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Mood as a lock gate canalizing multiple creativity: A heuristic single-case study

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ABSTRACT

Background: The concept of creativity encompasses the ability to produce innovatively original solutions that exceed the status quo. Eminent creatives are frequently afflicted with bipolar disorders, and persons presenting certain forms of bipolar disorder might have enhanced creativity. The link between creativity and bipolar disorder has intrigued researchers but no definite liaison has been established between creativity and mood alterations.

Methods: We address this issue on this perspective by analysing various expression forms of creativity, as well as creative achievement according to the clinically diagnosed mood states at an eminent person, treated for bipolar disorder. Beside full agreement of the patient, an ethical committee approval has been granted for processing and publishing the case.

Results: Hypomania boosts visual artistic creativity and scientific work while mild to moderate depression facilitates literary performance. Severe depression and depressive mixed states do not promote either aspect of creativity, and euthymia, with blunted mood swings by medication, is also detrimental to creativity.

Conclusions: It appears that positive but also negative mood have curvilinear effects on creativity. We argue that there are different correlates of a creative process in one person, where mood functions as a lock gate to canalize various creativity forms, resulting in multiple creativity as a function of distinct mood states in bipolar disorder.

Limitations: The lack of performing the studies of personality is a limitation of the paper.

1. Introduction

Creativity, as well as other essential phenomena of human existence, have engendered extensive debates among scientists. One of the most considerable challenges encountered by creativity researchers of various approaches (e.g. psychological, sociological, neurobiological, computational) is defining properly creativity. Creativity research offers indeed an impressive array of approaches and paradigms to analysing distinct definitions of creativity. The term itself is confounded by value judgements and different viewpoints have already been offered on determining creativity as its definition should be necessary for scientific enquiry. Nonetheless, disagreements persist since some researchers prefer broadening the definition, arguing that creativity is a property of a *process* (Boden, 2003; Guilford, 1967; Wiggins & Bhattacharya, 2014), whereas others maintain the classic conceptual boundaries of creativity, defining it in terms of exceptional creative *product*. We eschew here entering into the polemics on process *versus* product view of creativity, retaining the concept of creativity in the sense that it encompasses the ability to produce something originally new and positive (Andreasen, 2005), which is accepted as the new status quo (Zaidel, 2014). Creativity is thereby the hallmark of extraordinary achievement in a broad range of human activities, such as arts, sciences, engineering, technology and other domains, and is considered as a principal driver of evolution that enables societies to adapt to varying circumstances, to improve cohesion through communicative systems (language, art), and to prosper through scientific innovations (Baas, Nijstad, & De Dreu, 2015; Zaidel, 2014). Flexible responses to events in the world are crucial in this perspective. It is, however, important to emphasise that there is another feature of creativity which contributes to fitness functionality, especially the adaptive prediction based on previous experience, which allows to individuals and groups to manage life more effectively by anticipating the forthcoming future (Wiggins & Bhattacharya, 2014). The complex social aspect of creativity implicates that this contribution to the promoted functionality should achieve some kind of recognition by the peers (Csikszentmihalyi, 1996; Zaidel, 2014). Creative accomplishments are, therefore, the most plausible forms of creativity even though the valuation is constrained by socio-cultural factors, influenced by subjective judgements, and this

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stringent criterion can't be always entirely met.

Several approaches tend therefore to refine the scope of creativity in order to identify this enigmatic phenomenon. Despite lack of consensus about the proper definition, the concept of creativity does exist, and creativity research has its own place since the ability to produce previously non-existent, innovative solutions is among the most valued human attributes. Creativity research has even extended its importance adopting methods from other fields, such as network science to assess creative thinking, considered the substrate of creativity, as a network. In this perspective, complex systems such as semantic memory structure of the cognitive system are viewed as a network, where the basic units are linked by complex relations (e.g. semantic memory linked by semantic similarity). Creative thinking can thereby be conceptualized as a flexible multicomponent construct and creative performance as a function of multiple cognitive, affective/emotional, motivational processes and links (Friedmann & Förster, 2010; Baas, De Dreu, & Nijstad, 2011; Kenett & Levy et al., 2018). Several creativity-associated factors have already been identified, including intelligence level (Lefebvre, Reader, & Sol, 2013), personality attributes (Eysenck, 1997; Helson, 1996; Urban, 1997; Vellante & Zucca et al., 2011), neurotransmitters (Boot & Baas et al., 2017), candidate genes (Reuter & Roth et al., 2006), and there are also promising data on brain functional networks (Beaty & Kenett et al., 2018).

Among these components, affective predictors of creativity have attracted substantial interest given the apparent link between creativity and specific mood states. Mood is a prominent predictor of creativity and mood–creativity relationship has been studied throughout decades. Mood is theorized to serve "as an intermediary state between a host of situational and personality predictors, on the one hand, and creative performance, on the other" (Baas, De Dreu, & Nijstad, 2008). Distinct dimensions of mood states, namely hedonic tone, activation level, and regulatory focus (promotion focus and approach motivation *versus* prevention focus and avoidance motivation) are related to creativity, respectively, and influence, alone and also in combination, creative outcomes. The interaction of different aspects of mood can, at least partially, explain inconsistencies in mood–creativity literature concerning association between mood alterations and creative productivity (Baas et al., 2008). Most theoretical accounts and research data suggest that positive affect enhances cognitive flexibility and creative problem solving compared to mood-neutral conditions (Ashby, Isen, & Turken, 1999; Lyubomirsky, King, & Diener, 2005) or to negative mood states (Hirt & Melton et al., 1996). Nonetheless, this approach is somewhat countered by other findings indicating the detrimental effect of positive mood on creativity (Kaufmann & Vosburg, 1997). Moreover, some investigations show that negative affective states promote creative performance (Adaman & Blaney, 1995) in certain conditions even to a greater extent than do positive moods (Gasper, 2003) yet other studies display a negative effect of negative mood on creative responding (Vosburg, 1998). Different dimensions of mood (positive or negative tone, activating or deactivating, promotion focus with behavioural approach or prevention focus with avoidance; Baas et al., 2008) as well as their interplay should be considered when analysing how specific mood states influence creative performance, which, on the other hand, also has various facets (Mumford & Gustafson, 1988). Inconsistent findings on mood–creativity link can therefore be elucidated in the light of the multidimensional aspect of mood states related to the complex construct of creativity (Baas et al., 2008). Shall we use a rough medical analogy: mood's dimensions, like components of a compound therapy, interact and act on the syndrome of creativity, enhancing and/or tempering, separately or in combination, its particular "symptoms", such as fluency, flexibility, originality. These symptoms (*vide* facets) of creativity have often been measured together in mood–creativity studies as divergent thinking is considered being a key feature of creativity. Mental process of creativity is undoubtedly characterized by divergent thinking, but is followed by convergent thinking process (Guilford, 1967) on the one hand, and there are, on the other, various facets of creativity, such as pre-conscious processing and mind wandering (Wiggins & Bhattacharya, 2014) which are not either qualified. The nature of creativity is not entirely disclosed, and research yet encounters challenges as complex construct of creativity shows wholly different configurations under the multicomponent mood's kaleidoscope.

Pervasive mood states that cause clinically significant distress and/or marked impairment in different areas of functioning are deemed to be mood disorders. The compelling association between creativity and mood disorders, particularly bipolar disorder has incited systematic studies to reveal the putative mechanisms of elevated creative performance in bipolar disorder. We eschew here entering into the fully detailed description of bipolar phenomena, and we rely on diagnostic and dimensional approaches of the DSM-IV-TR and DSM-5. It is, however, relevant to emphasise that the diagnostic class of bipolar disorders admits disorders "characterized by marked swings in mood, activity, and behaviour", and different forms of bipolar disorder are defined by the occurrence of the two poles of mood alterations of varying severity and duration. Bipolar I disorder is distinguished by the presence of at least one lifetime manic or mixed episode, whereas bipolar II disorder includes less severe hypomanic episodes along with depressive mood states. Cyclothymia is conceptualized as the less prominent form of the disorder where syndromal severity of affective poles does not meet criteria for mania or major depression. Nevertheless, cyclothymia, also referred to as an affective temperament, implies propensity toward fully syndromal bipolar disorder, since conversion rate to bipolar II or I disorder are relatively high (Akiskal & Akiskal et al., 2005; Johnson & Murray et al., 2012). Diagnostic classes of bipolar disorders are not absolute and definitive categories and cyclothymia, along with bipolar II, are designated bipolar spectrum disorders to seize that show common features with bipolar I, the most severe form of the disorder.

Extensive literature has been destined to analysing the link between bipolar disorder and creativity (Andreasen, 2008; Johnson & Moezpoor et al., 2016; Rihmer, Gonda, & Rihmer, 2006), showing that hyperthymic or cyclothymic temperament may predispose to creativity. This was also demonstrated in the study by Vellante and Zucca et al. (2011) using the TEMPS-A (Temperament Evaluation of the Memphis, Pisa, Paris and San Diego - Autoquestionnaire), confirming that the cyclothymic dimension of the bipolar spectrum is linked to creativity. The association between creativity and bipolarity was also confirmed using the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE), showing higher scores on creativity scales in bipolar patients (Rybakowki & Klonowska, 2011). Biographical studies provide evidence for overrepresentation of bipolar disorder in eminent creatives (Ludwig, 1992), and also indicate that milder forms of the bipolar spectrum, bipolar II and cyclothymia are particularly common among famous creatives (Jamison, 1989; Wills, 2003). Consistent with biographical studies, standardized assessment of bipolar symptoms among prominent authors (Andreasen, 1987) and musicians (Akiskal & Akiskal, 1994) found higher prevalence of bipolar disorder, and its less severe manifestations were more common than bipolar I, supporting the idea that milder forms of the disorder might imply better adaptive qualities and particular benefits for creativity (Johnson & Murray et al., 2012). From another perspective, creative accomplishment proved to be higher among bipolar patients and their normal relatives, and liability for bipolar spectrum conveys advantages for creativity (Richards & Kinney et al., 1988). Moreover, creativity is subjectively valued by individuals from the bipolar spectrum (Lobban & Taylor et al., 2012), and persons with bipolar spectrum display aesthetic preferences for novel and complex geometric structures (Santosa & Strong et al., 2007).

There is extensive evidence that supports relationship between bipolar disorder and creativity, but no definite liaison has been established between creativity and bipolar mood alterations. Data are inconsistent concerning the impact of mood on creativity, ignoring that creativity might have different expressions forms which are, on the other hand, influenced differently in distinct mood states. Accordingly,

we sought to provide a better understanding of the bipolar disorder–creativity phenomenon by analysing various expression forms of creativity as well as creative output according to the clinically diagnosed mood states at an eminent creative individual. Criteria for recruiting highly creative subjects may be difficult, and eminent individuals are often selected on the basis of having attained specified recognition(s), operationalized as a prize or award in a distinct field, or acceptance by prestigious forums to present their work (e.g. journals for writers, poets and scientists, exhibition forums such as art galleries, museums or equivalents for visual artist). Multiple creativity, conceptualized as recognized creative accomplishments in diverse disciplines at one and the same person is even more difficult to recruit, and is scarcely available for an investigator to study, since people with multiple creativity are exceptional.

2. Method

Our subject meets the criteria of multiple creativity as she has won prestigious international and national awards for her visual art, as well as exposed her artworks individually and in famous collective salons. Engaged in neuroscience, she has published her scientific results in international journals, acquired a prominent research scholarship, and also published her literary work. This eminent person shows thereby different forms of creativity (visual artistic, scientific and literary), the productivity being reflected in prized artworks, individual and collective exhibitions, awards, scientific publications and fellowship, as well as published literary work (Table 1).

This creative individual, has, on the other hand, been diagnosed with bipolar disorder (initially with cyclothymia, then with bipolar disorder), and treated at the Department of Psychiatry, Faculty of Medicine, University of Szeged, from January 25, 2006 until present. She has been hospitalized three times. The striking relation observed between distinct mood states and creativity forms intrigued our attention, particularly during the period between January 2006 and April 2009, which was the most informative in this perspective. We systematically analysed the clinical history and documentation of symptoms detected during clinical evaluations in this period, allowing us to trace the patient's mood states on a temporal coordinate, represented by a hypothetical two-dimensional continuum, a "curve of mood".

The initial psychiatric interview, as well as each clinical evaluation during the investigated period were performed by the same psychiatrist. Diagnoses were made on the basis of psychiatric evaluation according to clinical practice, following the principles and guidelines of the DSM Fourth Edition (DSM-IV-TR, 2000), revised in the light of DSM Fifth Edition (DSM-5, 2013). The 25-year-old, Hungarian, highly qualified, single woman had no relevant general medical history, and the past psychiatric history was confined to two consultations for insomnia and anxiety. A trial of zolpidem, being totally ineffective, was followed by a prescription of clonazepam, stopped due the sedative and cognitive side effects. She did not consult anymore and had no medication during the following period in spite of a chronic mild instability of mood associated with sleeping difficulties. Nevertheless, insomnia and loss of energy progressively sharpened to such an extent that the patient consulted in January 2006. The initial primary diagnosis was cyclothymia since the patient experienced mood swings without significant social or professional incapacitation from early adulthood. A few symptoms of depression (such as moderately depressed mood, insomnia, fatigue) were currently present, but social and vocational activity were preserved. Over the course of a few weeks, the patient experienced a greater burden of depressive symptoms which were severe enough to meet criteria for a major depression, and the diagnosis was converted into bipolar II disorder. The diagnosis of bipolar II has been maintained along the course of illness notwithstanding the onset of two depressive mixed states, characterized by major depressive episodes associated with a few hypomanic symptoms, such as racing thoughts, moderately accelerated speech, goal-directed activity and distractibility. The DSM-IV definition of mixed episode excluded bipolar II disorder, mixed states having been determined as the co-occurrence of a fully manic and a major depressive episode, and classified as bipolar I disorder. However, criteria for a mixed episode of bipolar I disorder have never been met in this case since the patient has never presented a full-blown form of mania, neither as a "pure mania", nor in the context of a mixed state. Major depressive episode with a few hypomanic symptoms, called depressive mixed state, occurring also in bipolar II patients have been reported in literature (Benazzi & Akiskal, 2001; Benazzi, 2003a; Benazzi, 2003b; M'Bailara & Van den Bulke et al., 2007), but not covered in the DSM-IV. The DSM-5 includes relevant revisions for diagnosing mixed episodes, the mood specifier "with

Table 1
Creativity forms and creative outputs of different periods.

Period	Mood state	Creativity form	Creative accomplishment
Jan. 2006 – Jun. 2006	Mild to moderate depression	Literary work[1]	Prose, essays, critics, interviews in NewTon(e)*
July 2007 – Jan. 2007	Hypomania	Visual art[2]	Novartis: Visions of Science, «Science and arts» category, II. prize
		Scientific work[3]	Creation of the works exposed at European Researchers' Night
			Young artist sponsorship
			Preparation and submission of the paper to Neuroscience
Feb. 2007 – Apr./May 2007	DMX, then MDE	———	
	HP: Apr. 26, 2007 - May 02, 2007		
May 2007 – Nov. 09, 2007	Hypomania	Visual art[4]	Creation of the second part of the works exposed at European Researchers' Night
	(2-week period of euthymia in June)	Scientific work[5]	Preparation and submission of the paper to Endocrinology
Nov. 10, 2007 – Nov. 21, 2007	Mild to moderate depression	Literary work[6]	Prose, essays, critics published in Newton(e)*
Nov.22, 2007 – Mar. 2008	Severe MDE	———	
	HP: Jan. 29, 2008 - Feb. 11, 2008		
Mar./Apr. 2008 – Sept. 2008	Hypomania	Visual art[7]	Epson Photography Competition Award, exhibition at Photokina**
			Photography Competition «Reflexions about a forgotten war», I. prize
Oct. 2008 – Jan. 2009	MDE, then DMX	———	
	HP: Oct. 07, 2008 - Oct. 17, 2008		
Feb. 2009 – Mar. 2009	Hyperthymia	Scientific work[8]	Submission of the tender dossier for Bolyai Research Scholarship***
		Visual art[9]	Participation at the Contemporary Photography Exposition
Apr. 2009 – until now	Euthymia	———	

DMX: depressive mixed state or depression with mixed features (major depressive episodes associated with typically three hypomanic symptoms); MDE: major depressive episode; HP: Hospitalisation at the Acute Ward of the Department of Psychiatry.
Visual art[2,4,7] encompasses photography, photo montage, tint-drawing and mixed technics.
* Journal of the Faculty of Science and Informatics of the University of Szeged, Hungary.
** Award at Epson 40th Anniversary Photography Competition « 40 years of Innovation », exhibition at Photokina in Cologne, Germany.
*** Janos Bolyai Research Scholarship of the Hungarian Academy of Sciences.

mixed features" being applied in either bipolar I or II disorder when the predominant mood is associated with three or more distinct symptoms of the other mood pole. The diagnosis of bipolar II disorder is fully maintainable in this perspective, and mixed depressive symptoms occurring along the course of illness, previously labelled as "depressive mixed state" correspond herewith to "depression with mixed features".

Within a distinct mood episode, we evaluated mood states on the basis of detailed records of psychopathology (e.g. psychomotor activity, thought, suicidal ideation, vegetative symptoms, sleep-wake patterns, degree of social and professional impairment) using a virtual positive and negative scale, and we expressed and plotted the estimated mood levels on a ± 1 to ± 10 vertical scale through time, applying a time range of one month on the time-scale of the x-axis. Positive and negative mood ranges were subdivided in function of the global severity of symptoms (mild, moderate, severe depression, and hyperthymia, hypomania, mania, respectively). Hyperthymia was considered when criteria for hypomania were not yet met (e.g. slightly elevated mood with one manic symptom, typically increased goal-directed activity). Euthymia, permitting normal fluctuations in mood, perceived by the patient as "slight and white flat waves" or "soft swings" of mood, has been considered between +1 and –1 on vertical mood scale. We displayed on the mood curve different expression forms of creativity that characterised distinct periods (visual art, scientific work, literary performance), reflected by recognized achievement. It is important to emphasise that we considered the period of creation of artworks, and not the dates of prizes, awards or exhibitions. Similarly, we considered the period of preparation and submission of papers regarding scientific activity, as well as the period of writing literary works, and not the date of publication.

We displayed also pharmacotherapies used along the phases of the illness although relationship between particular medications and creativity was not in the focus of the investigation. However, given that creativity has been blunted when psychotropic treatment stabilized the mood, it appeared pertinent to raise the issue of treatment implications. Since constantly euthymic mood through medication has lowered creative productivity, we dispensed with displaying the mood curve exempted from notable creative achievement.

Prior to the investigation, the euthymic patient provided oral and written informed consent, gave free run of her laboratory and medical evidences, as well as submitted us the detailed and documented history of her overall creative activity. A written permission has also been granted for the inclusion of the detailed creative accomplishment in the article. The work has been carried out in accordance with the declaration of the Medical World Federation proclaimed in Helsinki, approved by the Human Investigation Review Board of the University of Szeged.

3. Results

Analysing the mood–creativity link, we found a clear association between distinct mood states and different creativity forms, as shown in Fig. 1. Since elevated mood, particularly hypomania boosts visual artistic creativity and scientific work, mild to moderate depression promotes literary performance. Milder elevation of mood, designated herewith as hyperthymia, slightly enhances artistic and scientific productivity, however, creative output is less significant than during a hypomanic phase. Severe depression and depressive mixed states are counterproductive, and do not facilitate either form of creativity. Intriguingly, constantly euthymic mood with blunted mood swings by medication since April 2009 turned out to be detrimental regarding creativity. Psychotropic treatment that has finally and effectively prevented serious, disruptive crashes into major depression (occasionally with mixed symptoms), avoiding iterative hospitalisations, and permitting a considerably better quality of life, proved, on the other hand, to be disadvantageous to creativity. There were no more prominent creative manifestations in the period after the stabilization of mood by psychotropic treatment as creative productivity and quality of work has lowered (although not totally ceased).

Creative achievements of particular periods are detailed in Table 1, and we also indicated the absence of creative productivity in sever major depression and depressive mixed states, as well as during the constantly stabilized euthymic mood, exempted from salient mood fluctuations.

4. Discussion

The case of this eminent creative patient is consistent with the evidence that creativity is increased in persons with bipolar spectrum disorder (Richards & Kinney et al., 1988; Santosa & Strong et al., 2007), and also with the concept that milder forms of bipolar disorder occur commonly among highly creative individuals (Ludwig, 1992, Akiskal & Akiskal, 1994; Andreasen, 1987; Jamison, 1989; Wills, 2003). Indeed, it appears that bipolar mood (even liability for bipolar spectrum) conveys particular benefits for creativity. However, since substantial literature supports the association between creativity and bipolar disorders, the mechanisms driving this link are still unfolded. Little is known about the breadth of creative processes fostered by distinct mood states, or the impact of different forms of symptoms on the indices of creativity. Part of the reason for this is obviously the complexity of creativity, as well as the multidimensional aspect of mood, but, we claim, in accordance with Andreasen (2008), it might also be due to the relatively narrow range of creativity types studied as yet. Conscious of the argument that this could ignite, we broadened the concept of creativity forms, considering scientific performance as relevant as various forms of artistic and literary creativity.

While analysing the relationship between distinct mood states and different expression forms and outputs of creativity (literary, visual artistic, scientific), the results apparently support the assumption that mood functions as a lock gate with sluices for creativity. Mildly and moderately positive mood states enhanced visual artistic and scientific performance, mildly and moderately negative mood fostered literary achievement, but severely depressed mood was detrimental to creativity. Considering positive alterations, moderately heightened mood states (hypomania) were linked with superior creative performance than was mildly positive mood (hyperthymia). Although abnormally elevated mood with complete manic symptomatology has never been identified in this case, full-blown manic episodes are generally disruptive and detrimental regarding creativity. However, this depends seemingly on the constellation of manic symptoms, since adaptive manic symptoms, such as increased goal-directed activity, energy, broadened attention and thinking, faster thought, decreased need for sleep bolster creativity, while poor judgement, hyper-sexuality, overspending, anger are not beneficial to creative processes (Jamison, 1989; Johnson & Murray et al., 2012). Given this approach, positive but also negative mood appears to have curvilinear effects on creativity as mildly to moderately positive mood, as well as mild to moderate negative mood enhances creative performance, whereas severely altered positive and negative mood is unfavourable compared to moderately altered mood states. It has already been identified that moods were conversely related to creative performance under particular conditions (e.g. negative moods were positively, positive moods negatively associated with creativity when recognition, rewards, and clarity of feelings were present; George & Zhou, 2002), this being conceptualized as a mood-as-input model. The mood-as-input model attributes an informational role to mood and postulates that the motivational implications change as a function of the situation (Martin, Stoner, & Martin, 1996; Martin, 2001). Mood, or its dimensions - activation, hedonic tone, motivational system, such as promotions focus with approach *versus* prevention focus with avoidance - individually or in combination, seems therefore to have the propensity to deflect creative processes and components of creativity in different "canals", such as verbal-literary, visual artistic, scientific, and presumably other

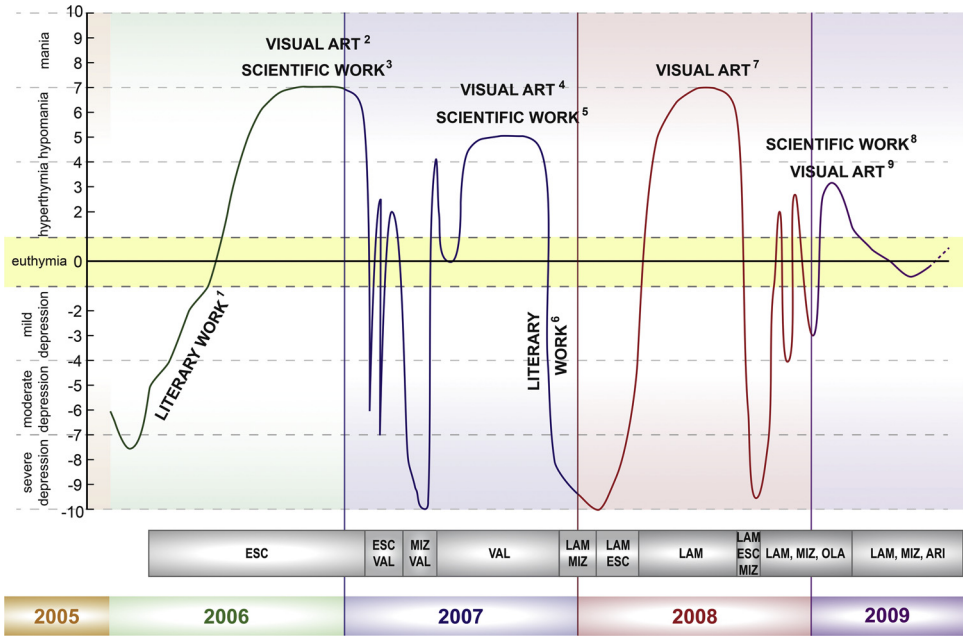

Fig. 1. The mood–creativity curve with different creativity forms that are characteristic for distinct mood states. We displayed the period between January 2006 and April 2009, which was the most informative regarding creativity and mood relationship. Mood levels are expressed and plotted on a 1–10 positive and negative vertical scale, applying a time range of one month on the time-scale of the x-axis. Creative outputs of particular periods are detailed in Table 1, according to index numbers. Constantly euthymic mood, stabilized by medication since April 2009 was disadvantageous to creativity, as there were no more prominent creative manifestations (illustrated symbolically by broken lines). Depressive mixed states (depression with mixed features), occurring in February – March 2007, and October – November 2008 respectively, are shown symbolically as "rapid cycling curves" in order to preserve perspicuity. Pharmacotherapies used along different phases of the illness are also presented.
ESC: escitalopram, VAL: valproate, MIZ: mirtazapine, LAM: lamotrigine, OLA: olanzapine, ARI: aripiprazole

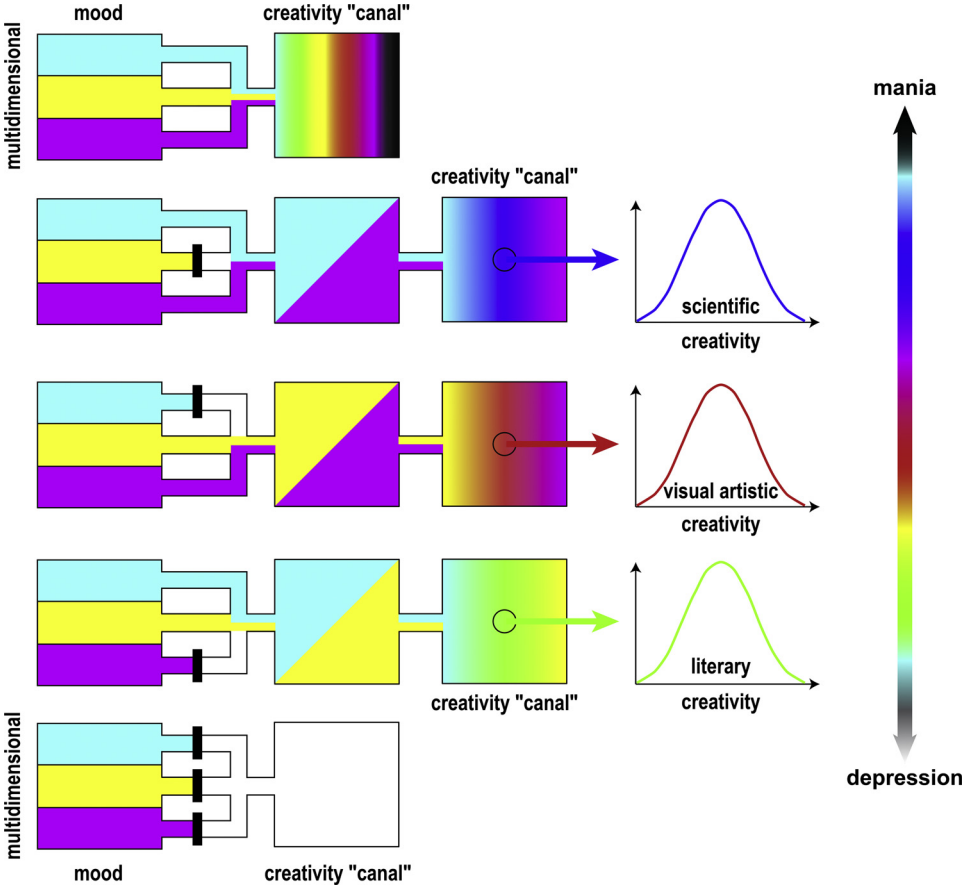

Fig. 2. Hypothetic modelling of bipolar mood as a lock gate with sluices to canalize multiple creativity. Mood being a multidimensional entity, its components (e.g. activation, valence or hedonic tone, approach–avoidance motivation or promotion–prevention focus) are symbolically illustrated as horizontal bands with different colours. Mood (or its distinct dimensions individually or in varying combination) mediates distinct creative processes, represented by quadrates as "cross sections of creativity canals", which finally results in different creativity forms and outcomes (represented by different colours). Both positive and negative moods appear to have an "inverted U" effect on creativity (mildly to moderately positive and negative moods trigger creativity, moderately altered moods are related to better productivity than mild mood swings, whereas severely altered positive and negative mood is detrimental).

creativity forms. A rough analogy may be drawn to operating a canal lock gate, although the correspondence between multidimensional mood and multiplex creativity processes are likely more complex. As a canal lock with gates raises and lowers watercrafts between stretches of water of different levels on canal waterways, mood deflects components of creativity between different creativity domains of various levels. Mood can therefore be viewed as a lock gate with sluices to canalize multiplex creativity. Hence, we propose a hypothetic modelling paradigm that might be relevant to disclose how positive and negative mood (or its distinct dimensions individually or in various combinations) do mediate different creative processes, resulting in different creativity modalities and outcomes as a function of distinct mood states in bipolar disorder (Fig. 2). Mildly to moderately positive moods progressively trigger creative processes that bring about visual artistic and scientific

performance, moderate mood elevations (hypomania) are therefore related with prominent creative achievements in these domains. Positive mood states appear to foster creative performance by increased associational fluency (Kocsis & Shaw et al., 1993; Levine & Schild et al., 1996) and conceptual over-inclusiveness (Andreasen & Powers, 1975), but it appears also to broaden the scope of visual attention, evidenced likewise in experimentally induced positive emotional states (Frederickson & Branigan, 2005; Schmitz, De Rosa, & Anderson, 2009). It is important to mention that some schizotypal features, like unusual perceptual experiences, are present in artist, whereas other features, such as introversion and social anhedonia, are present in other creatives, such as scientists. Schizotypal features appear to represent a common conceptual over-inclusiveness with unusual associative processes (Vellante & Sarchione et al., 2018). The association between creativity and schizotypy was also confirmed by Rybakowki and Klonowska (2011), corroborating the link between schizotypal features and creativity in bipolar patients. Furthermore, similarly to positive emotional states, hypomania seems to extend the array of internal and external percepts, allowing thereby access to tangential, peripheral and incidental informations, as well as to outermost details of memories (Talarico, Bernsten, & Rubin, 2009), which, given the enhanced associative fluency, might come upon and emerge in the same conceptual drift. As our patient described, hypomania is “the gate that gets access to the big flow that carries images and thoughts in a lucid stream”, and this experience is consistent with the argument that positive emotional states enhance the capacity to globally seize phenomena (“see the big picture”), as well to process information at global level (Frederickson & Branigan, 2005), which, on the other hand, can engender and incite visual and scientific creativity. It is also worth noting that enhanced associativity registered by the clinician and experienced by the patient during hypomania were expressed not only at cognitive-verbal, but also at visual-technical level since photomontage and mixed technics were used by choice. Moreover, increased energy, relaxed inhibitory control and the openness to new experiences and actions led to free, unbound use of technical knowledge and tools, which, after all, booster innovation both in arts and science.

Depressive mood states do not definitely extinguish creative processes in bipolar disorder but seem to change their course. Extraversion, behavioural approach, enhanced cognitive flexibility and unimpeded ideational stream (apostrophized as “the big flow”) elicited by elated mood states are usually followed by depression. Depression, on the other hand, unavoidably implies a turning inward with specific cognitive patterns such as increased susceptibility and preference to negative bias, reflected also in topic choice and preference. Confronting with essential, inevitable and painful existential questions such as sense of life or aim of life in the light of dying, depression seems to drive creative individuals toward adequate, in this instance, verbal expression forms. However, Schildkraut, Hirshfeld, and Murphy, (1994) draw similarly conclusion when studied the 20th-century abstract expressionist artists, approximately half of whom having suffered from unipolar or bipolar depression. It has been theorized that depression could have brought “the artist into direct and lonely confrontation with the ultimate existential question, whether to live or die”. Similarly, clinical depression brought Rembrandt, presumably suffering from bipolar disorder, to a poignant confrontation with the tragic mystery of doom and death, which was depicted in two masterpieces (Schildkraut, Cohn, & Hawkins, 2007). Nevertheless, severe depression associated with unbearable psychic suffering is detrimental to creativity since serious pain doesn’t quest for expression but asks for release, even by suicide. Mixed depressive states are also expressly disadvantageous to creative processes given the pervasive distress linked to this symptomatology. Moreover, persistent creative processes are most likely impossible since the regulatory “locking” function of mood is totally impaired, resulting in a chaotic, tempestuous and barren fluster of mental phenomena, incompatible with the state of “flow” during process of creativity (Csikszentmihalyi, 1996).

5. Conclusions

Positive, but also negative polarities of mood, exempted from extreme swings appear to convey advantages to creativity, which, on the other hand, might have various expression forms as a function of bipolar mood. Excessive and uncontrolled mood swings, however, imply substantial individual suffering, and, as an additional concern, high risk of suicide among creative individuals affected by mood disorders. The clinician’s endeavouring to stabilize mood in order to diminish extreme, perilous mood amplitudes as well as individual suffering and suicide risk seems, on the other hand, to be unfavourable regarding creativity. Could it be theorized that mood functions not only as a “lock of creativity” but also of individual well-being? Creativity, frequently associated with bipolar mood disorder, provides advance and advantages for society, however, it comes at a price, as often entails individual torment. Nevertheless, there other aspects and dimensions of bipolar mood–creativity interactions beyond distinct mood states and medication, such as personality attributes, course of illness that affect creativity and should be considered in future research. The lack of performing the studies of personality in this patient is a limitation of the paper.

Declaration of interest

None.

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