

Life in Art: A Study of the Life of Vincent van Gogh through his Artwork

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Abstract. The *Starry Night*, painted in June 1889, is a timeless masterpiece created by Vincent van Gogh. The painting is the view of the sky, just before sunrise, from the window of St. Remy, the hospital where van Gogh spent his creative years following a series of psychiatric episodes. *Dunes*, painted in August 1882, is one of the very first pieces of art that van Gogh created. Many argue that the artistic difference between these two paintings along with every other masterpiece created by van Gogh can be accounted by his mental illnesses. Using regression analysis and independent t-test, we can show that there is an artistic difference in his style of paintings before and after the start of his psychiatric episodes.

1 Introduction

Vincent van Gogh (1853-1890) was not the first child to his parents. He was named after his stillborn brother. He had three sisters and two brothers. Although he did well in school, especially for languages, van Gogh dropped out half way through his second year for reasons that are not known to anyone (*Vincent's Life 1853-1890*, n.d.). His first job was as a trainee at an international art dealership in the Hague. Over the years, he worked as an unpaid assistant teacher at a boarding school and at a bookshop in Dordrecht before he turned religious. He turned to study theology in Amsterdam. Abandoning his studies, van Gogh left for Belgium to work as a preacher to serve God. After a failed career, at the age of 27, he decided to become an artist (Blumer, 2002). After 6 years in Netherlands and Belgium, van Gogh moved to Paris to live with his brother, Theo. His psychiatric episodes of sudden terror and unstable behaviour seems to have started in Paris. He had recurring psychiatric episodes and was known to have an unstable personality. He was believed to have committed suicide at the age of 37 after being hospitalised for the last two years of his life.

From 1887, van Gogh's eating and sleeping habits declined while his alcohol consumption increased. The uncertainty of his career as an artist caused him extreme psychological stress (Voskuil, 2020). He was emotionally and socially dependent on his brother. It is said that following key moments in Theo's life, van Gogh had major breakdowns.

Vincent van Gogh was hospitalised in the later stages of his life due to his psychotic episodes towards the end of 1888 after cutting off his ear. During his intense psychiatric struggle, van Gogh paintings show his artistic incline (Meissner, 1994). His artwork reflected the struggles he faced during this period until his death in 1890. Following his death, his paintings gained recognition and appreciation for their intrinsic nature that mirrored the psychological problems he faced.

The suicide of van Gogh can be attributed to various reasons. He had unhealthy attachments to his brother who financially supported him throughout his life. Starting from trauma in his childhood, separation from his parents and his emotional instability led to the suicidal process (Mehlum, 1996). The intensity and frustration of his life can be seen through his artwork. People, knowing his life and psychiatric problems, can understand the pain and chaos behind his paintings. The question that many argue about van Gogh is the reason behind his change of style in paintings over the years. The mad genius hypothesis is one question that many ponder over, namely that the artistic development of van Gogh can be contributed to his mental illness.

2 Methodology

The data contains 1152 artworks of Vincent van Gogh which include paintings, sketches and drawings from the museums of van Gogh, Kröller-Müller and various other private collections. The data includes the human ratings of 402 participants to measure the creativity, arousal, valence and cohesivity of the various paintings. The participants were representative of all ages and genders with a higher proportion of participants within the age range of 21 to 31 years. 37,540 human ratings were collected for all the paintings of van Gogh.

The participants were asked to select superior and inferior images from a range of four van Gogh's artworks under the different categories. No two pairs of images were repeated and each image was shown to the participants an equal number of times. Each artwork has a ranking for creativity, arousal, valence and cohesivity which shows how conservative or groundbreaking the participants feel the painting is, how relaxed or stimulated and how sad or happy the paintings make them feel and, how disorderly or organised the painting seems respectively.

Each artwork is uniquely identified with an id number along with the date it was painted on. The data also contains the Shannon Entropy calculated using the Scikit-Image library in Python for each individual artwork. Homogeneity contains the difference between the Gaussian blurred images and the original images. The dataset contains the title of each paintings and a URL for the painting.

For further analysis, the unique id, the date, the type of human ratings and the value for each are the only information that is relevant. While cleaning the data using RStudio, certain category ratings with duplicates for the same image were averaged to get a composite score while separating the values for the different types of human ratings. According to the years, the artwork and ratings were categorised into two groups, namely before and after 1888, which marked the start of van Gogh's mental health problems. The data was also grouped into different time periods according to the key moments in his life to evaluate the differences in his artwork.

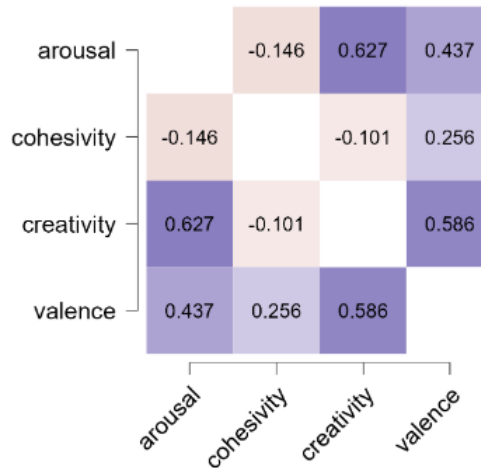


Figure 1: Pearson's r correlation coefficients of the different types of artwork in a heatmap

Using JASP, it is seen that the human ratings are related to each other. Figure 1 shows the heatmap for the Pearson's r correlation coefficients amongst the different categories. Arousal and valence have a moderately positive effect on creativity while cohesivity has a weak negative effect on creativity of the artwork. There is a moderate positive relationship between the valence ratings and the arousal ratings of the paintings of van Gogh.

From the data, it is seen that the participants see the paintings of Vincent van Gogh before the start of his mental health problems as more organised than after. However, the valence and arousal ratings are higher after 1888. The participants feel that the paintings after his mental health problems started

were more stimulating with extreme emotions seen. Figure 2 shows the difference in creativity, arousal, valence and cohesivity before and after 1888, the start of his mental problems. It is also seen that the creativity ratings increase after 1888.

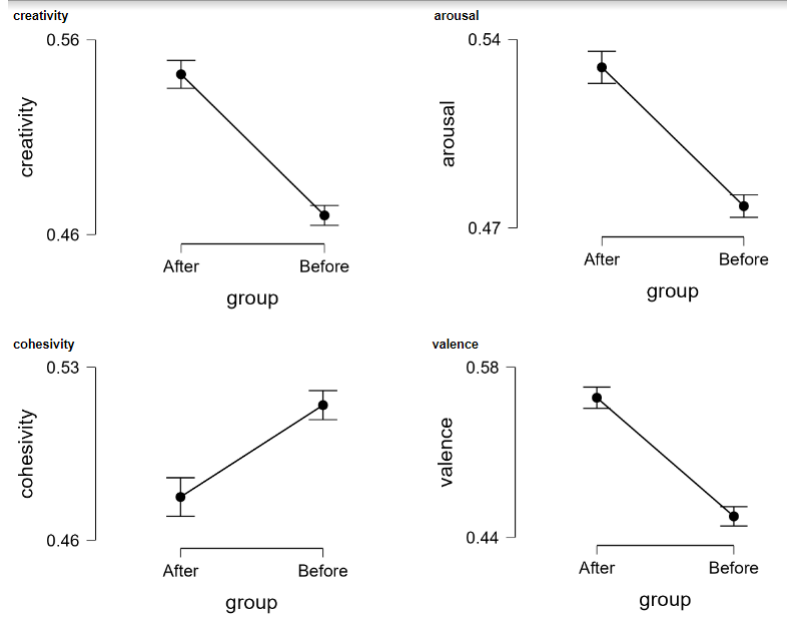


Figure 2: Mean rates of creativity, arousal, cohesivity and valence of Vincent van Gogh's artwork before and after 1888

During the analysis of van Gogh's artwork, it is seen that the different human ratings are correlated to each other as seen in the heatmap in figure 1. From the above formed relationships, the effect of valence, arousal and cohesivity ratings on the human ratings of creativity on van Gogh's artwork can be explored. It is very likely that the participants ratings for creativity was dependent on their opinion of the different categories of the paintings. The multiple regression function can be defined as

$$y = a_0 + a_1x_1 + a_2x_2 + \dots + \epsilon$$

where y is the independent variable

x_i are the i dependent variables

a_0 represents the intercept

a_i represents the coefficients of different dependent variables

ϵ represents the error component

The psychiatric episodes were an important turn in van Gogh's life. The mad genius paradox, which states that creativity and psychopathology are somehow related, can be applied to his life. 1888 saw the start of his mad descent. As seen in figure 2, there is a difference in the human ratings of his paintings for the various categories. We can evaluate this further by using the Independent Student's t test. It is used to determine the statistical difference between the means of two groups, if it exists. The test statistic is given by

$$t = \frac{(x_1 - x_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where x represents the mean

s represents the standard deviation

n represents the number of sample points

Model		Unstandardized	Standard Error	Standardized	t	p
H ₀	(Intercept)	0.500	0.002		209.741	< .001
H ₁	(Intercept)	0.161	0.017		9.321	< .001
	valence	0.322	0.017	0.447	18.693	< .001
	arousal	0.508	0.029	0.408	17.459	< .001
	cohesivity	-0.151	0.021	-0.156	-7.169	< .001

Table 1: Regression model of creativity as a function of valence, arousal and cohesivity

3 Analysis and Results

The ratings for creativity for each of van Gogh’s artwork can be written as a function of the valence, arousal and cohesivity ratings. Table 1 shows the coefficients, standard error, t-statistic and the significance level of the null and alternate multiple regression model in JASP. The model is given by

$$Creativity = 0.161 + 0.322 * Valence + 0.508 * Arousal - 0.151 * Cohesivity$$

When the ratings for valence, arousal and cohesivity are 0, the creativity ratings are at a constant rate of 0.161. When there is a unit increase in the valence, arousal or cohesivity ratings, the creativity increases by 0.322, 0.508 and decreases by 0.151 respectively. Through JASP, we can see that the F-statistic is significant ($p < .001$) which shows that the model is a significantly good predictor of the creativity ratings. From table 1, we can see that all the predictor regression coefficients are significant. The above model can be visualised using the seaborn package in Python grouped by the different periods in van Gogh’s life, as illustrated in figure 3.

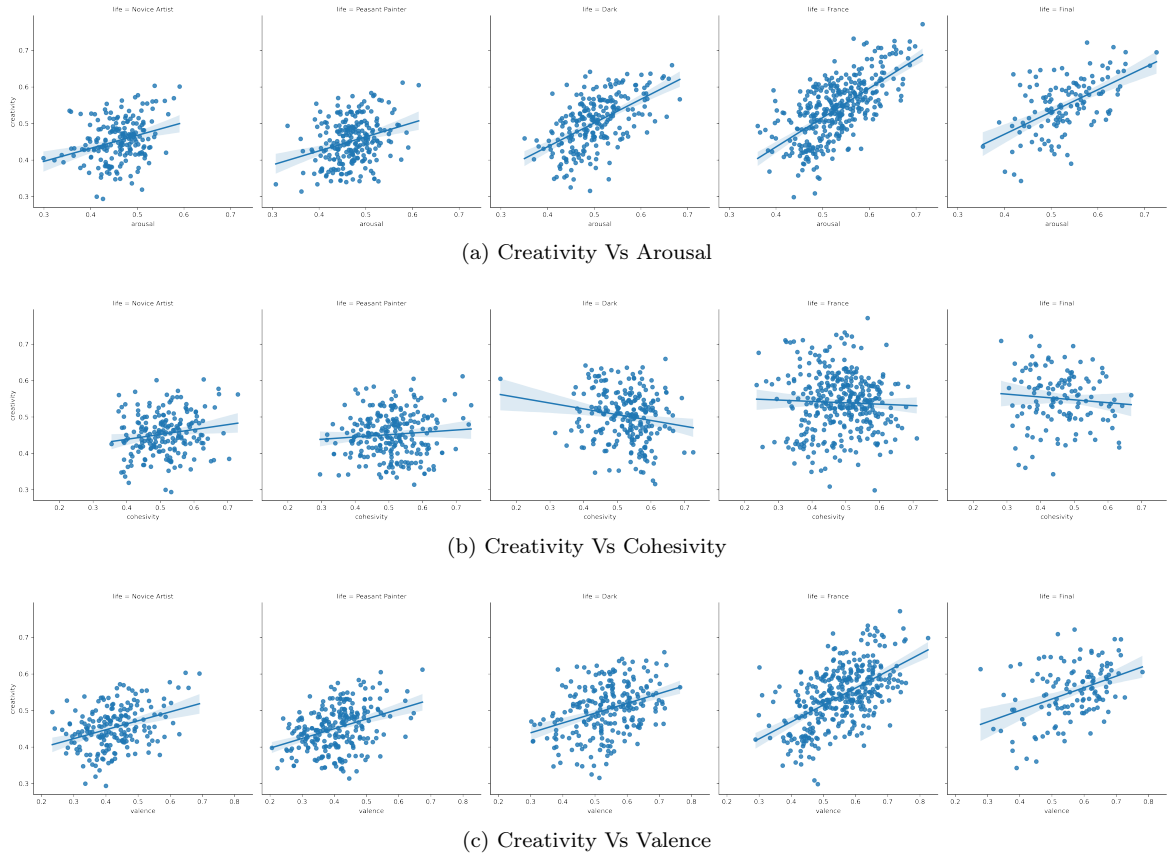


Figure 3: Linear regression models for creativity as a function of arousal, cohesivity and valence through the various time periods of Vincent van Gogh’s life

The novice artist group contains van Gogh's paintings before 1883 such as 'Dunes', 'Two Women in the Woods', 'Woman with Dark Cap' and so on. Arousal, valence and cohesivity ratings are moderately positively related to the creativity ratings. Peasant painter was grouped with artwork such as 'Avenue of Poplars in Autumn', 'Peasant Woman Digging' and any paintings till 1885. Here, the arousal and valence ratings show a positive relationship with the creativity ratings however, cohesivity shows almost no relationship. The dark phase was characterised with his signature style with bright colours while he was in Paris. The paintings from this period (1886 - 1888) included 'The Hill of Montmartre with Stone Quarry' and 'Bridge in the Rain'. While the arousal and valence ratings have a stronger positive relationship to the creativity than the prior phases, the cohesivity has a negative effect on the creativity scores. France and Final phases was characterised by the duration of his mental illness followed by his suicide. These phases see an increase in artistic talent as seen by the ratings of arousal and valence having a strong positive relationship with creativity and cohesivity having a negative or no effect on the creativity ratings. The paintings from this period include 'The Harvest', 'Portrait of Gauguin', 'The Starry Night', 'Almond Blossom' and so on.

From the above analysis, it is clear that there is a significant difference between the paintings before and after 1888 and the ratings given by the participants also show that their opinions of the paintings in the two time periods are varied as seen in figure 2. To further understand the distance and its significance, a Student's t-test analysis can be done using JASP. Here, we have assumed the null hypothesis to be such that there is no difference in the means of the human ratings between the two time periods i.e. before 1888, where there was no indication of any mental illness and after 1888, where van Gogh started showing symptoms of psychiatric illness.

Table 2 shows the computed t-statistic for all types of ratings. All ratings show a significant statistical difference between the two time periods. A larger t-score indicates a larger difference between the time periods. Hence, it is clear that the creativity scores were significantly higher after the start of van Gogh's mental issues ($t(1157) = 16.661, p < .001$). The arousal and valence scores are also significantly higher after 1888 ($t(1157) = 14.375$ and 16.053 respectively, $p < .001$). However, the cohesivity scores are significantly lower after 1888 ($t(1157) = -7.613, p < .001$).

	t	df	p	Mean Difference	SE Difference
creativity	16.661	1157	< .001*	0.072	0.004
arousal	14.375	1157	< .001*	0.052	0.004
cohesivity	-7.613	1157	< .001*	-0.037	0.005
valence	16.053	1157	< .001	0.098	0.006

Table 2: Independent t-test for creativity, arousal, cohesivity and valence before and after 1888

The above results can be visualised in a scatter plot using the seaborn package in Python as shown in figure 4. It is easy to visualise the higher scores for creativity, arousal and valence after 1888 and lower scores for the same before 1888. However, the cohesivity has higher ratings before 1888 and lower scores after 1888. The figure shows the relationship between the different scores in both time periods with clear statistical difference.

4 Conclusion and Discussion

From the analysis, it is clear that there is a significant artistic difference before and after Vincent van Gogh experienced his psychiatric episodes and his hospitalisation soon after. The participants feel that his paintings after 1888 were more creative and disorganised than before the start of his mental illness. Participants felt more aroused and happier after seeing the pictures of the paintings he created after his hospitalisation. Through different stages in his life, we can see the artistic incline across his artwork. This effect is significantly evident in the artwork created at St. Remy's.

Artists are considered to be eccentric and skilled. Vincent van Gogh is one of many who fit the description of a mad genius. However, this effect is valid only when perceived by other people. In a study conducted in 2014 (Van Tilburg & Igou, 2014), people's evaluation of van Gogh's 'Sunflowers'

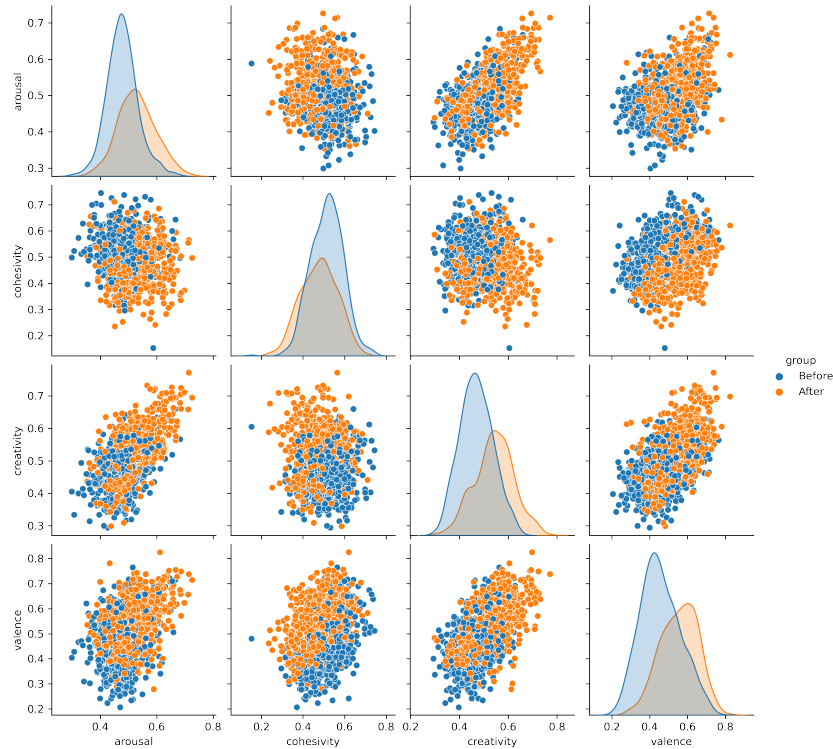


Figure 4: Scatter plot before and after 1888

was highly positive only after the information that he cut his ear off was presented. The study concludes that participants rated artwork on a higher scale when they know that the artist was eccentric. It is a well known fact that towards the end of his life, van Gogh had many psychiatric episodes. The results obtained from the participants can be influenced by the knowledge of this fact.

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