Trauma and *Jouissance* - A Neuropsychoanalytic Perspective

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1. Neuropsychoanalysis: Epistemological Considerations

In the most general terms, neuropsychoanalysis proposes a conceptual elaboration at the interface of psychoanalysis and neuroscience. Its main actors and approaches are multiple and diverse[1] but, amongst all, the epistemological line most held is the so-called 'dual aspect monism' perspective (Solms & Turnbull, 2003). This perspective holds that 'our brains, including mind, are made of one kind of stuff, cells, but we perceive this stuff in two different ways' (Solms & Turnbull, 2003, pp. 56-58; our italics). One is the neuroscientists' 'objective' way of studying the brain, which we dissect 'with scalpel and microscope or look at it with brain scans and then trace neurochemical pathways'. The alternative is the psychoanalysts' 'subjective' way or the mind defined in terms of: 'how we feel and what we think. Freud refined this kind of observation into free association'. As, however, there is only one object, in the end, there is a more or less linear correspondence between phenomena of the brain and phenomena of the mind. Research follows the classical paradigm: neurophysiologic observations are connected to behavioural or personality characteristics; knowledge about the brain can be (directly) useful for psychoanalytic clinical work.

We propose, to the contrary, that an object cannot exist as an inert object, constituted independently from its perception. Our approach is a transcendental one, which considers that an object is constituted in the negotiation between a grasping subject and a resisting real (see e.g. Van de Vijver & Demarest, 2013). The idea is that the object is also shaped by the questioning through which it appeared. In this approach, biology leads to the constitution of the object 'brain' on the one hand, and clinics to the constitution of the object 'mental apparatus' at the other though there is not necessarily a linear correspondence between the two.[2] What is coherent in the brain cannot be made to correspond point-by-point with what is coherent in the mental apparatus. In this approach, the mental is constituted in a field of tension between the push arising from a biological substrate, and the pull exerted from the social level, that is, between a drive pressure and a beckoning other. From this ontology, it results that the apparatus is marked both by its biology and by the other. The 'neuropsychoanalytic' dimension in our approach tries to characterise the attachment or nodal points between the biological and the mental. That is to say, we intend to articulate how some mental phenomena are able to capture at once a diversity of otherwise seemingly disparate biological observations. At the level of these nodes the correspondence between the biological and the mental is direct.[3] Nevertheless, the biology involved in these nodes does not in itself dictate the organisation of the mental, but functions as a constraint, as a point of contention both limiting and enabling the mental constitution (Van de Vijver, 2010. For more, see Bazan, in press, a,b.). We previously proposed physiological frameworks for two possible knots, namely the signifier (and also repression and the primary process, Bazan, 2006, 2007, 2009, 2011, 2012; Bazan & Snodgrass, 2012) and *jouissance* (Bazan & Detandt, 2013). Indeed, recently we published a so-called 'neuropsychoanalytic' proposition for 'a physiology of *jouissance*'; in the present paper we want to expand upon this model for the specific case of trauma.

2. On the Physiology of *Jouissance*

Jouissance: Some Psychoanalytic Definitions

The concept of *jouissance* (sometimes translated as 'enjoyment' in English; Evans, 1996) appears relatively late in the teaching of Lacan and only in bits and pieces. *Jouissance* might be pragmatically defined as that which indicates the unconscious advantage tied to certain behaviours causing them to persist even when they are no longer pleasurable, or even when they are causing suffering or damage (Evans, 1996, p. 92; Lacan, 1986, p. 209). In *Mourning and Melancholia*, for example, Freud (1917e, p. 251) says literally: 'The self-tormenting in melancholia, (which) is without doubt enjoyable': the melancholic subject gains satisfaction from self-devaluation. *Jouissance* thus explains why, against all rationality, subjects are sometimes wedded to their problems, be it at the highest price, i.e., at the cost of their professional career, of their relationships or of their lives. Addiction, for example, is a psychopathology of *jouissance* par excellence (Braunstein, 1992, p. 17; Delourmel, 2009). *Jouissance* is also what is thought to subserve the repetition compulsion (Freud, 1955 [1920], p. 42; Lacan, 1991[1969-1970], pp. 111-112).

In the early seminars, Lacan (1975 [1953-1954]; 1978[1954-1955]) uses the term *jouissance* with reference to its original, juridical, meaning: the term arose in the XV century, to designate *the action of using a property for the purpose of obtaining the satisfaction it is supposed to provide*. It is akin in its meaning to the juridical concept of *usufruct*, which is a *right of enjoyment, enabling a holder to derive profit or benefit from property that either is titled to another person or which is held in common ownership, as long as the property is not damaged or destroyed*. Thereby, a distinction is made between the satisfaction of *consuming* something, whereby it could be damaged, destroyed or lost in consumption, and the satisfaction of *using* something with this satisfaction being explicitly not tied to its consumption. Indeed, while up to 1957, the term *jouissance* seems to mean no more than the enjoyable sensation that accompanies the satisfaction of a biological need such as hunger (Lacan, 1994, p. 125), in *The Ethics of Psychoanalysis*, Lacan (1986, p. 209) proposes that '*jouissance* appears not purely and simply as the satisfaction of a need, but as the satisfaction of a drive'. In this seminar *jouissance* and pleasure are distinguished. For Freud pleasure is defined thus:

> We have decided to relate pleasure and unpleasure to the quantity of excitation that is present in the mind but is not in any way 'bound,' and to relate them in such a manner that unpleasure corresponds to an increase in the quantity of excitation and pleasure to a diminution.
> (Freud, 1920g, p. 7-8)

The satisfaction of a need, by calming down the body tension it brought about – i.e. by realising the aim of the drive – leads to pleasure, while *jouissance* lies in the drive activity in and of itself. 'The aim and object of the drive is pure enjoyment, without an object and unconditionally' (Scherrer, 2010, p. 143).

Here, we thus have an analogous difference between the consumption of the property (pleasure) and the *usufruct* of making use of it (*jouissance*).

Marie now says:

> When the question of enjoyment appears in the writings of Freud, in *The Project*, it is about the experience of satisfaction of the drive economy.
> (Marie, 2004, p. 25)

Thus, equipped with the above definitions, we have tried to understand what happens physiologically (Bazan & Detandt, 2013) during such an 'experience of satisfaction' (Freud, 1956 [1895]).

The Dopaminergic Physiology of Action Sensitisation in Case of Reward

When, in a new-born, a hunger stimulus arises from the internal body (the dehydration of the stomach tissue, for example) and reaches the central nervous system, this signal of a lack is translated into an alarm, i.e. into excess. This alarm mobilises the whole body, especially the external body of the striated muscles (Bazan, 2008). However, since no specific action pattern is ready to be activated, the baby merely activates everything that can be activated: he jiggles, he cries. It takes the interpretation of a fellow human being ('oh he must be hungry') to bring the baby to a food source. A hungry child who has been put to a breast by his mother will start sucking, because this is one of our reflex motor activities. The sucking activity is pleasurable (in the Freudian sense) because it enables the release of tension that has built up in the mouth muscles. Suddenly, however, the pleasurable activity also leads to the coming of milk: this is an unexpected event, leading, through the activation of the sugar receptors in the mouth, to the immediate sudden activation of so-called 'opioid hedonic hot spots' in the brain, the neuroanatomical pathway supposed to subserve pleasure in the affective sense (Berridge, 1996).[4] This opioid release induces a surge of dopamine in the 'nucleus accumbens',[5] the neuroanatomical mechanism often termed as 'reward' (see later). The first milk coming in acts as a surprise, and it is this surprise which (through the opioid activation) induces dopamine release (Schultz, 1998). The dopamine peak then sensitises the rewarded voluntary action pathway, here the sucking, by inducing structural changes at the level of the neurons: this 'incentive sensitisation' is materialised by molecular and cellular changes in the concerned dopaminergic pathway (Robinson & Kolb, 1997, 1999; Robinson & Berridge, 1993). That is, the dopaminergic release leads to the memorisation of the specific motor pattern, which is associated to it. This sensitisation has the effect that any new encounter with a stimulus announcing the milk will induce in and, by itself, dopamine release. This then energises the motor sucking pathways, since these were sensitised in the inaugural experience. This activation leads to a build-up of tension in these motor pathways, including peripheral leaks of tension in the mouth muscles themselves. In other words, *the dopaminergic peak pushes for the remembered action to be repeated*. The order, now, is reversed: in first instance, it was the massive event of the milk coming in, which induced a dopamine peak (sensitising associated motor pathways), now any stimulus announcing the milk induces a dopaminergic peak, activating the sensitised motor pathway.

The dopaminergic sensitisation of the motor pathways means that the threshold for mobilisation is lowered, in such a way that tension in these pathways easily builds up, triggered by an enlarged range of possible stimuli, announcing the milk, the breast or the mother, and all the more (but not exclusively so) if the child is hungry. *It is now this build-up of tension which renders the sucking activity in and by itself much more pleasurable* because it allows for an important discharge, *quite independently of this action still leading to milk coming in*. This is crucial: by this dopaminergic logic, the success of the result of an action is dissociated from the inherent pleasure of executing the action. Thereby, this dopaminergic logic enables the history of an organism (its contingent encounters and actions) to be encoded physiologically if they were sanctioned by a dopaminergic peak in the past. In other words still, this logic enables virtually any kind of action to be engrammed in the motor history and thus included in a repetition compulsion, by it having been associated to a dopamine-release inducing event in the past.

On the Physiology of *Jouissance*

In our original proposal (Bazan & Detandt, 2013) we had proposed that, in Freud's model of the drive:

> pleasure is what results from the release of tension induced by the consumption of a suitable object of the drive while *jouissance is the (benefit gained from) the motor tension underlying the action which was (once) adequate in bringing relief to the drive*.
> (Ibid., p. 2)

In this definition, both pleasure and *jouissance* can be aspects of the satisfaction of the drive, but, while pleasure implies the consumption of an object, *jouissance* is in the motor mobilisation or *use* of the body. This definition fits with the juridical origins of the word *jouissance*, where it was reserved for the satisfaction of *using* something without consuming it. Moreover, in the distinction here proposed, pleasure is tied to the object, while *jouissance* is related to motor action.

With this definition of *jouissance* as:

> the (benefit gained from) the motor tension underlying the action which was (once) adequate in bringing relief to the drive.
> (Ibid.)

we then proposed that *this could correspond, on a physiological level, with the dopaminergic motor activation in the so-called mesolimbic pathway*, i.e. the pathway through which dopaminergic surges sanction surprise events (as noted above).[6] Note that this dopaminergic pathway could be what is referred to by Freud when he refers to 'Nature' when he says:

> This satisfaction (of a drive) must have been previously experienced in order *to have left behind a need for its repetition*; and we may expect that *Nature will have made safe provisions so that this experience of satisfaction shall not be*

> *left to chance.*
> (Freud, 1905d, p. 184; italics added).

The next step, then, in our epistemological approach, consisted in verifying if the diverse functions of this mesolimbic dopaminergic pathway find a logical coherence at the mental level in the concept of *jouissance*. Indeed, it turned out that *jouissance* was able *to capture at once the diverse physiological functions of the dopaminergic mesolimbic* activation, and for the following reasons:[7]

(1) it captures the drive-function of the NAS-DA (e.g. Panksepp, 1998; Shevrin, 2003), mobilising the external body from within since it is also 'evident that the endogenous drives (in the experience of satisfaction) constitute an aspect of *jouissance*' (Jadin, 2012 [2009], p. 58).

(2) It captures the event-marking function of the NAS-DA by tagging the action associated to a reward (Bromberg-Martin, Matsumoto & Hikosaka, 2010), corresponding to the role of *jouissance* in the experience of satisfaction.

(3) It captures the tension-inducing function of the NAS-DA in its potential threat to induce excess to the point of exhaustion, corresponding to the 'bodily tension' role of *jouissance* (Knutson *et al*., 2003; Van den Bos *et al*. 2006).

(4) It captures the sensitisation-function of the NAS-DA, which leads to the engramming of a motor pathway or trait (Robinson & Berridge, 2000), pushing for its repetition, corresponding to the role of *jouissance* in the repetition compulsion (Freud, 1955 [1920]).

For all these reasons, we concluded that the mesolimbic accumbens dopaminergic pathway is a reasonable candidate for the physiology of *jouissance*.[8] We now propose several adjustments. Importantly, whilst in this first paper we were struggling with the quite obscure notions of 'reward' or 'benefit' but we now propose a much-simplified scenario, based on the idea that pleasure is tied to tension discharge, while *jouissance* is tied to tension build-up. Thereby *jouissance* is structurally at the same time inherently unpleasant, but as its excitation by definition holds the promise of a potential big discharge, it is always potentially also pregnant with an (imminent) rush of pleasure. The benefit or reward, then, is this promise of (big) discharge.

Also, in our first proposition, we had tied the pleasure exclusively to the satisfaction of the need, which by the very 'removing (of) the endogenous stimulus' is experienced as pleasure. This still holds in our new logic, since by satisfying the lack, we remove the need for alarming the external body, i.e. we calm down the drive which would have put the body under tension. However, in the case of food, it should be noted that, physiologically, there is already opioid activation by sugar receptors in the mouth, well before the incoming food can satiate the stomach receptors. It is this opioid activation then, and apparently not the calming down of the hunger, which seems to constitute the 'event' sanctioned by a dopamine peak. Therefore, it is not a marker for the adequacy of the act – here the calming down of the hunger which had induced the jiggling and crying – that, in the case of the food experience, functions as a criterion for dopamine release. Thus it is not a marker for the adequacy of the act which leads to *jouissance* being tied to that acting. This leads to our second adjustment, namely that we give up the idea that for the action to have the character of *jouissance*, it should (once) have been adequate in bringing relief to the drive.

What, then, constitutes the criterion for the sudden release of dopamine, and, consequently for the sensitisation of the associated motor pattern? In the context of trauma, it will become clear that not only pleasant events are sanctioned by a dopamine peak, but also a variety of unpleasant, aversive, stressful and painful events. The common denominator is, then, not the valence, but it is the event character in and of itself, i.e. the organism being taken by surprise, the body stirred up unexpectedly. Thus, before any judgement about valence is operated, there is a bodily system equipped to discriminate, and simultaneously register, what constitutes an event as distinct from what does not. The motor pattern associated with the event is sensitised, i.e. remembered and more easily repeated. The body tension involved in this sensitised motor pattern would then, in our proposal, constitute *jouissance* in its form whereby it is most directly tied to its physiological conditions of emergence. This is what will be developed in the context of trauma.

3. On the Physiology of Trauma

Trauma: some Psychoanalytic Definitions

In a Freudian perspective, an event is traumatic when there is no possibility of *abreaction* or emotional discharge of its experience: trauma is caused by:

> an 'excess of excitation' which the mental apparatus is not able to reabsorb for lack of a representation that could take charge of it and in that manner channel it.
>
> (Pickmann, 2003, p. 41)

Trauma exceeds the subject's capacity for mental, integration (Freud, (1955/[1920]), or else: trauma is a 'breakage of the psyche by the unthinkable. The shockwave of this intrusion, 'its memory', Freud (1949/[1905], p. 4) says:

> acts like a foreign body which long after its eruption, continues to play an active role. (…) Thereby trauma not merely relates to the subject's history but rather, to the eternal return of that which resists any historicisation.
>
> (Pickmann, 2003, p. 41)

Impossibility of Discharge or of Representation: The Void in the Mental

When an action is adequate, i.e. when it is able to alleviate an internal body need (Freud, 1895b, p. 108), it is also pleasurable because it calms down the stirring up of the external body, induced by the lack. This type of adequate action has an effect on the source of the drive, and therefore it is chiefly effective. We propose to define 'adequacy', therefore, as that which allows for tension (or excitation) discharge.[9] Since only the motor end of the mental apparatus allows for discharge we propose that, in contrast with this scenario, and in line with Freud's perspective, trauma is defined by the *radical* *unavailability of motor programs for the discharge of the excess excitation* induced by the traumatic event. In other words, there is a radical impossibility to act upon the traumatic event adequately. Indeed, some events can induce an intensely high mobilisation of the body by increasing (muscle) tension levels all round, without inducing any specific form of motor activation to deal with the event. The general tension increase has not been transformed (yet) into specific 'destined' forms. This, then, is anxiety and high levels lead to trauma. Importantly, trauma does not preclude acting in and by itself, however, for there to be trauma, this action should be without any effect on the event: it cannot stop the event but neither can it modulate it. In other words, trauma means that *the action of the subject and the traumatic event are incommensurate*; the acting of the subject does not relate to the traumatic event, and therefore does not inform it in any way.

There is an impossibility of action execution, moreover, there is already a lack of motor preparation because no candidate motor forms are available to bind the free excitations. Put differently, the free excitations do not have a destination that would bind them in a motor form that, by lack of being effectively discharged, would already constitute a dischargeable form. These motor (preparation) forms are mental representation species (see, for example, Jeannerod & Decety, 1995; Gallese, 2000). Therefore, the unavailability of motor forms to bind the excitation means that the traumatic event does not get represented, and thereby leaves the subject – both in a literal and in a metaphorical sense – in a radical inability to grasp it. As the traumatic event does not get represented, it cannot be integrated in a chain of representations (i.e. of signifiers) and therefore it is not historicised. Trauma, thereby meets the definition of *jouissance*, as the French psychoanalyst Maugeri says, *jouissance*:

> is thus a real, this is a bodily experience beyond sense, which by being unnamable and unrepresentable, constitutes a trace in the life of a subject.[10] (Maugeri, 2011, p. 1)

It is to this lack of representations that Lacan (1974) refers when he uses the signifier ‘trou-matisme’, that is to say, the mark of a gap in the chain of representations (or signifiers), i.e. of a void in the mental.

It is important to redevelop, in the light of the previous, the notion of unexpectedness as a founding idea for both *jouissance* and trauma. Strikingly, we are reminded of Freud’s (1920g, p. 35) words: ‘Novelty is always the condition of enjoyment’. Unexpectedness, as we have used the term so far and will use it in the following, is, of course, nothing else, than this impossibility of motor preparation, this is, of representation, which is at the centre of the notion of trauma. In other words, no system of the organism has a clue whatsoever on how to handle what falls upon it. The systems concerned are primarily motor systems: in an animal model, unexpectedness thereby concerns behavioural motor systems but, in humans, behaviour seen in the Lacanian perspective is organised linguistically. Therefore, unexpectedness in a human subject concerns the unavailability of a signifying chain, or the breakdown of existing chains, to grasp the traumatic experience.

Enactment, Repetition and Après-Coup

Trauma leads to symptoms of suffering that are characterised by the compulsion to repeat certain actions as opposed to verbalisation. Freud says:

> we may say that the patient does not remember anything of what he has forgotten and repressed, but acts it out. He reproduces it not as a memory but as an action; he *repeats* it, without, of course, knowing that he is *repeating* it. (Freud,1914g, p. 150)

Resistance to signification, says Lacan, becomes ‘repetition in acts’ (1977 [1973], p. 26), similarly remarking that the traumatic encounter, is the *tuché*, the unexpected encounter, which happened without appointment. In other words, it is an encounter with the real which sets off repetition, though for Lacan this repetition is, first and foremost, a return of the signifier.

Though the repetition testifies to a mindless 'demonic force' steering our actions (Freud, 1955 [1920], p. 45) the repetition can also be received as aiming at *Nachträglich* constitution of the traumatic scene. In particular, with Lacan, the relentless return of such signifiers may be received as an unflagging attempt to assimilate the void at the centre of the traumatic encounter. This *après-coup*, then, might imply that the mindless repetition machine is, in principle, stoppable. This might be conceived as the spell cast upon the miserable subject that can be broken – if the oracle can be heard – that is if what insists in the repetition gets deciphered.

The Dopaminergic Physiology of Action Sensitisation in case of Trauma

When there is sudden and important reward in a cognitive sense (e.g. inducing opioid release) then there is a dopaminergic peak at the level of the nucleus accumbens, energising but also sensitising the frontal action pathways (Schultz, 1997). In trauma, there is no such reward; still several traumatic events have been shown to induce dopamine release. Indeed, it is remarkable that dopamine levels have been proven elevated by painful and aversive stimuli. A large number of studies showed dopamine release in situations of sudden pain in animal models.[11] Something comparable, though less outspoken, has been observed with 'non-noxious primary aversive stimuli', such as an air puff to the hand or face or hypertonic saline to the mouth, especially when the stimuli were unpredictable (Mirenowicz & Schultz, 1996; Matsumoto & Hikosaka, 2009). Although being non-noxious, these stimuli are aversive because they disrupt behaviour (Schultz, 2002, p. 242). In other terms, traumatic and disruptive events induce dopamine peaks, in a comparable way as unexpected rewards do.

Moreover, in a similar way reward-associated stimuli subsequently are able to induce an 'anticipatory' dopamine peak (Schultz, Dayan & Montague, 1997), energising the associated motor pathway so as to prepare the organism to act upon the reward-to-come, trauma-associated stimuli subsequently also induce such an anticipatory peak. For the case of sudden and intrusive somatic pain, several studies show that central DA systems are activated by environmental stimuli previously paired with mild electric shocks.[12] Remarkably, exacerbated dopamine metabolism is found in the amygdala, a deep brain structure well known for its ability to memorise affect. For the case of psychological pain, Kaneyuki et al. (1991) exposed rats to emotional responses of other, foot-shocked rats, but they were themselves prevented from receiving foot shocks. The authors show indications of elevated dopamine in these rats. Interestingly, some results for conditioned stress paradigms have been found in humans too. For the case of somatic pain, anticipation of an aversive (cutaneous or thermal) stimulus was associated with indications of exacerbated DA activity (Jensen et al., 2003; Aharon et al., 2006). For the case of psychological pain, several studies point to dopaminergic hyperactivity in response to clues that resemble the traumatic event in Post-traumatic Stress Disorder (PTSD), such as shown in combat veterans (Yehuda et al., 1992; Liberzon et al., 1999), adult women traumatised in childhood (Glover et al., 2003; Lemieux & Coe, 1995), abused and neglected children (De Bellis et al., 1999) and victims of violence in the city of São Paulo (Hoexter et al., 2012).

In the ‘reward model’, the dopaminergic release leads to structural changes at the level of the neurons materialised by molecular and cellular changes in the mesolimbic system, called ‘incentive sensitisation’ (see above). These changes involve more neurons, more synapses and molecular changes at the synapses making them faster. The idea is that these changes materialise the memorisation of specific motor patterns, associated with the reward. It is now proposed that, in the cases of trauma or of disruptive events, a sensitisation, comparable to the incentive sensitisation, also takes place as a consequence of the dopamine release. Some indications point in that direction. For example, in a rat model, Valenti, Lodge and Grace (2011) show that there are more dopamine neurons firing spontaneously after stimulation with noxious stimuli (foot shock) or after psychological stress (restraint). Moreover, the exacerbated dopamine release is driven by hyperactivity in the hippocampus, a structure well known for its memory function by cellular modifications similar to those shown in the incentive sensitisation. Similarly, in a rat model, Guarraci *et al*. (1999; 2000) show that dopamine transmission in the amygdala contributes to the formation and consolidation of fear memories. In fact, for an emotional memory, the ‘scenic component’ is consolidated in the hippocampus and the ‘affective component’ in the amygdala by this type of molecular and cellular modifications (LeDoux, 1995). Similar indications are found in humans (Pruessner et al., 2004; Hoexter, 2012).

Repetition Compulsion

In the reward model, the idea is that the dopamine peak sensitises the voluntary action pathway *sanctioned by the reward*, thereby enabling the learning of the adequate act leading to reward. When the sudden event is a disruptive event, painful or simply aversive, the sensitisation may hit an avoidance behaviour (see e.g. McCullough, Sokolowski and Salamone, 1993), which by removing (some of) the excess excitation tied to the pain or the annoyance by discharge, is then ‘adequate’ in the Freudian definition. As in the reward model, in these cases the dopamine sensitisation has a survival value.

In the case of trauma, now, there is by definition no adequate action possible. However, specifically in humans, but also, sometimes, and amazingly so, in animal models, we observe what in psychoanalysis is called ‘repetition compulsion’, i.e. *the tendency to repeat the scenario of the initial traumatic event*. For example, Mitchell and colleagues (1985) show that mice placed in a model T-maze with a start box and two possible goal arms will normally alternate the choice of the arm, but when they are subjected to a continuous mild foot shock, they will persevere in choosing the same arm as the one chosen (by accident) in the first trial. Amazingly, they do so independently of this choice leading to more shock or to the termination of the shock! So, even though they increase their exposure to the foot shock, they persevere with their initial behaviour. The authors have explained this result by pointing out the role of ‘habituation’ and by stating that ‘the proclivity of stressed animals to avoid novel alternatives’ can override their proclivity to choose satisfying responses above discomforting ones (Mitchell *et al*., 1985, p. 216).

For an example of repetition compulsion in a clinical case study (see Bazan, 2007, pp. 13-21), a gentleman complains about obsessional behaviours, in particular, he often catches himself ‘counting’. For example, he feels obliged to count until four before performing certain movements. As an adolescent, he counted when going to bed. Also, he obliged himself to jump in and out of the bed before sleep. He forced himself also, before getting out of bed, to turn four times to the left and four times to the right by passing over his belly. In the course of the analysis, the man comes to make a connexion between these behaviours and behaviours of a similar kind he had often performed as a child, albeit in a different context. Indeed, this man had undergone, from an early age, many surgeries under complete narcosis. He recalls that each anaesthesia was particularly frightening and that, in order to ward off his fears, he had taught himself to count before falling asleep, so as to pick up the counting where he left it on waking up. That, he felt, would help to keep him alive. He had also taught himself, as a child, never to turn from one side to the other directly from the laid-back position, since this is the position of death, but always to turn over his belly. What we propose is that this can be seen as a compulsion to repeat certain action or behaviour patterns, while not being particularly appreciative of them, or even while complaining about them. The actions, which are repeated, are those associated with the initial traumatic scenario.

For these reasons, we propose that the dopamine release at the unexpected event sensitises in the most general way *the motor behaviour proximal to the dopamine peak*. When the sudden event is a pleasant surprise, or when it is the avoidance of a nuisance, the sensitisation may hit an ‘appropriate’ or even an ‘adequate’ act, having either brought about the reward or stopped the disturbance, and thereby it has a survival value. However, in the case of trauma, the sensitisation will, by definition, hit an action with no effect on the traumatic source, as shown in the examples above. Still we are inclined to think it is that action which gets sensitised, independently of its valence. We propose that the dopaminergic tagging does not select for the survival valence and sensitises, independently of valence, *any* behaviour proximal to the dopamine peak (this behaviour having or not a survival valence, or even, as shown above, being detrimental to survival). This last case is *par excellence* what is at stake in the repetition compulsion.

Drives are not Concerned with Valence

In some ways, even this last proposition still fits in the ‘adequate action’ model, and therefore in some ways in the ‘survival’ model. In trauma, no discharge of the traumatic tension excess is possible, but, nevertheless, action or motor behaviour are still possible, even if this motor behaviour has no effect whatsoever on the traumatic event. What we propose, then, is that in the case of trauma, *any behaviour or any kind of action* performed, tied to the irruption of trauma, is by definition more adequate than doing nothing, i.e. than stunning or sideration. Indeed, even if the behaviour does not lead to some result from which the subject would benefit in regard of the traumatic event, the fact in and by itself of binding some of the excess of undirected body tension in a motor pattern, is a benefit, since it lowers the amount of potential energy. Any motor form is, by definition, at least a dischargeable form and this is a structural gain as compared to the excess of unbound tension in need for discharge. We refer to Lacan:

> Freud shows that we can conceive here of what occurs in the dreams of traumatic neurosis at the most primitive functioning – that in which it is a question of obtaining *the binding of energy*.
> (Lacan, 1977 [1973] p. 51, our italics)

Thereby, we again come to see the role of central dopamine release (in its diversity) as intimately reacting upon the *event* level of an experience, whereby the elements of sheer unexpectedness (novelty), intensity and an (unregulated) effect upon the body, are the triggering factors, and not *per se*, the valence of the experience. This approach fits well with different neurophysiologic accounts portraying the dopamine release as a *motivational mechanism*. For example, Wise proposes:

> The ability of phasic dopamine release to augment the motivation that is induced by drives and conditioned stimuli is thought to involve dopamine’s actions in the nucleus accumbens.
> (Wise, 2004: 8. See also Salamone, Correa, Farrar & Mingote, 2007)

By including the cases of disruptive and traumatic events in our model of *jouissance*, we are thus brought back to where we started our thinking, namely the drive. Both *jouissance* and dopamine-pathways are related to a basic drive mechanism, but, importantly, *this drive mechanism seems radically independent from valence*. For example:

(1) It is not the valence of the inaugural event which decides for there to be dopamine release, or not, nor for there to be *jouissance* or not.

(2) What gets sensitised is the action most proximal to the dopamine release, independent of its valence in the physiological model, and what gets repeated is the scenario prevailing at the time of trauma independent of its valence in the psychodynamic model.

(3) When triggering conditions bring back the sensitised or the memorised action, the organism will be driven to engage in these actions, independently of their valence.

By including trauma in our model, we are therefore inclined to propose that, at the basis of living organisms (vertebrates?) lies a drive mechanism, which in its first and foundational logical time, is radically not concerned with valence or affect. It is indeed concerned with 'adequacy' in its logical definition, namely, the discharge of tension[13] but in a way that is radically independent from this adequacy being hedonic in an affective sense.

This 'neuropsychoanalytic' thought endeavour thus brings us to propose that the Freudian concept of 'pleasure' is quite radically distinct from the neurocognitive concept of 'pleasure'. In the Freudian sense, it is brought about by discharge and this discharge marks the adequacy of the act, but it should always be thought against the background of tension – against the background of displeasure – if not trauma. Pleasure is always the discharge of some tension, of which there is structurally as long as we live, an unpleasantly high level. The first air entering the respiratory system, the first milk entering the digestive system, are probably traumatic experiences, even if, at another level, they mark the adequacy of the act, and allow some relief of tension, which is pleasurable. When not (any longer) a trauma, a mother feeding her child will always do so imperfectly (too fast, too slow, too hot, too cold, too much, not enough, too brutal, too gentle, etc.) and any adequacy accidentally occurring, will be merely a lessening of inadequacy. Pleasure in a Freudian sense is always a temporary, floating and partial suspension of displeasure in its logical and mechanical principle. Freudian pleasure, then, is probably not an affect in the neurocognitive sense of the word. Indeed, affects in a neurocognitive approach are defined as having an experiential value: the pleasure affect should be pleasant, 'hedonic' even, and it seems incompatible with concomitant displeasure, disruption, annoyance or trauma. Therefore, we have come to see this affect of pleasure, as probably other affects, as a secondary, behavioural organisational system, which are probably far less determining and orienting for behaviour than the drive system and which are not organised around the adequacy of the act. *Jouissance* and pleasure are intimately intertwined, belonging to the category of the drive and relating to the (in-)adequacy of the act, while affect, in the neurocognitive sense, including hedonic affect, is another (secondary) category altogether.

4. Conclusions: On the Physiology of *Jouissance* and Trauma

In conclusion, for the case of trauma we actually come to propose exactly the same physiological mechanism as we had originally proposed for *jouissance* (Bazan & Detandt, 2013).[14] Indeed, the physiological basis for both mental experiences is articulated in the same three dynamical steps:

(1) An unexpected event leads to central dopamine release.

(2) This dopamine release activates the body and pushes it to act. Importantly, it also sensitises the most proximal action pathway; this sensitisation involves structural modifications of the neurons.

(3) With the re-encounter of a triggering stimulus (external or internal) there is again dopamine release which now energises the sensitised pathways and

drives the organism to repeat.

Note that in this proposition, for both *jouissance* and trauma, we do not simply see the dopamine release as underlying a motivational, alerting or attentional mechanism for stimuli with a reward or an aversive character. We underscore its role in historicising what is associated with the event, i.e. to register in the physiology of the body, the action or behaviour of the organism at the happening of the event, independently of valence.

From a psychoanalytic perspective, this parallel between *jouissance* and trauma is not amazing, indeed, since it is thus an encounter with a real, a real that we may specify [as] *an excitement that goes beyond the limits of the pleasure principle* [this being the definition of trauma]. This is what, in the field of psychoanalysis, with Freud and since Lacan, we refer to by the term *jouissance*. The initial bad encounter, in other words, is the encounter with *jouissance* (Pickmann, 2003). In psychoanalytic theory *jouissance* and trauma are contiguous terms: what has the character of *jouissance* is traumatic, what is traumatic results in *jouissance*.

It is for neuroscience that the proposition is surprising.[15] Indeed, it leads to the proposed idea that the dopaminergic pathways subserve a drive mechanism, including its two major aspects (its activational and its historicising aspect) in a way which is radically independent from valence, in the affective sense of the word. So, simply, when applying clinically-rooted psychoanalytic theory to physiology, we come to conclude that drive and affect are different categories and that drive is a logically more primitive category than affect, in the sense that *there is first a mechanism to act that is oriented by a history of events, independently of their affective valence*.

5. Perspectives

Before closing, let us go back to the brief clinical excerpt of the 'counting gentleman', so as to point out one important aspect of both *jouissance* and trauma, namely the signifier and the way it determines what is re-enacted and repeated. For our counting man, the connection between actual and past behaviour was made after a first intervention, when the first author pointed out the centrality of the bed in his different examples. He thereupon gave another association: when he takes a cup of coffee, he forces himself to take the cup with his right hand and to make circle movements around the handle with his left. Now, the Dutch words for 'cup' and 'handle' are 'kopje' and 'oortje' respectively (he used the diminutives), the first meanings of which are, in fact 'little head' and 'little ear'. The first author then simply repeated after him 'bed, kopje, oortje' ('bed, cup/little head, handle/little ear'). Thereupon, all the associations, lasting for that and another session, with all the frightening anaesthesia situations, with his counting and turning tricks in his bed, with the narcosis performed at the level of his head came tumbling down. This last example (the circling movement around the handle of the cup) shows how behavioural patterns are repeated, not because they once were implied as such, but because *their linguistic structure is similar to the linguistic structure of behavioural patterns*, were once implied with the happening of the event. In other words, for human subjects, action is organised along the logic of the signifier, and more than the behavioural motor pattern as such, it is their signifier-structure which is involved in the mechanisms of *jouissance* and repetition.

notes

[1] Shevrin, Bond, Brakel, Hertel & Williams, 1996; Solms, 1997, 2000; Brakel, 1997; Panksepp, 1998; Shevrin, 2003; Ansermet & Magistretti, 2007; Bazan, 2007; Fotopoulou, 2010).

[2] Thus our approach is a form of dualism, even if it is not an ontological dualism. We might say that it is an *epistemological dualism*, this is to say, an approach that refuses to explain mental states in terms of body states. We thereby situate ourselves in the non-reductionist approach of von Helmholtz (such as described by Hatfield, 1990, p. 182). We also refer to the words of the neuroscientist Marc Jeannerod (2002): 'the paradox is that personal identity […] belongs to a category of facts that are beyond objective description and appear then excluded from a scientific approach. It is not true that it is impossible to understand how meaning is rooted in the biological. But

knowing that it is rooted there, does not guarantee we can have access to them.'

[3] We propose that these nodes not only tie together the biological and the mental, but even the biological, the mental and the social.

[4] It should be noted, however, that none of the research referred to here has been done directly on babies or newborns. These are inferences drawn from observations in animal models and adult populations.

[5] The nucleus accumbens is a region in the basal forebrain, i.e. a structure that lies near the bottom of the front of the brain.

[6] The mesolimbic dopaminergic pathway includes the ventral tegmental area (VTA), a brain stem structure, which innervates the nucleus accumbens shell (NAS), a midbrain structure; the neurotransmitter from the VTA to the nucleus accumbens is dopamine (DA); this system is therefore referred to as NAS-DA.

[7] Note that we explicitly refute the reciprocal stance, i.e. that the physiological functions of the dopaminergic pathways could capture the diverse mental roles of *jouissance*, let alone 'at once'.

[8] In our epistemological approach, the mental is the interpretation of the physiological: therefore it should be able to capture the body's diversity, but reciprocally, we make no claim whatsoever that the physiological is able to capture the diversity of the concept at a mental level.

[9] Please note, thereby, that the definition of 'adequacy' is a logical one, and not an ethical, let alone a moral one. If a living system, and, *a fortiori*, a human being, is structurally rickety and utterly inadequate, this implies that we have some understanding of what adequacy should be: here, we propose that, in a logical sense, it is 'that which allows for discharge'.

[10] Our translation of: 'Si l'on devait rapprocher les termes que je viens de préciser, la jouissance est donc un réel c'est à-dire une expérience corporelle hors-sens, qui fait trace dans la vie d'un sujet puisqu'elle est innommable et irreprésentable.'

[11] Electric foot shock or tail pinch; Lavielle *et al*., 1978; Fadda *et al*., 1978; Herman, 1982; Deutch, Tam & Roth, 1985; Claustre, Rivy, Dennis & Scatton, 1986; Louilot, LeMoal, & Simon, 1986; Abercrombie *et al*., 1989; Young *et al*., 1991; Doherty & Gratton, 1992; Inoue, Tsuchuya and Koyama, 1994; Brischoux *et al*., 2009)

[12] Guarraci and Kapp, 1999; Herman *et al*., 1982; Coco, Kuhn, Ely, & Kilts, 1992; Inoue *et al*., 1994)

[13] And, thereby, it corresponds with Freud's original definition of pleasure, which is also

a logical one.

[14] Except for this difference that we have to include all central dopaminergic pathways (not restricted to the mesolimbic pathways) as well as a diversity of terminal fields, also including the amygdala and the hippocampus.

[15] This is in line with our epistemological position on neuropsychoanalysis, which considers that the exercise leads to an interpretation of the physiological and neuroscience results from a mental perspective, and not to an interpretation of the mental events from a physiological perspective. Logically, the mind is a perspective on the body, but the reverse is not true.

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