	0.104	0.090	0.947
R	0.607	0.740	1.109	1.225	2.156	1.211	1.892	2.097	2.031	2.338	

Step 5- Finding Prominence and Relevance: The (i, j) element of the matrix T, (t_{ij}) denotes the full direct-and indirect-influence exerted from criterion E_i to E_j . Now

calculate D_i and R_j respectively, where $D_i = \sum_{i=1}^n t_{ij}$

($i=1,2,\dots,n$) and $R_j = \sum_{j=1}^n t_{ij}$ ($j=1,2,\dots,n$), (D+R) is called

prominence, which indicates the element's degree of influence and being influenced. (D-R) is called relevance. If it is positive, the criterion tends to fall under the result category. If it is negative, the criterion tends to fall under the causal category. (D+R) and (D- R) shown in Table-5.

Step 6- Calculate a threshold value: This value is calculated using method of MMDE. Which is computed (Chung & Tzeng, 2002). The threshold value for this system is 0.312.

Step 7- Analysis matrix for total relations: In order to explain the structural relationship among the criteria while keeping the complexity of system to a manageable level, the cause-effect diagram is drawn. The X-axis shows (D+R) that indicates the sum of the criteria attribute that influences other criteria and the sum of the criteria attribute over which other criteria exert an influence. The Y-axis shows (D-R) that indicates the difference in the criteria attribute influencing other criteria and the difference in the criteria attribute over which other criteria exert an influence. For this system cause effect diagram is shown in Fig. -1.

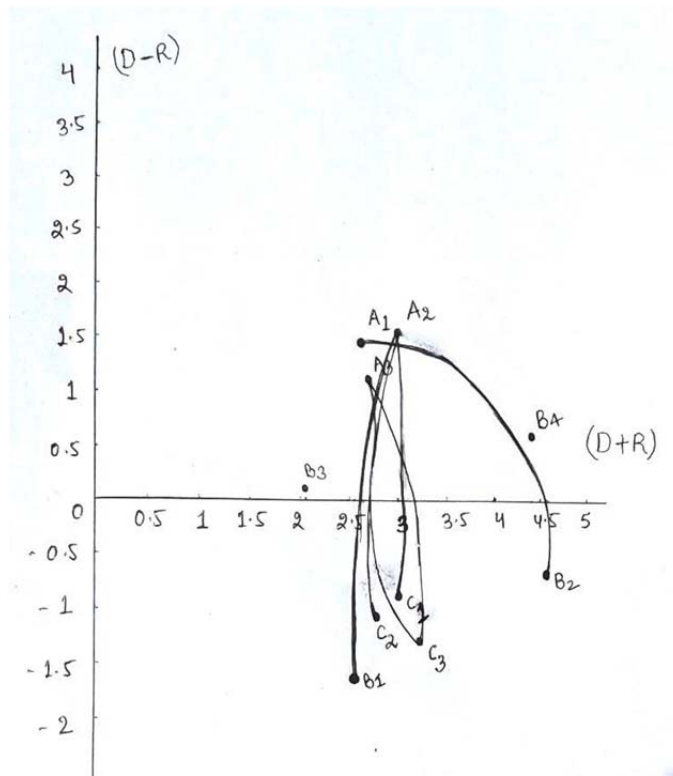


Fig. 1

Table 5: Prominence and Relevance

	D	R	D+R	D-R
A1	2.143	0.607	2.750	1.536
A2	2.332	0.740	3.072	1.592
A3	2.250	1.109	2.770	1.141
B1	1.661	1.710	2.669	-1.951
B2	1.444	2.156	4.689	-0.712
B3	1.247	1.211	2.118	0.036
B4	2.533	1.892	4.425	0.641
C1	0.907	2.097	3.004	-1.190
C2	0.765	2.031	2.797	-1.266
C3	0.947	2.338	3.285	-1.390

3. RESULTS

The Fig. -1 shows that “paranoid P.D”, “schizoid P.D”, and “schizotypal P.D” have positive higher influence degree which means these have great influence on the other P.Ds like- (B_1) antisocial P.D, (B_2) borderline P.D, (C_1) avoidant P.D, (C_2) Dependent P.D, and (C_3) obsessive-compulsive P.D This means a person who is suffering from any of these three P.Ds has a higher chance of being influenced with these disorders. Thus he/she must consult with a doctor at initial stage because if the symptoms of these three P.Ds are avoided

then it can be transformed into the symptoms of other harmful P.Ds.

4. CONCLUSION

In this paper a framework is developed to find the Effective relationship among various types of personality disorders. DEMATEL method and MMDE algorithm is used to analyse the effect. The implementation of the determined influence personality disorder will help to stopping the transformation of one P.D symptoms into harmful P.Ds symptoms. This kind of analysis can improve the health of people who is suffering from P.D.

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