

Case Study

# Variable Coordinates

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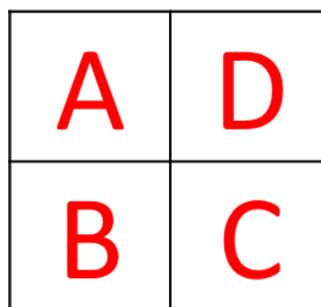
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**Abstract:** Working on developing geometric coordinates with a special case - in the interest of human engineering - to fit with the humanities or with the famous psychological tests such as the Herman Brain Dominance Instrument Test, which is abbreviated as HBDI, or the Personal Compass test, which is abbreviated as (P.C).

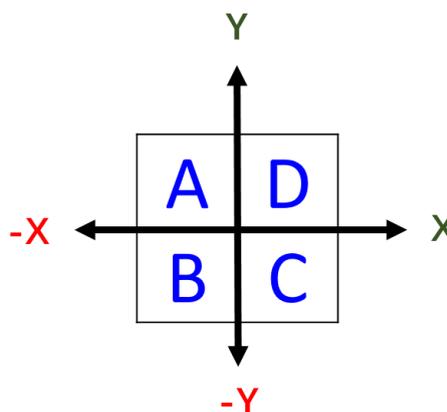
**Keywords:** Personal Compass, Hermann Brain Dominance Instrument, Coordinates, Humanistic Mathematics

## 1. Introduction

The greatest distance between mathematics and the humanities is the lack of understanding of mathematics for the nature of those sciences (for example), we find that the theory of "Hermann" - which is abbreviated as HBDI (Lake Lure, 1990) - wonderfully determines the different thinking patterns of individuals and institutions, and its shape is as follows:



If a mathematician is asked to place coordinates (x, y) for the previous square, most of them will make it as follows:



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And we find that the meaning represented by the symbol (D) is always positive, while the meaning represented by the letter (B) is negative because it always falls next to the negative axes!

Therefore, since the symbols A and D are in opposite states, in the previous form we think that, for example:

$$C5 = -A5$$

And that is incorrect, as the relationship between the two meanings (mental and psychological) represented by A and C, respectively, in the "Hermann" test is a case of (opposition) and not a case of (reflection).

Thus, the fact that I have five mental qualities does not eliminate the five psychological traits that distinguish me, and they both fade away. Also, in such psychological tests, there is no presence of what is called (negative numbers).

Here, we may find this mathematician saying that it is not worth the effort and thinking that goes into problems like Fermat's Last Theorem, which is only a mental challenge and what most mathematicians love. However, using the mind to achieve compatibility between social and human sciences on the one hand and mathematics on the other will certainly be of great benefit.

The following is one of the efforts in this regard.

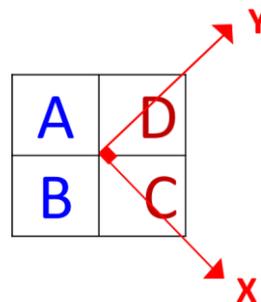
## 2. Part One

### 2.1. Non-fixed or non-negative coordinates

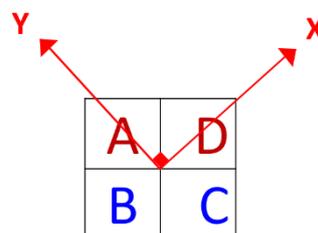
Let us return to the previous problem, which is how to reconcile geometric coordinates with the previous example of the "Hermann" square.

We want to place coordinates that contain - for example, without limitation - the two highest values in the results of the "Hermann" test. This, of course, makes the coordinates (positive but non-fixed).

For example, if we find that the two highest values in the results of a person's test were for types C and D, the coordinates will be around them as follows:



Or if we find that the two highest values in a person's test results were for types A and D, the coordinates will be around them as follows:



## 2.2. Impact point

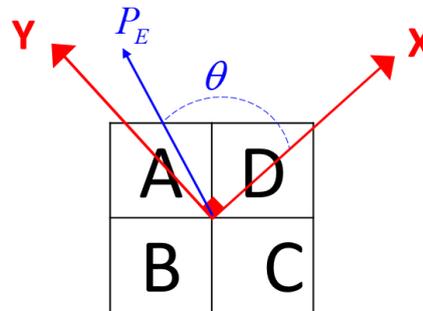
In the "Hermann" test - which is the example through which we have shown clarification - or the Personal Compass test or any of the testing procedures, we extract the two highest or lowest values or degrees, which we call (the impact point) depending on whether they are higher or lower, as follows:

### 2.2.1. Weak point

It is the point  $P_{LE}$  that consists of the two lowest degrees or values obtained by the person in the test.

### 2.2.2. Power point

It is the point  $P_{HE}$  that consists of the two highest degrees or values obtained by the person in the test.



The above figure shows that the impact point  $P_E$  tends to the y-axis more. The slope here shows us the extent of convergence or divergence of personalities, regardless of the results, as it provides us with an indicator of the direction of that person or that.

## 3. Part Two

Now we are presenting the equations for the variable axes.

### 3.1. The Equations

In the case of the HBDI test, we have four cases A, B, C, and D. In the case of the PC test, we have four cases, which are N, E, S, and W.

We will refer to the values of those symbols with the following Latin letters, meaning that:

In the case of the HBDI test, the value or degree will be

1)

Degree of side A =  $\alpha$

Degree of side B =  $\beta$

Degree of side C =  $\theta$

Degree of side D =  $\gamma$

Or in the case of the PC test, it will be

2)

Degree of side N =  $\alpha$

Degree of side E =  $\beta$

Degree of side S =  $\theta$

Degree of side W =  $\gamma$

After performing the equations and abbreviations, we obtain the following equations:

$$X = \frac{1}{6}(a\theta - b\beta - c\gamma + d\alpha) \rightarrow [\text{I}]$$

$$Y = \frac{1}{6}(a\beta - b\alpha - c\theta + d\gamma) \rightarrow [\text{II}]$$

$$\left. \begin{aligned} a &= 3m(m^2 - 5m + 6) \\ b &= m^3 - 6m^2 + 11m - 6 \\ c &= 3m(m^2 - 4m + 3) \\ d &= m^3 - 3m^2 + 2m \end{aligned} \right\} \rightarrow [\text{III}]$$

### 3.2. An illustrative example

Let's take the Personal Compass (P.C) test, which includes cases of N, E, S, W (Thelma Greco, Diane Turner 1998)

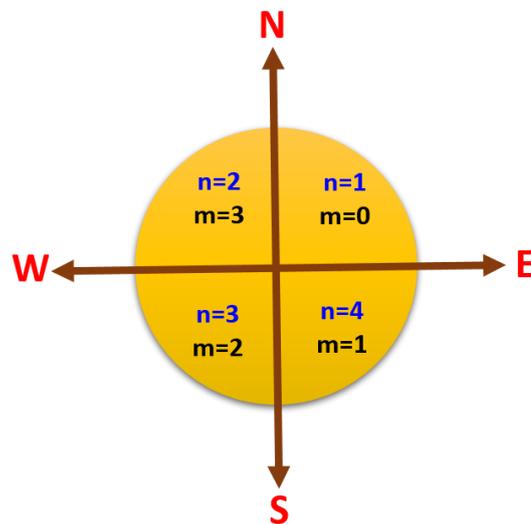
As previously mentioned, in this case the value or degree of each side will be:

Degree of side N =  $\alpha$

Degree of side E =  $\beta$

Degree of side S =  $\theta$

Degree of side W =  $\gamma$



Assuming that the highest values are (E, N) which means that the tested person is in the northeast (Diane Turner 2001).

the horizontal and vertical coordinates (x, y) can be determined as follows:

1) We know that (m=0) indicates that the impact point is located in the first quadrant.

2) When we put (m=0) in the previous equations [I],[II],[III]

we get the variable coordinates as follows:

Take (m = 0) in [III]

$$\left. \begin{array}{l} \therefore a = 0 \\ \therefore b = -6 \\ \therefore c = 0 \\ \therefore d = 0 \end{array} \right\} \leftarrow (m = 0)$$

And in [I]

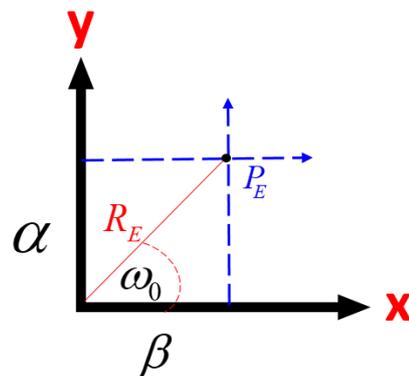
$$\therefore x = \frac{1}{6}(0 + 6\beta + 0 + 0) = \beta$$

And in [II]

$$\therefore y = \frac{1}{6}(0 + 6\alpha + 0 + 0) = \alpha$$

$$\left. \begin{array}{l} \therefore x = \beta \\ \therefore y = \alpha \end{array} \right\} \leftarrow (m = 0)$$

Here, we consider that  $\hat{\omega}$  is the positive angle with the x-axis, (m=0) as shown below:



$$slop = \tan \omega_0 = \frac{y}{x} = \frac{\alpha}{\beta}$$

We will talk about this in more detail in the "General Slope" section.

Determining the value of  $R_E$  which is the radius of the circle centered at the variable coordinates and passing through the impact point, can be named as (the impact circle).

$$R_E = x^2 + y^2$$

The importance of variable coordinates:

### 3.2.1. The importance of variable coordinates:

**Firstly:** Not waiting for psychological test results that depend on four points, allowing for many new insights and laws that apply to all cases, as we will see in this article, such as the general slope and the impact circle.

**Secondly:** The laws of variable coordinates are very suitable for the compass.

- 1) We only need to enter the values of the test results  $\alpha, \beta, \theta, \gamma$
- 2) the parameter value (m), which can be determined from the quadrant number (n) in which the impact point is located, using the following equation:

$$m = (5 - n) \times S_1 \quad : \quad S_1 = \text{sgn}(n - 1)$$

## 4. General Slope

The slope can be determined in general as follows:

$$slop_m = \tan \omega_m = \frac{a\beta - b\alpha - c\theta + d\gamma}{a\theta - b\beta - c\gamma + d\alpha} \rightarrow (IV)$$

Simply, we determine the measurement of the horizontal angle (to determine the direction) as follows:

$$\omega_m = \tan^{-1} \left( \frac{a\beta - b\alpha - c\theta + d\gamma}{a\theta - b\beta - c\gamma + d\alpha} \right) \rightarrow (V)$$

### 4.1. Preliminary notes

- 1) The distinctive slope is for the two highest values or degrees.

If two people have completely opposite tendencies (contradictory), their distinctive slope will be equal, but with compatibility in the pairing or individuality of the m value. To be more precise, they are as follows:

$$slop_1 = slop_3$$

OR

$$slop_0 = slop_2$$

However, if the compatibility is in the pairing or individuality of m without equality (conflict), they are (conflicting).

2) If two people have completely different tendencies (dissimilar), their distinctive slope will be equal, but with a sequence of m values as follows:

$$slop_1 = slop_2$$

$$slop_2 = slop_3$$

**OR**

$$slop_0 = slop_1$$

However, if the sequence is only in the value of m without equality (difference), they are (different).

#### 4.2. The impact circle

1. Of course, we can determine the so-called (impact circle) with a very simple equation.
2. By determining the value of  $R_E$  which is the radius of that circle.

$$R_E = \sqrt{(a\theta - b\beta - c\gamma + d\alpha)^2 + (a\beta - b\alpha - c\theta + d\gamma)^2}$$

#### 5. Conclusion

At the end of our article, we see that the commonly accepted fixed coordinates may not serve the intended purpose in some subjects, especially social and psychological ones. In fact, the facts may be distorted by this stability. Therefore, there is a need to innovate "variable coordinates" that are suitable for dealing with psychological tests, which naturally yield different results based on the answers or the nature of the person taking the test. Here, the main axes change from one person to another - and we have previously given examples of that. From this, we find a special importance in generalizing and disseminating the idea of "variable coordinates," which move or position their axes based on the obtained results.

God willing, there will be further development of this study to make the coordinates variable in three-dimensional and even four-dimensional space.

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