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The Creative Side of Mood Disorders

Michael H. Chruszczewski
University of Warsaw, Poland
E-mail address: Mikael@psych.uw.edu.pl

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ABSTRACT

The paper describes the relationship between creativity and mood disorders. After outlining the main directions of research in this field, the nature of the ascertained correlation between creativity and mood disorders is analysed from a theoretical perspective. Psychological and biological approaches are taken into account. The first is focused on the significance of periods of mania and their influence on cognitive and motivational processes; the second is focused on genetic aspects. A compromise hypothesis based on both approaches is proposed and discussed, in which creativity and mood disorders, although co-determined by basic genetic factors are not independent and influence each other mutually.

The psychology of individual differences places creativity at the crossroads of personality and intelligence (Aguilar-Alonso, 1996; Eysenck, 1995a). Both can be affected by disorders. Therefore, it would seem that deficiencies in the sphere of personality or intellect caused by psychological disorders would inhibit creative activity. An assumption of this kind might potentially be true, under one condition: that creativity is fostered only by those individual traits that are associated with good adaptation. However, in the light of philosophical reflections dating back to antiquity, and empirical studies which have been conducted for at least seventy years (for an example see Eysenck, 1994), this is not the case.

In discussions on the relationship between creativity and psychological disorders Plato and Aristotle are often quoted. The first of them (see „Phaedrus", XXII, by Plato, IVth century BC/1993) emphasised the affinity of art and madness, and argued that art – treated as being born from divine madness (mania sui generis) – is superior to all kinds of academism. Plato also stressed the particular proximity of that madness to poetry. The second of them, Aristotle, linked melancholia (which means depression or at least dysthymia in modern psychology terms) with eminence in various domains, not only artistic, but also in philosophy and politics (cf. „Problemata"[1], XXX, 1 – Aristotle, IVth century BC/1980). The

classical philosophers, could not have Known the truth of, these ancient observations but they have been corroborated by the results of modern empirical research, according to which some psychological disorders have been found to correlate to varying degrees with creativity.

There are various methods of addressing the phenomenon of creativity on different levels. In particular, inferences about exceptional creativity are made on the basis of achievements, while creative potential is assessed on the basis of test results. Such tests usually measure divergent thinking. In order to present as complete a perspective as possible on the subject, this paper addresses both types of creativity with reference to existing examples from the literature.

The research in this field started with biographical analyses and then turned to studying actual creators. Such studies involved clinical and psychometrical approaches, using both diagnoses and questionnaire methods. A significant supplementation of these methods came in the form of clinical studies on people without particular creative achievements, which corresponded to testing potential creativity. In recent years a new methodological approach has been developed that is based on analysing various amounts of pre-existing data that was collected for purposes other than psychological research, i.e. epidemiological studies, gathered for administrative purposes, usually in the domain of public health.

The aim of this paper is to present the key findings from the existing research on mood disorders and creativity and to discuss hypotheses that could provide an explanation for the co-existence of creativity and such disorders. In the light of many findings, bipolar mood disorders seem to be particularly bound with creativity, which have made them the key focus of this paper. The main assertions are that affective mood disorders and creativity have a common genetic basis, and that they are not only co-related on a biological level, but also mood swings may stimulate creativity in people suffering from affective mood disorders.

THE RESEARCH METHODS AND KEY FINDINGS

The historical approach revolved around a basic question on the relationship between psychopathology and creativity *in genere*. Therefore, it was almost impossible not to address the relationship between creativity and other disorders, some of which, such as alcoholism, are highly related to affective disorders. In particular, a tangential approach of this kind was prominent when presenting older, mostly biographical, studies.

Biographical studies

One of the first important biographical studies was performed by Juda (1949) who ana-

[1] In fact „Problemata" is traditionally attributed to Aristotle, however, this work was created by his students.

lysed the biographies of German and Austrian eminent artists, writers, composers and architects. She had a number of predecessors, e.g. Raskin (1936), although the forerunner in this field was undeniably Galton (1869). Galton studied the inheritance of abilities by analysing generations of families, and was also the pioneer of twin studies. He claimed that individuals who were extremely active intellectually must have interesting minds and are likely to become crazy or even break down. The seventeen years of Juda's work led her to the conclusion that among creative achievers there was a high prevalence of mental disorders. According to her study, the lowest percentage of mental disorders was observed in the group of architects (17%) and sculptors (18%), it was somewhat higher in the group of painters (20%) and was significantly higher among musicians (38%). The highest prevalence of mental disorders was observed for the group of poets (50%). Moreover, Juda found that children and siblings of creative individuals suffered from manic-depressive psychosis and cyclothymia (the milder form of the bipolar disorder) more often than would be expected in the general population. The suicidal rate was also higher.

More contemporary, although narrower, biographical research was performed by Martindale (1972), who studied the biographies of forty well-known and highly appreciated English and French poets living between 1670 and 1909. In his findings Martindale stated that the symptoms of severe psychopathology existed in about half of the poets included in the study (55% for English poets, and 40% for French poets). This conclusion was consistent with Juda's results. Twenty years later Ludwig (1992) accomplished a vast study based on thirty years of work with biographic material, in which he established that the ratio of psychoses, suicidal attempts and drug abuse was three time higher in a group of artists than in the general population.

Another major study was conducted by Post (1994), who reviewed the biographical data of almost three hundred world-class scientists, composers, politicians, artists, philosophers, thinkers and writers. The study employed DSM–III-R diagnostic criteria. The results of the study differentiated the occurrence of severe psychopathological symptoms based on the domain of creativity. The symptoms were various in nature, but their common outcome were difficulties at work and in daily routine, which resulted in their classification as severe. Symptoms particularly associated with creative individuals were related to affective disorders, alcoholism and to a lesser extent psychosexual disorders. Such symptoms were present in 17% of politicians, 18% of scientists, 26% of philosophers and thinkers, 31% of composers, 38% of artists, and 46% of writers. These results were very similar to Juda’s findings, despite the fact that half a century had passed, bringing different classifications of mental disorders and differences in methodology in general.

Another key finding in Post's research was that although the number of cases with schizophrenia was marginal, the odds ratio for this diagnosis was 1.7 times higher in the group of creators, in comparison to the general population (1.7% versus 1%). The results suggest a link between mental, especially affective, disorders and creativity.

Studies on living creative individuals

Studies on living creators have corroborated the findings of the biographical studies, by showing a relatively large co-occurrence of creativity and psychological disorders or tendencies towards such disorders. An example of one of the early clinical works of this kind was published by Myerson & Boyle (1941). In the following decades Andreasen (1987) became famous due to her work on a group of thirty distinguished writers who taught in literary workshops at Iowa State University. Among numerous literary workshops organised each year in the USA, those organised by Iowa State University are considered to be highly prestigious. The courses were taught by, among others, Philip Roth, Kurt Vonnegut and John Irving, all of whom agreed to participate in Andreasen's research. According to her findings, half of the studied writers had been affected by bipolar mood disorder and two thirds of them were psychiatric patients. She did not observe any cases of schizophrenia, even though she hypothesised that her subjects would be more likely to disclose symptoms of schizophrenia than of mood disorders. Interestingly, first degree relatives of the participants of the study quite often also demonstrated some kind of creative activity and had psychological disorders. Among others, the relatives were professional musicians, inventors, painters, or scientists etc. In this group affective disorders in general were almost 9 times more frequent than among relatives of the control group; for the major depressive disorder alone the ratio equalled 7.5. Further evidence supporting Andreasen came from Jamison (1989), whose study results indicated more frequent affective disorders (and milder states such as hypomania and subdepression) among artists, particularly writers.

Further interesting results, although limited to women, were observed in a study by Ludwig (1994). He compared the results of clinical interviews and questionnaires in a group of women writers with a numerically equivalent control group (n=59), finding that writers were more likely to suffer from affective disorders. Furthermore, in the group of writers the abuse of psychoactive substances, anxiety and eating disorders were more prevalent. Also, writers were more likely to experience more than one psychological disorder, when compared to the members of the control group. The analysis of the interviews showed that writers were more often exposed to domestic violence, sexual abuse and other forms of mistreatment in their childhood. At the same time, the writers' mothers

were more likely to have psychological problems, but writers' parents were also more creative than parents of the members of the control group. This may suggest that creativity and affective disorders co-occur partially as a result of family environment determinants.

Psychometrical studies

Within the psychometrical approach to the subject, a study by Barron (1963, 1969) requires particular attention. Barron ascertained that writers scored highly on all but one of the basic MMPI scales. The exception was the masculinity-femininity scale, which is not related to any disorder. The writers' scores reached approximately +1,5 SD, which was high, but not high enough to place them above the clinical level (of +2 SD). Therefore, the interpretation of the results discussed proneness to disorders rather than disorders as such.

Eysenck was another prominent author (Eysenck & Furnham, 1993), who demonstrated consistent and stable positive correlations – from low to moderate – between psychoticism as an individual trait and various measures of creativity, in particular those referenced by the Barron-Welsh Art Scale scores and Word Association Rare Responses Test scores. Eysenck's understanding was that psychoticism was a risk factor for general psychopathology (with the exception of the neuroses). His studies, similarly to Barron's, have shown that creative individuals' results usually did not reach +2 SD in the psychoticism scale.

These empirical facts might substantiate hypotheses placing creative thinking in the sphere of conceptual borderlands: at the edge of what we consider a norm and pathology, in a penumbra between rationality and irrationality (for more, see regression in the service of the ego – Kris, 1952) or even more literally: between states of dreaming and wakefulness (appropriate neuropsychological view: Obiols, 1996). Consequently, creators would be expected to be sensible, independent and original, and free from pathological disorganisation of behaviour and reasoning. This assertion has been supported by another finding; creators who scored high on the clinical scales paradoxically also demonstrated two important attributes of good functioning: high scores on the ego-strength scale and high results on the intelligence scales (see Fodor, 1995). Further research by Simonton (2004), who also used psychometrical methods, confirmed that the relationship between creativity and psychological disorders, or tendencies towards such, is statistically significantly stronger for artists than for scientists; a notion previously well established in numerous biographical and clinical studies.

The results presented above do not directly substantiate the assertion that creativity and affective disorders (or any disorders for that matter) are correlated. Firstly, any co-existence of creativity and mental disorders does not imply that affective disorders, or any others, are a pre-requisite to creativity, even in exceptional forms. The majority of creative

individuals, with perhaps the exception of writers, are mentally healthy. Secondly, a psychometric assessment is not equivalent to clinical diagnosis; therefore, it is possible for one to suffer from a disorder and have low test scores, or equally likely, to obtain high test scores and be mentally healthy. Yet, the sole fact that creative individuals do obtain unusually high scores on clinical psychometric scales may signify the existence of a statistical trend that weakly reflects the true relationship between creativity and mental disorders.

Epidemiological studies with profession used as a creativity marker

Additional support for the above-mentioned findings has come from analyses conducted on large datasets, primarily collected for medical epidemiological and genetic studies. For example, in a vast study (n=5040) performed in Denmark on individuals who were adopted as very small children (McNeil, 1971), a comparison was made between three groups of highly creative individuals (n=10), moderately creative individuals (n=20), and non-creative individuals (n=20). The first division was made on the basis of profession. A hundred individuals were chosen from potentially creative professions or where the likelihood of being creative was higher, and two hundred individuals were selected from professions considered less creative. All participants were given self-descriptive questionnaires, where their creativity was tested through problem-solving tasks and expressive behaviour measures. Psychiatric evaluations were collected from hospital registers, science institutes and military registers. The results showed higher prevalence of psychological disorders among members of the highly creative group, in contrast to the other two groups. Moreover, a higher percentage of mental disorders was observed among the biological parents of members of the highly creative group, supporting the genetic background for the disorders. The psychological problems that the individuals in the highly creative group experienced usually revealed themselves before they reached eminent professional status. Unfortunately, due to small sample sizes, the study did not allow psychiatric diagnoses to be differentiated on the basis of creativity levels. However, an analogical study which began almost simultaneously with McNeil's, but was published forty years later, factored in the effect of type of disorder on creativity.

Kyaga, Landén, Boman, Hultman, Långström and Lichtenstein (2013) analysed data from the Swedish National Patient Register, collected between 1973 and 2009. The dataset contained information on more than one million patients (1,173,763 to be exact). Swedish state registers are very reliable and accurate; therefore, the study was performed on a complete sample equivalent to the general population. The method used in the study was to classify patients into creative groups on the basis of profession, which is a weak assumption, of which the authors were aware. Individuals in the creative pro-

fessions had a higher risk of experiencing affective bipolar disorder. Moreover, the choice of a creative profession was more often observed among first degree relatives of patients suffering from affective and schizoaffective disorders or schizophrenia, (even more often than among the patients, whose relatives they were). Analyses performed for writers as a subgroup indicated that the risk of experiencing affective bipolar disorder and, which may be interesting, schizophrenia, was twice that expected for the control group. Writers were also more prone to anxiety disorders, addictions, and affective unipolar disorders. Suicides were also more prevalent in this group. Kyaga et al. (2013) also conducted an analysis on the group containing cases of suicide, after excluding all cases of psychological abnormality. The results suggested that even writers considered mentally healthy tended to commit suicide more often than the mentally healthy Swedes in general (odds ratio=1.49). Additional findings provided some insight into autism and anorexia. It was found that in the group of identical twins, if the first twin was autistic or had anorexia, the other twin with no diagnosed disorders tended to be a member of a creative profession (odds ratio=1.30, and 1.04, respectively). The same applied to the parents of anorectic children. In contrast, not the parents, but the children of individuals with attention deficit hyperactivity disorder tended to choose creative professional work; for scientific professions the odds ratio equalled 1.19, while for artistic professions – 1.21.

A somewhat similar pattern of relationships was observed in a group of Polish students studying at artistic faculties when compared to the students of technical faculties (Siwek et al., 2013). Art students obtained higher scores in the scales measuring certain bipolarity features and were more likely to show behaviours and activities associated with such disorders, for example, use of psychoactive substances and seeking psychological or psychiatric help, respectively.

Clinical studies on non-eminently creative individuals

Further indication of the existence of a relationship between creativity and disorders was observed in studies of clinical groups. Although such studies were aimed at assessing creative potential measured with test scores, their findings are relevant to the subject of this paper. Two of these studies are discussed in detail below; however, other research projects have also provided similar or non-opposing results (for example, see Rybakowski & Klonowska, 2011).

The first study was conducted by Santosa et al. (2007) who compared performance on tests of creativity in a group of patients suffering from bipolar affective disorders and major depressive disorder with a control group of healthy individuals, and with a group of creative students. The latter group comprised various arts students including design and

members of literature workshops. Members of the clinical groups were at the time of conducting the study in the normal non-depressed state (euthymia) and 75% of them were being pharmacologically treated. The group with affective disorders obtained significantly higher scores on the Barron-Welsh test in comparison to the control group. No differences were observed for the Gough and Heilbrun ACL test or Torrance's tests that were also used. This inconsistency is not entirely clear, although the authors addressed it with Adolph's (1999) arguments. He argued that damage to the amygdala leads to a preference for simple stimuli; therefore, enhanced stimulation of the amygdala may result in an adverse effect. This could potentially explain the higher results in the Barron-Welsh test, which calls for a choice between complex and simple stimuli.

An interesting observation from this study was also that 60% of the creative students had suffered in the past from various disorders; however, no cases of mania, hypomania, or psychosis were noted. At the same time, results on the Beck Depression Inventory for the creative group placed their members between the bipolar affective group and the major depressive disorder group.

The second study conducted by Simeonova, Chang, Strong and Ketter (2005) compared performance on creativity tests (including the Barron-Welsh test, often used in clinical studies) between parents suffering from bipolar affective disorder and their children, and a control group comprising parents and their children of similar age. The children were on average 13 to 14 years old (range of age: 9 to 18). In the clinical group none of the children was mentally healthy; they either suffered from bipolar disorder or ADHD or depression. The results of the study indicated that both parents and their children from the clinical group were more creative than members of the control group. The most significant difference was observed on the scale where assessment was related to preference of graphic forms – clinical group members disliked simple forms. The authors argued that „this could reflect increased access to negative affect, which could yield both benefits with respect to providing affective energy for creative achievement, but also yield liabilities with respect to quality of interpersonal relationships or susceptibility to depression" (Simeonova, Chang, Strong & Ketter, 2005, p. 623). The results suggest the existence of biological factors influencing creativity and the inclination towards affective disorders. Interestingly, the authors also argue that the increased creativity of the children might have also been a result of the family environment. Probably, both arguments are valid.

Summary of the empirical results

On review of the above-mentioned studies it is necessary to emphasise the existence of a positive statistically significant association between creativity and affective disorders,

bipolar in particular. The strength of this relationship was found to depend on the creative domain, the highest values being obtained in the field of literature, smaller ones for fine arts and music, and the weakest ones in the sciences and politics. In the case of fine arts this relationship was generally quite strong, however, only when eminent creativity was considered (cf. Ludwig, 1995). Little evidence exists on the relationship between moderate creativity and mental health issues. However, an example could be a study by Schuldberg (1990) where a correlation between moderate creativity and hypomania was observed. As the biographical studies suggest, it would seem that mental disorders are antecedent to creative acts, rather than following them or arising from them.

Drug abuse, addictions and suicides were more prevalent in the group of creative individuals as compared to the general population of those suffering from mood disorders, independently of their creative abilities. Another important conclusion from the presented studies related to the siblings of creative individuals, who also tended to be generally creative, though not necessarily in the same domain. Siblings also tended to suffer from a variety of psychological issues.

Clinical studies also confirm the co-existence of creativity and bipolar disorder, suggesting the complex nature of this relationship resulting both from biological factors and the family environment.

These results are consistent throughout studies irrespective of their methodology, across time, and despite the fact that different medical classifications for mental disorders were employed, which only further supports the conclusions. The significance of these findings is not derived from the measurement process nor from the definitional approach. Instead, a relationship between these two phenomena consistently appears, which begs for an explanation as to its nature.

CREATIVITY – MOOD DISORDERS EXPLANATORY MODELS

In order to explain the existing relationship between creativity and mood disorders Richards (1999) presented five explanatory models of covariance between the tendency towards psychological disorders and creativity. The first model assumed that psychological disorders directly cause creativity. The second model assumed that disorders indirectly cause creativity, with the presence of a moderator of an unknown nature. The third and fourth models reversed the causality chain, and hypothesised that, respectively, creativity is a direct cause for psychological disorders, or creativity is an indirect cause of psychological disorders (per analogiam to models one and two). The fifth model did not assume any causality between creativity and psychological disorders, but suggested that both have a common latent determinant.

The basic question behind attempting to resolve the problem of causality revolves around bipolar mood disorder (see also Richards, 1994). Even though the majority of eminent creators are mentally healthy and, in particular, free from mood disorders, the overrepresentation of cases where creativity and bipolar mood disorders co-occur is intriguing. Which specific factor, that could potentially facilitate eminent creativity, would also be involved in extreme mood fluctuations?

It is well known that bipolar mood disorder consists of two alternating phases of mania and depression, which are usually separated by a period of fairly normal functioning. Irrespective of the causality models for the moment, what is the psychological mechanism that allows mood disorders to foster creativity? Let us consider what that mechanism could be and how it could work. In order to do so, let us compare unipolar and bipolar disorders. Bipolar mood disorders differ from unipolar mood disorders because of the presence of the episodes of mania. Since unipolar disorders do not seem to be related to creativity, the answer could potentially lie within the episodes of mania, which could serve as periods of inspiration. Elevated mood connected with intuitive and irrational thinking could facilitate creating remote associations and using broader conceptual categories, which are important factors in fostering the process of inventing new ideas. Such ideas could then be evaluated during the phase of normal functioning or sub depression, probably more strictly and critically in the latter. The ideas that survive such an appraisal could potentially be valuable, assuming that the creator is also highly competent in his field of activity and demonstrates higher than average abilities. A consecutive episode of mania might then provide the large amount of energy required for intense work, which would speed up the process of creation. Another benefit for the creative process would be resistance to any criticism and elevated self-confidence, typical for both mania, and required in the generative phase of the creative process, when premature criticism (and self -criticism) might be dangerous to the new ideas.

Therefore, it is possible that states of mania (or hypomania) may temporarily enhance creative cognitive abilities (to read more about pro-creative functions of positive mood see: Hirt, 1999; Isen, Daubman & Nowicki, 1987; Sterczyński & Kolańczyk, 2004). Subsequently, such states may create advantageous motivation for a creative project, which can be a rather risky enterprise. The depressive (or subdepressive) periods would perform a corrective or control role. However, it can also be argued that both severe depression and mania, or phases of extremely low or high activation in general, effectively limit or prevent creativity, due to their detrimental impact on behaviour. For this reason creativity is more likely to be stimulated in the hypomanic and sub-depression phases rather

than in severe depression or manic phases. Richards and Kinney (1990) studied the self-assessment of the impact of affective states on creativity in people suffering from affective disorders. The subjects' responses varied, but the positive effect of hypomania was pointed out more often and it was the preferred state for the respondents. Further, it is possible that positive mood increases creative productivity in terms of quantity rather than quality of the products (Weisberg, 1994). However, the relative importance of positive mood may decrease in favour of negative mood when the task changes from a play-like situation to a serious one (Baas, de Dreu & Nijstad, 2008). In general, positive mood would seem to be crucial for the phase of generating new ideas, while later, in the phase of implementation, „looking through darker glasses" might be beneficiary to the process. The relationship described above could serve as an explanation, linking the influence of mood with the stages of the creative process. It could also serve as a framework for a synthesis of the empirical research, bearing in mind their different and sometimes contradictory findings (Baas, de Dreu & Nijstad, 2008; Davis, 2009; Kaufmann, 2003). Nevertheless, these findings only pertain to mood disorders in non-clinical populations. The aforementioned meta-analyses did not include clinical group studies. Any inferences regarding the influence of mood on creativity in clinical populations per analogiam to non-clinical populations, however tempting, have not been proven and remain speculative.

Apart from mania, there is yet another feature of bipolar mood disorder that could hypothetically, facilitate the creative process, namely the abrupt mood changes that may occur (Richards, 1994). Nonetheless, any clear, empirical evidence supporting such facilitation processes is still lacking. In the case of bipolar disorder, such changes can reach in their extent, beyond the experience of the majority of the population. As such they could possibly create the opportunity for a 'transitional' connection between the areas of experience marked by adverse emotions, which probably facilitate the process of creating astonishing and original solutions.

(Un)answered questions

Possible explanations for the mechanism that might facilitate creativity do not provide answers to several important questions. First, how can the differences in the distribution of mood disorders among creative people in different creative domains be explained? Second, why do those differences pertain only to eminent creativity? And finally, do mood disorders determine facilitation of the creative process or not?

The answer to the first question is related to the interaction between creativity and other mind activities or traits. Different domains of creativity demand – to a different extent – logical thinking, planning, concentration, conscientiousness, but also unconventionalism,

quest diversity, thought wandering, independence, auto-expression, fantasy, and associative and irrational thinking. Therefore, different domains require different proportions of order and chaos, or logic and fantasy. Assuming there is a continuum that spreads from the sciences to the arts, different creative domains are likely to be set at different points along that continuum, and different people may be attracted to different domains on the basis of their personal preferences. The opportunity to express oneself seems to be particularly appealing in this context. A painter has more opportunity to express himself than, for example, an archaeologist. And mood disorders may enhance that need. People suffering from mood disorders or people prone to such, may more willingly choose those domains, in which the rules of social correctness are more lenient and where the opportunities for unhampered auto-expression are greater. More formalised and strict domains, such as architecture or technical sciences, would probably be less appealing to a personality influenced by mood disorders than less formalised domains such as ethnology or literary studies.

A response to the second question calls for a highly speculative explanation. It is possible that a high level of creative abilities makes up for the downside of being affectively disordered; or that such abilities employ those aspects of the disorder that would work in favour of creativity[2]. Another possibility, which is more probable, is that eminent creativity and mood disorders are biologically determined, and their connection is overly theoreticised. Nonetheless, there is no easy explanation. On the one hand there are strong arguments for the biological background hypothesis. For example, the higher level of creativity among siblings of persons suffering from affective disorders, the higher prevalence of mood disorders among relatives of creative individuals, or the higher level of creativity among siblings of creative persons, etc. One of the most prominent supporters of this explanation was Eysenck (1995b). On the other hand, there are some environmental and individual (psychological not genetic) factors that take part in fostering creativity. For example, it has been documented that many creative people had a lonely and difficult childhood (Eisenstadt, 1978; Feldman, 1999; Simonton, 1988), which might have led to developing certain mood disorders. Nevertheless the question then arises: did they have an unhappy childhood by tough luck, but that may be the way they became creative people? Or is it a special, reactive variant of a genotype-environment correlation, where the children who are (partly due to genetics), independent, original, even „strange", are also more likely to be badly treated? The evidence gathered does not allow us to judge in favour of either explanation, and it is highly probable that both options are or might be true. A lone-

[2] Based on the criteria of social recognition for outstanding achievements (cf. Runco, 2009).

ly and difficult childhood may not only be due to bad treatment or bad nurturing, but also may be the consequence of random unhappy events, such as a parent's death. Nevertheless, it seems that people with mood disorders are more likely to be attracted to the arts, including poetry and drama, in principle, as means for e.g. channelling out the unprocessed tension, than to e.g. studying the evolution of the excretory system in invertebrates.

The hypotheses described above should be considered as complementary rather than competitive; however, they should not be perceived as equivalent. In response to the third question, and following the conceptual models proposed by Richards (1999), a few examples can be drawn. Firstly, mental disorder sometimes becomes the substance for the creative work (e.g. Gérard de Nerval). Secondly, creativity can serve as a means for auto-therapy (e.g. Jan Lechoń). Thirdly, a crisis during creative work may push a person into a psychological breakdown or towards suicide (see „Rotten wood" by Wacław Berent, a literary fiction masterfully set in the reality of the epoch), or, with reference to the fourth model, an unhealthy lifestyle appropriate for some artistic, medical, juridical and some other professional circles may drive someone (probably prone to such) into addictions or depression. Finally, there is a common biological, partly genetic, background for the creativity and mood disorders tandem; but mood disorders and creativity are independent. This last model is most strongly supported by empirical studies and is further briefly discussed below.

The most probable hypothesis

Eysenck (1995b) proposed a complex causative model in order to explain the correlation between mood disorders and creativity. He stated that a well-defined genetic factor influences both the activity of the hippocampus formation and dopamine (increased) and serotonin (decreased) levels, which jointly weaken cognitive inhibition – one of the cognitive mechanisms fostering creativity. Weakened cognitive inhibition, including among other things, overinclusive thinking, is the ground on which affective disorders, schizoaffective disorders, schizophrenia, and independence and originality (all associated with Eysenck's trait of high psychoticism) may flourish when appropriately combined with other, also external, factors. Psychoticism when supported by high intelligence, other abilities, competences, and knowledge, and in favourable environmental circumstances, may bring forth some good fruits in the form of creative achievements. It seems that Eysenck's model has found partial support in molecular genetics.

Molecular genetics contributes to creativity – mood disorders debate

The new evidence that shed some light on the issue of the effects of genes on the creativity and mood-disorders debate was presented by new research in molecular genetics.

According to Schmechel's (2012) study, 38% of professionals in creative domains, as opposed to 13% of people performing other jobs, had rare polymorphisms (called S and Z) of the alpha 1-antitrypsin (A1AT) gene. A similar percentage of these gene polymorphisms was observed among subjects with bipolar affective disorders, anxiety disorders, and lung and liver diseases. A positive side-effect of polymorphisms in A1AT was intense energetic, creative drive. The A1AT gene is, therefore, currently perceived as one of the molecular determinants of the creativity – mood disorders correlation.

Soeiro-de-Souza et al. (2012) have demonstrated that brain-derived neurotropic factor (BDNF) involved in the pathophysiology of bipolar disorder is also genetically (i.e. BNDF polymorphism Val(66)Met) associated with creativity, but only in clinical populations. The carriers of Met–allele (Val) were more creative than Met+ allele (Met) carriers according to scores on the Barron-Welsh Arts Scale. This finding was strictly limited to subjects who suffered from episodes of mania. Neither Met– vs. Met+ patients undergoing an episode of depression nor members of the control group displayed any change in their levels of creativity.

In another study, Reuter, Roth, Holve and Hennig (2006) found an association between creativity and two other genetic polymorphisms. The first polymorphism was observed in the Tag IA dopamine receptor gene of the second subtype (DRD2); the gene is responsible for the density of dopamine receptors. Earlier, Chávez-Eakle (2004) pointed in her study, to another dopamine gene: the dopamine receptor of the fourth subtype gene. The second polymorphism observed by Reuter et al. (2006) was in the A779C hydroxylase tryptophan (TPH1) gene, which is engaged in serotonin synthesis. According to Reuter et al. (2006), both of these polymorphisms statistically explained 9% of the variance in creativity measured psychometrically. In the reality of genetic studies, in particular in terms of the effect sizes observed in such studies, 9% of variance assigned to two polymorphisms jointly suggests a powerful effect. As an explanation, the authors of the study referred to hemispheric organization of cognitive functions: DRD2 indirectly favours divergent thinking in the area of the left hemisphere, whereas TPH1 accounts of similar processes in the area of the right hemisphere.

In accordance with the findings of Li & He (2006), the polymorphism of the A779C gene, briefly called TPH1 (see above for the details), was one of two polymorphisms associated with schizophrenia. These findings immediately created a link with the discussion on the madness-creativity affinity on the grounds of a partly common genetic basis; however, more evidence pointed to affective disorders rather than schizophrenia or similar disorders as being implicated.

CONCLUSION

The field of molecular genetics is certain to provide more evidence in the near future on the origins of creativity and its links to mood-disorders. However, even without that, the hypothesis on the common cause of creativity and mood disorders and their correlation has currently strong support. It is much stronger than when it was formulated by Eysenck, and even then it was influential.

It is worth noting that research projects negating the relationship between mental disorders, and mood disorders in particular, and creativity are rare. One exception is a paper by Waddell (1998), which is a review rather than a research report. The author comments on the methodological shortcomings of previous research (case studies, etc.) and argues that any conclusions on a positive relationship between creativity and psychological disorders emerges solely from the minds of the authors and are not supported by the evidence. In the light of the empirical findings presented above, which are more recent and methodologically superior to the ones criticised by Wadell, and in the light of the theoretical considerations presented, it is hard to agree with Wadell's arguments.

Assuming that to a certain extent, there is a common genetic basis for creativity and a tendency for developing mood disorders, future research should focus on the less-well researched effect of family environment on the creative potential of persons suffering from bipolar disorder. A rational starting point would be a study involving individuals suffering from bipolar disorder and their children. The research should focus on analysing the relationship between parents and their children, their communication styles, and parental attitudes, all in the context of creativity assessment. Future projects might also potentially aim to replicate prominent experimental studies on the effect of mood on creativity in clinical groups.

Arguably, creativity and mood disorders are determined by common factors; moreover, they are not independent from one another, contrary to the orthodox fifth model presented by Richards. Any mood experienced at a particular moment may favour or inhibit (on an affective, cognitive, or motivational level) the course of various stages of the creative process. Creativity and mood disorders influence each other reciprocally. There is a common cause, but there is not complete independence.

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Corresponding author at: Michael H. Chruszczewski, Faculty of Psychology, University of Warsaw, 5/7 Stawki St., 00-183 Warsaw, Poland. E-mail: Mikael@psych.uw.edu.pl