On the physiology of jouissance: interpreting the mesolimbic dopaminergic reward functions from a psychoanalytic perspective

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INTRODUCTION

We previously proposed physiological frameworks to understand the mesolimbic dopaminergic reward functions from a psychoanalytic perspective. On the basis of Freud’s “experience of satisfaction” we have proposed a first working definition of jouissance as the (benefit gained from) the motor tension underlying the action which was [once] adequate in bringing relief to the drive and, on the basis of their striking reciprocal resonances, we have proposed that central dopaminergic systems could embody the physiological architecture of Freud’s concept of the drive. We have then distinguished two constitutive axes to jouissance: one concerns the subject’s body and the other the subject’s history. Four distinctive aspects of these axes are discussed both from a metapsychological and from a neuroscience point of view. We conclude that jouissance could be described as an accumulation of body tension, fuelling for action, but continuously balancing between reward and anxiety, and both marking the physiology of the body with the history of its commemoration and arising from this inscription as a constant push to act and to repeat. Moreover, it seems that the mesolimbic accumbens dopaminergic pathway is a reasonable candidate for its underlying physiological architecture.

Keywords: neuropsychoanalysis, jouissance, enjoyment, Lacan, addiction, reward, dopamine, psychoanalysis

Jouissance is a Lacanian concept, infamous for being impervious to understanding and which expresses the paradoxical satisfaction that a subject may derive from his symptom. On the basis of Freud’s “experience of satisfaction” we have proposed a first working definition of jouissance as the (benefit gained from) the motor tension underlying the action which was [once] adequate in bringing relief to the drive and, on the basis of their striking reciprocal resonances, we have proposed that central dopaminergic systems could embody the physiological architecture of Freud’s concept of the drive. We have then distinguished two constitutive axes to jouissance: one concerns the subject’s body and the other the subject’s history. Four distinctive aspects of these axes are discussed both from a metapsychological and from a neuroscience point of view. We conclude that jouissance could be described as an accumulation of body tension, fuelling for action, but continuously balancing between reward and anxiety, and both marking the physiology of the body with the history of its commemoration and arising from this inscription as a constant push to act and to repeat. Moreover, it seems that the mesolimbic accumbens dopaminergic pathway is a reasonable candidate for its underlying physiological architecture.

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In the early seminars, Lacan (1975/1953–1954, 1978/1954–1955) uses the term with a 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. There is an essential distinction to take from these juridical definitions, which sounds the notion of jouissance: it is the distinction between the satisfaction of consuming something, whereby it could be damaged, destroyed or lost in the consumption, and the satisfaction of using something with this satisfaction being explicitly not tied to its consumption. Several Lacanian authors explicitly use this definition of jouissance in its original juridical reference: e.g., Robin (2006, p. 29), in the context of addiction, defines enjoyment as the profit one can obtain from something which he does not possess. Jadin (2012/2009, p. 42) explains that abuse could be defined as “treating the body of the child as if one had usufruct of it.”

Later on in Lacan’s work, the sexual connotations of jouissance become more apparent. It is in The Ethics of Psychoanalysis, then, that (Lacan, 1986/1959–1960, p. 209) proposes that “jouissance appears not purely and simply as the satisfaction of a need, but as the satisfaction of a drive.” Indeed, up to 1957, the term seems to mean no more than the enjoyable sensation

"fnhum-07-00709" — 2013/11/5 — 20:32 — page 1 — #1
that accompanies the satisfaction of a biological need such as hunger (Lacan, 1994/1956–1957, p. 125), but in this seminar jouissance and pleasure are distinguished. It is therefore that, starting precisely from Freud's model of drive, we will propose a metapsychological understanding of the concept of jouissance which will allow for an operationalisation in physiological terms. We have organized our paper in two parts, a psychoanalytic (metapsychological) part followed by a (neuro-)physiological part. Moreover, we have distinguished two constitutive axes to jouissance: one has to do with the body and entails the aspects of (1) the drive, (2) the experience of satisfaction and (3) the dimension of excess (of body tension); the other has to do with the (subject's) history and basically entails the commemoration of a trait, complying to repeat. These four distinctive aspects are respectively discussed both from a metapsychological and from a neuroscience point of view.

**METAPSYCHOLOGY: FROM BODY TO HISTORY**

**BODY**

Freud's model of the drive

In Freud's (1915) model, a drive has a source (a biological need or lack), an aim (the satisfaction of that need), an object (adequate in satisfying the need) and an impetus (a pressure pushing to act). Hunger could, in this model, start with a biological signal, such as low blood sugar sensed in the lateral hypothalamus (LH). This lack is sensed by the central nervous system (symbolized by $\psi$ in Freud's Project) where the lack accumulates as an excess of endogenous quantities: “The nucleus of $\psi$ is connected with the paths by which endogenous quantities of excitation ascend. (...)”The filling of the nuclear neurones in $\psi$ will have as its result an effort to discharge, anurgy which is released along the motor pathway. Experience shows that here the first path to be taken is the path of internal state (e.g., by the child’s screaming). When the attention of an object is mobilized, the organism is mobilized. The newborn child reacts by an undirected motor discharge, in a (vain) attempt to lower the body tension. The baby giggles and screams. Freud (1956/1895a, p. 318) continuous: “The removal of the stimulus is only made possible here by an intervention which for the time being gets rid of the release of QH (excitation quantity) in the interior of the body; and this intervention calls for an alteration in the external world (supply of nourishment, proximity of the sexual object) which, as a specific action, can only be brought about in definite ways. At first, the human organism is incapable of bringing about the specific action. It takes place by extraneous help, when the attention of an experienced person is drawn to the child’s state by discharge along the path of internal state (e.g., by the child’s screaming). When the helpful person has performed the work of the specific action, an experience of satisfaction occurs in the body – i.e., in the motor mobilization of those action pathways that were (once) adequate in delivering pleasure. This definition suits 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. This is in agreement with e.g., Marie (2004, p. 27) who says: “Jouissance (...) is very close to l’Agieren, (...) according to its Latin etymology, agere, i.e., accomplish, express by the movement. Any modality of jouissance is of the order of the Agieren.”

**Experience of satisfaction**

The “experience of satisfaction” is a good place to start discussing jouissance, e.g., Marie (2004 p. 25) 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.” Let’s go back to Freud (1965/1895, p. 318): “The total event then constitutes an experience of satisfaction, which has the most radical results on the development of the individual’s functions. For three things occur in the $\psi$ system: (1) a lasting discharge is effected and so the urgency which had produced displeasure in $\omega$ is brought to an end; (2) a cathexis of one (or several) of the neurons which correspond to the perception of an object occurs in the pallium; and (3) at other points of the pallium information arrives of the discharge of the released reflex movement which follows upon the specific action. A facilitation is then formed between these cathexes
and the nuclear neurones.” The “pellinum, in Freud’s vocabulary, is the part of the central nervous system which is connected with the nuclear neurones (specific sense and visceral sense)” while the nuclear neurones innervate the inner body (the visceral). Freud (1956/1895a, p. 312) adds that “so is assumed to be filled from ψ,” in other words, it is the (nucleus of) the central nervous system which informs of the actual values of the homostatic situation in the inner body.

In other words, the experience of satisfaction is as much the adequate response to a drive tension as it is the “radical result” of it, namely a lasting facilitation of the associations between a state of body tension at the level of a neural comparator system (ω), a perceptual image of an adequate object, and a motor representation of an action adequate in resolving the tension. As a result: “(...) when the state of urgency or wish-to-arouses (from ψ to ω), the cathexis will also pass over on to the two memories and will activate them. Probably the mnemonic image of the object will be the first to be affected by the wishful activation. I do not doubt that in the first instance this wishful activation will produce the same thing as a perception – namely a hallucination” (Freud, 1956/1895a, p. 319). We would now add that the wishful activation will also produce a motor body tension, and that this motor tension would then be equivalent to the Lacanian concept of jouissance. The biological needs are capable of inducing a reserve of motor tension, which will be recruited in order to meet the demands of life, and this reserve of motor tension is equivalent to jouissance: “A little bit of jouissance, a certain excess is nevertheless necessary from the start. Indeed, the necessities or demands of life (Net des Lebens) are such that the nervous system needs to gather a reserve amount to face them” (Jadin, 2012/2009, p. 58).

A question at this point, then, is if this state of body tension is in and by itself in some ways satisfying? It is difficult to decide this question. It could be that body tension has an inherently rewarding effect (see further), but it could also be that the dimension of enjoyment more particularly refers to an inaugural experience(s) of satisfaction. For example, Scherer (Freymann et al., 2012, p. 7) says: “The drive is caused by the search, the sting of the recovery of the hallucinatory revival of a previous experience of satisfaction. Hallucination of which we may assume that it was accompanied by an unprecedented pleasure, particularly intense, excessive, incommensurate with the pleasure associated with the simple release of tension of the need” (italics added).

Excess of body tension

For Lacan (1986/1959–1960, p. 42; 1965–1966, p. 137, 1999/1972–1973, p. 26), a body “is something that is made to enjoy, to enjoy itself,” “it belongs to a body to enjoy” and “a body is there to be enjoyed.” To understand this, let’s push the Lacanian understanding of jouissance a little bit further. In the inaugural experience of satisfaction of hunger, the baby is given the breast by his mother. In a following frontal encounter with the breast, the sucking movement will be released. Jadin (2012/2009, p. 58–59): “But the case may be that the breast is seen from the side. Discharge, then, is delayed and will only take place after a certain search, for example by means of a movement of the head. For this quest, the child must in a first time decompose the perception, this is the Uraus (…) (the judging). The child will perceive at the one hand something identical and specific of the breast, the thing itself of the breast, the Thing (Das Ding) seen from the front, and on the other hand, an element that may vary. When this variable element is strange, the child will delay the discharge. (...) You can see that the Thing is something very specific. It is present at the same time when the object satisfying the drive is effectively perceived, and when the object is only imagined as complete, anticipated by desire. The Thing is the portion always invested by the jouissance (…). In the system of neurons described by Freud that the perceptual complex corresponds to a nuclear neuron of the brain which is continuously invested, continuously filled by endogenous quantities, the production of which is constant.”

In our opinion, the notion of jouissance thus seems to balance between two kinds of body tension. The notion of “body tension” is a kind of readiness to act, a motor preparedness, which is probably situated mostly centrally, as an activation level of the central nervous system, but some of which may percolate to the body through subthreshold peripheral motor commands and executions (e.g., mini-contractions). At the one hand, there is the body tension, which we referred to before, specifically preparing an adequate act, which was once accomplished before during an experience of satisfaction. We propose that this part would then correspond to the variable part, as it is activated in reaction to an “attribute” (or an “affordance”, in cognitive term; Gibson, 1977).
which functions as a handle for manipulation of the object, as a consequence, it can be represented. At the other hand, there is the body tension, which is induced by the constant “and specific” part of the object, the essence of the thing, das Ding itself, which allows it to be identified as such even if the usual attributes for grasping it have changed. What we propose goes as follows: as the thing is identified – i.e., identified from a past experience of satisfaction, as a potentially satisfying object – it induces body tension, which will be needed to act upon it, but as the usual “handles” have changed, this body tension is yet without clear motor execution form. We could say that it has not yet moved (very far) to the motor discharge part of the mental apparatus. Probably this second reading of jouissance is closer to Lacan’s (1986/1959–1960) concept of “enjoyment of the Thing.” (Italics added) Indeed “jouissance, the Thing, is thus that which preceded a certain manipulation. It dates from (the time) before the hand” (Jadin, 2012/2009, p. 50). It is (more) easily understood, then, why this jouissance is considered “out-of-representation” (see also Hoffmann, 2012/2009, p. 9): the reserve of body tension has not yet been destined to a determined motor form, which is the basis for representation (see further). Perhaps we could also say it is still very much biological, and not yet mental!

We should also consider the possibility that it is only in this second scenario that, by chance or by surprise, finding the “adequate” way to grasp the object will be “accompanied by an unprecedented pleasure, particularly intense, excessive, incommensurate with the pleasure associated with the simple release of tension of the need,” and that this is what specifically underlies the powerfully satisfying dimension of jouissance. But maybe, once found, a new share of body tension shifts to the mental side, where it can be represented. However, the successful mobilization of this share of body tension, though it will be activated at a new encounter with the Thing, won’t be able to induce the same extent of gratification as the first time. But at the other hand, if a pathway of discharge is not found, tension may accumulate and this, then, might lead to the experience of pain. Freud (1949/1905, p. 1212) says, speaking about the element of writing, of a trait in so far as it commemorates an irruption of enjoyment. Freud (1949/1905, p. 1212) says, speaking about thumb sucking, that the child is “is determined by a desire to be needed” (Freud, 1949/1905, p. 1212) – i.e., identified from a past experience of satisfaction (…) it is the difference in amount between the pleasure of satisfaction which is demanded and that which is actually achieved that provides the driving factor which will permit of no halting at any position attained, but, in the poet’s words, “ungebändigt immer vorwärts dringt” which coming from the source of the drive. Lacan (1991/1969–1970, p. 111–112) comments: “In 1920, what Freud is dealing with in the exploration of the unconscious, is repetition” (…) Repetition is the denoting, the precise denotation of a trait (…) being identical to the unary trait, to the little stroke, to the element of writing, of a trait in so far as it commemorates an irruption of enjoyment. Lacan (1991/1969–1970, p. 1212) says, speaking about thumb sucking, that the child is “is determined by a search for some pleasure” which has already been experienced and is now remembered. Repetition, thus, is the commemoration of jouissance and dopamine.

**HISTORY Commemoration of a trait, compelling to repeat**

The radical result of the experience of satisfaction is a facilitation or memory trace “between two mnemonic images and the nuclear neurons which are cathered in the state of urgency” (Freud, 1956/1895a, p. 319). It is the catheresis of the nuclear neurones (which coming from δfills us) which induces a facilitation between the mnemonic image of the satisfying object and the (once) adequate motor act. When Freud (1949/1905) says in: “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, 1949/1905, p. 184; Italics added), we may assume the new “promotions” mediated by the central, the described inscription of the memory traces. But these are not just passive traces: indeed, they “leave behind a need for their repetition.” Freud (1955/1920, p. 42) explains how this goes in Beyond the pleasure principle. “The repressed instinct never ceases to strive for complete satisfaction, which would consist in the repetition of a primary experience of satisfaction (…) it is the difference in amount between the pleasure of satisfaction which is demanded and that which is actually achieved that provides the driving factor which will permit of no halting at any position attained, but, in the poet’s words, “ungebändigt immer vorwärts dringt” which coming from the source of the drive. Lacan (1991/1969–1970, p. 111–112) comments: “In 1920, what Freud is dealing with in the exploration of the unconscious, is repetition” (…) Repetition is the denoting, the precise denotation of a trait (…) being identical to the unary trait, to the little stroke, to the element of writing, of a trait in so far as it commemorates an irruption of enjoyment. Lacan (1991/1969–1970, p. 1212) says, speaking about thumb sucking, that the child is “is determined by a search for some pleasure” which has already been experienced and is now remembered. Repetition, thus, is the commemoration of jouissance and dopamine.

**Jouissance and dopamine**

Bazan and Delaunay

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“fnhum-07-00709” — 2013/11/5 — 20:32 — page 4 — #4
an irruption of enjoyment. Lacan (1986/1959–1960, p. 289): “the drive as such is something extremely complex (…) It embodies a historical dimension whose true significance needs to be appre- ciated by us. This historical tendency is defined by this, by this mark, consisting of the drive presenting itself with a certain insis- tence, in its status of referring to something memorable because it was remembered9. Remembering, “historicizing,” is coextensive with the functioning of the drive in the human psyche.” We can read here the reference to Freud’s facilitation induced by the drive between the two mnemonic images, brought about by the experi- ence of satisfaction. This coupling of events forms a trait or a mark, commemorating an irruption of enjoyment, and induc- ing a relentless tendency to repeat: “The compulsion to repeat and (drive) satisfaction which is immediately pleasurable seem to converge here into an intimate partnership” (Freed, 1953/1920, p. 23).

Therefore, taking all this together, we are inclined to think that the experience of satisfaction, having been in itself an experience of jouissance, leaves behind a powerful memory trace, which will be readily activated whenever a similar body need or drive situation is aroused, or when “the Thing” is reencountered, thereby induc- ing a reactivation of the memory images of this (once) satisfying object as well as of the (once) satisfying action. This reactivation will bring about in and by itself jouissance through motor tension. This tension might procure (some) enjoyment, especially if some new motor pathway to approach the object has been thought out. Remarkably, this enjoyment then will be released quite indepen- dently of the object and action still satisfying the drive from which they historically originated.

**PHYSIOLOGY: THE DOPAMINERGIC PATHWAYS**

**BODY**

Model of the drive: mobilise the external body from within

In the natural history of life, it is with the first vertebrates 520 million years ago that the striated, or voluntary, muscles emerge as the system to move the newly invented internal skeleton (see also Bazan, 2008). Vertebrates, then, are schematically constituted of two bodies: an internal body, the invertebrate body, consisting of the so-called vegetative systems for blood circulation, respiration, digestion, excretion, sudation, reproduction etc., and an external body, consisting of the skeleton and the striated or skeletal muscles. These bodies having been in some ways superposed the one upon the other in the course of evolution, for the organism to function efficiently, there must be a system that adjusts the signalling of internal body needs (e.g., oxygen, food, hydration, sex objects) to specific actions of the external body which can alleviate these body needs.

A first physiological understanding of the Freudian concept of the drive, then, would be the dynamics whereby a body ten- sion, originating from a need in the internal body, mobilises the external body and instigates it to action. One key hypoth- esis then is that central dopaminergic systems could embody the physiological architecture of Freud’s concept of the drive. In the striatum, dopamine (DA) serves as a critical motor action signal; increases in DA are associated with increases in motor output, and decreases in DA with inhibition of behavior. In the case of the mesolimbic pathway, the ventral tegmental area (VTA) inner- vates the nucleus accumbens shell (NAS), which is part of the corpus striata (basal ganglia); this system is therefore referred to as NAS-DA. This is also the so-called SEEKING system of which the neuroscientist Panksepp (1998, p. 145, 144) says that when this system is stimulated: “organisms deploy the most energized exploratory and search behaviors an animal is capable of exhibiting: e.g., stimulated rats move about excitedly, sniffing vigorously, pausing at times to investigate various nooks and crannies of their environment,” or else: “The desires and aspirations of the human heart are endless: (…) But they all come to a standstill if cer- tain brain systems, such as the DA circuits arising from midbrain nuclei are destroyed. (…) These circuits appear to be major con- tributors to our feelings of engagement and excitement as we seek the material resources needed for bodily survival: (…) Without the synaptic “energy” of DA these potentials remain dormant and still. (…) When DA synapses are active in abundance, a person feels as if he or she can do anything.”

The psychoanalyst and neuroscientific researcher Howard Shevrin has previously made a convincing case that Panksepp’s SEEKING system could stand as a physiological correlate of Freud’s concept of the drive (Shevrin, 2003). Shevrin (2003) indicates how the four parts of the SEEKING system are remarkably similar to the four parts of Freud’s definition of drive and proposes to illustrate this with a simple table (Table 1).

Indeed, Panksepp’s SEEKING system is made up of four parts: regulatory imbalances, consummation, external stimulus, and powerful states of expectancy or anticipation, while Freud’s archi- tecture of the drive is also made of four parts. Shevrin (2003) proposes the following parallels: the regulatory imbalances in Panksepp’s model are the underlying specific need states such as hunger, thirst, and sex; thus they correspond with the somatic source of the drive. Consummation refers to the satisfying of the underlying need state, which is what corresponds to the aim of the Freudian drive. External stimulus refers to the object providing the consummatory satisfaction, the most variable com- ponent. Concerning the fourth component, Panksepp’s “powerful states of expectancy or anticipation,” they refer to the activa- tion of the NAS-DA. According to Panksepp (1998, p. 145),

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<th>Table 1</th>
<th>Shevrin’s (2003) proposition of the parallels between the four parts of Panksepp’s SEEKING system and the four parts of Freud’s definition of the drive.</th>
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<tr>
<td>Panksepp’s SEEKING system</td>
<td>Freud’s drive theory</td>
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<tr>
<td>Regulatory imbalances</td>
<td>Somatic source (Craving)</td>
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<tr>
<td>Consummation</td>
<td>Aim (Ziel)</td>
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<td>External stimulus</td>
<td>Object (Objekt)</td>
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<td>Energetic activity</td>
<td>Motor factor (Drang)</td>
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9One translation of “Cette tendance historique se définit eneci, dans cette marque que la pulsion se présente dans une certaine insistance, en tant qu’elle se rapporte à quelque chose de mémorable parce que mémorable,” which we prefer above the official translation which is “This dimension is to be noted in the insistence that characterizes its appearances, it refers back to something memorable because it was remembered.”

“fnhum-07-00709” — 2013/11/5 — 20:32 — page 5 — #5
activation of this system is characterized by a "psychic energization."
When it is activated "...animals perform a large number of motivated goal-seeking behaviors. If this system is damaged, a

Shevrin (2003) indicates that Panksepp's inference concerning
the subjective state of the animal when the NAS-DA circuits is
activated, "is based on the intense motor activity of the animal
engaging in exploratory activity. In other words the animal is
according to Panksepp, energetically active. This clearly impli-
cates a motor factor. Moreover, the activation of the NAS-DA
circuits results in an animal engaging in effortful behavior, in
Freed's terms, a demand for work is being made in the most
basic meaning of the word work. In this sense, the "power-
ful states or expectancy or anticipation" also correspond quite
precisely to Freed's component of motor pressure. We therefore
propose that the functioning of the (mesolimbic) dopaminergic
pathways could embody a physiological counterpart of Freed's
drive concept.20

Let's again take the case of hunger. Indeed, Panksepp (1998,
p. 167) states: "The SEEKING system, under the guidance of
various regulatory imbalances, external incentive cues and past
learning, helps take thirsty animals to water, cold animals to
warmth, hungry animals to food, and sexually aroused animals
toward opportunities for orgasmic gratification." However, if we
want to apply this model to the "simple" situation of a hungry
baby crying for food the first time, we run into an endless series
of complications. First, there are many redundant mechanisms
to ensure adequate food consumption any of which may be suf-
ficient to stimulate food intake. Second, the pathways from the
internal homeostatic receptor systems detecting various bodily
imbalances and inducing the activation of the SEEKING sys-
tem, i.e., inducing DA-release, are multiple. It is beyond our
goal and expertise to give an overview of these, but it seems that
the brain architecture underlying appetitive motivation is gener-
ally compatible with a drive concept embodied by dopaminergic
transmission. For example, if we want to go from hunger to the
mobilisation of the external body, the hypothalamus seems a good
place to start. It is well established that the accumbal nucleus of
the hypothalamus receives humoral signals, both from various
nutrients and from various hormones, regarding the status of
peripheral energy stores and conveys this information to the lateral
hypothalamic area (Elmqist et al., 1999). The LH influences vol-
untary somatic motor systems governing complex food-searching
and food-related behavior. If the LH is activated and food is not
present, animals act very aroused, are hyperreactive, and appear to
engage in searching or foraging behavior (Kelley et al., 2005a,b).

Moreover, this LH involvement seems to imply dopaminergic
pathways. The lateral hypothalamic corridor between the LH and
the VTA is part of the Medial Forebrain Bundle which runs from
the VTA to the NAS. The LH also has direct connections with the
accumbens shell giving the NAS a privileged access to hypothala-
mic energy-sensing substrates; however, the LH also more directly
reaches widespread areas of striatum (beyond the accumbens) via
midline thalamic projection (for review, see Kelley et al., 2005a).

In other words, dopaminergic innervation of the striatum, both
ventral and dorsal, is involved in food intake, and this system is
concerned with motor activation and foraging strategies associ-
ated with changing motivational conditions (Haberny et al., 2004;
Haberny and Carr, 2005). The complexity of these pathways,
however, is huge and there are discrepant opinions in different
authors.21 What is important in the present exercise, is not to
show that the dopaminergic transmission is a necessary condi-
tion for the engagement in appetitive behavior, but to show that
the architecture of the brain is broadly compatible with the drive
mechanism as embodied by dopaminergic transmission, i.e., that
it is a possible pathway. Indeed, the first experience of satisfac-
tion, the first cry of the hungry baby may have a quite different
physiology as the adult "routine" hunger usually studied in neu-
rosciences. Concretely, when Freud indicates that "The nucleus of
ψ is connected with the paths by which endogenous quantities of
excitation ascend. (...) The filling of the nuclear neurones in ψ
will have as its result an effort to discharge, an urgency which is
released along the motor pathway," it seems that, given the data
summarised above, we are in a position to translate this as: "the central dopaminergic systems are connected with paths
which convey information of the internal homeostatic situation
of the body, e.g., through the LH. Ascending excitation, indi-
cating, e.g., a food depletion centrally, will lead to release of DA,
which will lead to motor mobilisation."

But how can we now situate the proposed difference between
delineates that it has been established across many animal species
that once an animal is conditioned to expect a reward following
the appearance of a conditioned stimulus such as a light, that
at a certain point it will begin to treat the light as if it were the
reward itself, in particular if no reward has been forthcoming.
A pigeon, for example, will begin to peck at the light even though
its pecking has nothing whatsoever to do with the appearance of
the reward. This phenomenon is called autoshaping, that is, says
Shevrin (2003) "the animal's own response, the pecking, becomes
intrinsically rewarding." When the NAS-DA circuit is artificially
blocked with antagonists, the autoshaping disappears (e.g., 19)
Ciano et al., 2001). Shevrin (2003) comments: "(...) it is not the
anticipation of some consummatory pleasure that is involved, a
totally different matter, but a pleasure of some sort intrinsic to
drive activation. Consummatory pleasure and, if I may call it that,
drive pleasure are two different things. The first I submit is an emo-
tion or effect in the usual sense; the second is a unique state of
expectation or anticipation that is intrinsically gratifying, but not
pleasurable in the usual sense. It is entirely expressed through action.

20 Other neuroscientific authors have also made propositions in the same line,
though probably not with Freed's concept of the drive in mind. e.g., Kupfermann
et al. (2000, p. 998) in their seminal work Principles of neural science propose that
the mesolimbic DA transmission appears to represent a state of motivation or drive
when food states can be understood as a state of tension due to a physiological
need or homeostatic imbalance. Drives direct behavior toward a goal, able to main-
maintain homeostasis via consumption of an object (e.g., food). Moreover, they increase
general alertness, energizing an individual to act appropriately in a given situation,
in order to obtain a goal.

21 For example, even if a specific role for the medial accumbens shell in food-directed
behavior and food consumption was indeed demonstrated (Stratford and Kelley,
1997; Reynolds and Bermeda, 2001), Kelley et al. (2005a) sum up a number of results
which seem difficult to reconcile with the idea that dopaminergic transmission is
necessary for appetitive approach.
rather than accompanying actions as is the case with consummatory pleasure\textsuperscript{11} [Italics added]. Shevrin’s concept of consummatory pleasure seems to parallel Freud’s concept of pleasure, resulting from the release of tension induced by the consumption of a “suitable” object (of the drive). Shevrin’s difference between consummatory and drive pleasure therefore parallels quite nicely our own distinction between pleasure and jouissance, with jouissance defined as the benefit gained from the motor tension underlying the action brought about by the drive, and it allows us to state the concept of jouissance at the level of the intrinsic NAS-DA activation.

These distinctions are also in a remarkable resonance with another neuroscientific distinction. Indeed Berridge (1996), as well as Robinson and Berridge (1993, 2000, 2003), propose a distinction between wanting and liking. It was first this author’s merit to master two different ways of measuring appreciation in rats: at the one hand, the hedonic (liking) or aversive reactions are measured on the basis of facial reactions (some of which are conserved over different species); at the other hand the wanting is measured on the basis of the amount of motor activation which the organism is ready to invest in order to obtain the reward. These distinctive parameters allowed for the dissociation of two anatomical circuits (Berridge, 1996): the wanting circuit corresponds with the mesolimbic NAS-DA of Panksepp’s SEEKING system, the liking circuit corresponds with so-called “opioid hot-spots,” involving among others the shell of the nucleus accumbens, the ventral pallidum and the parabrachial nucleus of the pons in the brain stem. These circuits function independently of each other. For example, considerable research with the taste reactivity test has demonstrated that interference with DA failed to alter appetitive taste reactivity for sucrose (Berridge and Robinson, 1998). Also, enhancing DA neurotransmission is not sufficient to produce pleasurable subjective effects in humans (Rothman and Glowa, 1995). This has led Robinson and Berridge (1993) to conclude that, though the original hypothesis emphasized the role that pleasure played in mediating the effects of dopaminergic manipulations, brain DA does not mediate liking. Nevertheless, DA systems are involved in wanting of natural and drug reward (see Berridge, 2007); this wanting is determined by the intensification of the wanting circuits quite independently of liking. Indeed, work of these authors shows that activation of DA systems enables or increases behavioral responses necessary for obtaining a goal object, while interference with DA potently affects the willingness of the animal to engage in behavioral actions aimed at anticipating or foraging for food (e.g., Berridge, 1996). It is therefore tempting to draw a parallel between these physiological findings and the psychoanalytic concepts: Berridge’s wanting and the psychoanalytic concept of the drive bear some similarities for as far as they both concern the readiness to engage in a motor behavioral effort\textsuperscript{12}.

In summary, the proposition that the central dopaminergic systems, and in particular the NAS-DA system, could embody a physiological counterpart of the psychoanalytic concept of jouissance, seems to be coherent both with the drive-dimension of jouissance and with an understanding of jouissance as the benefit gained from the motor tension underlying the action which was (once) adequate in bringing relief to the drive, as Shevrin points out with the phenomenon of e.g., autoshaping. Furthermore, through Shevrin’s distinction between consummatory and drive pleasure, we can see how the Lacanian distinction between pleasure and jouissance might reflect or parallel a number of exclusively neuroscience-based distinction, as well as, prominently, the distinction between liking and wanting.

**Experience of satisfaction: tag the action associated to a reward**

A second aspect of the jouissance-NAS-DA convergence would be a convergence around some way of marking the adequate act. The psychoanalytic idea would be that the adequate act, which is also pleasurable, gets some ways “tagged” during the experience of satisfaction and we have proposed that it is this tagging by experience that will readily reactivate the specific motor pattern when a comparable situation of need is measured by the so-neurons. The reactivation of this body tension was tentatively understood as jouissance. Now, it is well characterised that the presentation of a rewarding stimulus, whose reward value cannot be anticipated, produces a burst of DA firing (Bromberg-Martin et al., 2010). This could fit the psychoanalytic model if some conditions are met. First, the idea of reward should also (partially) cover the Freudian dimension of pleasure, in the sense that the rewarding stimulus should procure tension relief, in particular by being an adequate response to a bodily imbalance situation. Second, it is then this pleasure which should induce the DA release. Third, the effect of this DA should (also) be on the level of the actions involved by stimulus rather than (exclusively) on the stimulus itself and in some ways tag these actions so as to distinguish them from other actions.

First, is the “reward” of the physiological observations comparable to the Freudian pleasure? Salamone et al. (2007, p. 462) define reward as a positive reinforcer with emotional effects, such as

\textsuperscript{11}Berridge, C. K., Robinson, T. E., Salamone, J. D., and Corbin, W. L. (2007, p. 465) summarize in a footnote a number of comparable distinctions which several authors have made between two kinds of gratifications e.g., instrumental versus directional, preparatory versus consummatory; instrumental versus consummatory; appetitive versus consummatory; etho-motor versus etho-hedonic; hedonic versus homeostatic.

\textsuperscript{12}Similarly, Robinson and Berridge’s liking and the psychoanalytic concept of pleasure bear some similarities for as far as they both concern a pleasure or hedonic experience upon consummation of an object. However, pleasure in the Freudian sense is defined as a relief of body tension due to the satisfaction of a bodily need. Liking, on the other hand, is brought about by stimulation of the opioid hot-spots which react by innate pathways to the “surroun… (\textit{it} is, its own taste and bodily shapes), to some extent independently of the information on the homeostatic situation of the internal body (Sclafani, 2004). Of course, this scheme works for as long as we stick with “biocentric” drugs which are so fundamental to life and conserved over evolution that they have strong innate foundations. But there are many other internal body tensions which can arise in the course of our first interactions with our primary caregivers besides hunger, especially in the human species, which is the most dependent of his first caregivers. It would be interesting to find out if homeostatic relief, in general, can lead to opioid activation and if this opioid activation could serve as a criterion for the dopaminergic tagging of the associated action. Different elements point in that direction, e.g., that homeostasis can modulate the rewarding value of a stimulus, but the total picture remains unclear. Now, for the model to function beyond more innate drive like hunger (where associated criteria like overflow may suffice as a criterion for the adequacy of action), i.e., for the model to function in more typically human situations, the dopaminergic reward system should be able to take into account the situation of the internal body as a criterion for tagging actions. In this sense the NAS-DA being inferred of this homeostatic information is sufficient (as further) and the opioid activation may or may not constitute a correlate of the Freudian concept of pleasure.
feelings of pleasure. The term reinforcer goes back to Thorndike’s (1911) “Law of Effect” which says that “any act which in a given situation produces satisfaction becomes associated with that situation so that when the situation recurs the act is more likely than before to recur also.” This is basically the same as what Freud says for the experience of satisfaction, but Freud gives a criterion for pleasure: he refers to a lasting discharge the information of which is conveyed by the so neurons, which are filled with the (subcorti- cal and brainstem) neurones in connection with the internal body. So, yes, there is some equivalence between the Freudian concept of “pleasure” and the cognitive concept of “reward” with this proviso that in the cognitive concept no concrete criterion for “satisfaction” is included.

Second, is it then this pleasure which induces the DA release? The neuroscience findings show that it is only when the reward is unexpected that there is a burst of DA firing (Schultz, 1998). Thus, DA neuron responses are not triggered by reward con- summation per se, except if the reward was unexpected. Instead, DA neurones discharge in anticipation of reward (Koob and Volkow, 2010). Indeed, DA neurones are excited when a cue indicates an increase in future reward value. Allowing to the higher described phenomena of auto-shaping, Volkow et al. (2010) (p. 9–11) say that “the mere prediction of a reward may eventually become the reward (…) this type of functional “switch” has also been reported for natural reinforcers, which are likely to induce an equivalent and gradual shift in DA increases (…) in the transition from a novel stimulus that is inherently rewarding to that of the associ- ated cues that predict it.” Berridge and Robinson (1998) propose that the phasic DA-bursts create a state of motivation to seek reward (see also Salamone et al., 2008). They motivate the individual to obtain the hedonic reward “so that the individual almost cannot sit still” (Berridge, 2007, p. 408). This DA release is necessary for reward cues to cause an increase in general motivation to per- form reward-seeking actions (Bromberg-Martin et al., 2010, p. 15). Kriston et al. (2001, p. 271) suggest that the nucleus accumbens “may provide the motivational “engine” that fuels attainment of immediate reward.” This characteristic of behavior has enormous adaptive significance because it enables organisms to exert effort to overcome obstacles or work-related response costs that sepa- rate them from biologically relevant stimuli (Van den Bos et al., 2006). We are tempted to make some parallel here between these diverse neuroscience interpretations and Jadin’s (2012, p. 58) psychoanalytic “little bit of jouissance” which is nevertheless neces- sary to face the “demands of life (Not des Lebens)” which are such that “the nervous system needs to gather a reserve amount to face them.” In this light, it is interesting to stress that DA systems are activated not only by positive stimuli, but also by aversive, painful and stressful stimuli and events (Berridge and Robinson, 1998; Salamone et al., 2007). Indeed, both rewarding and aversive situa- tions require an increase in general motivation to energize actions and to ensure that they are executed properly. This fits with the clinical observation that “jouissance can also be tied to actions which were (once) adequate not simply in obtaining pleasure (rewarding situations) but also in avoiding displeasure (aversive situations).

Now, when encountering such an unexpected reward, DA neu- rons often produce phasic bursts of activity including multiple spikes (Schultz, 1998). Strikingly, these phasic bursts, which are in this moment perceived as pleasurable (Bromberg-Martin et al., 2010), could be some physiological counterpart of the dimension of enjoyment which we have attributed especially to the inaugural experience of satisfaction, “an unprecedented pleasure, particularly intense, excessive, incommensurate with the pleasure associated with the simple release of tension of the need.” The pleasure here is not to be understood in the Freudian sense, since, indeed, DA and accum- bers neurons do not discharge during actual consumption of an expected reward, when the most pleasure is presumably experi- enced (Schultz, 1992, 1998). It is another kind of pleasure, namely jouissance. Strikingly, we are reminded of Freud’s (1935/1920, p. 35) words: “Nowhere is the condition of enjoyment.”

Thais, DA neuron responses are not triggered by reward con- sumption per se, except if the reward was unexpected. Instead, DA neurones discharge in anticipation of reward (Koob and Volkow, 2010). Indeed, DA neurones are excited when a cue indicates an increase in future reward value. Allowing to the higher described phenomena of auto-shaping, Volkow et al. (2012, p. 9–11) say that “the mere prediction of a reward may eventually become the reward (…) this type of functional “switch” has also been reported for natural reinforcers, which are likely to induce an equivalent and gradual shift in DA increases (…) in the transition from a novel stimulus that is inherently rewarding to that of the associ- ated cues that predict it.” Berridge and Robinson (1998) propose that the phasic DA-bursts create a state of motivation to seek reward (see also Salamone et al., 2007). They motivate the individual to obtain the hedonic reward “so that the individual almost cannot sit still” (Berridge, 2007, p. 408). This DA release is necessary for reward cues to cause an increase in general motivation to per- form reward-seeking actions (Bromberg-Martin et al., 2010, p. 15). Kriston et al. (2001, p. 271) suggest that the nucleus accumbens “may provide the motivational “engine” that fuels attainment of immediate reward.” This characteristic of behavior has enormous adaptive significance because it enables organisms to exert effort to overcome obstacles or work-related response costs that sepa- rate them from biologically relevant stimuli (Van den Bos et al., 2006). We are tempted to make some parallel here between these diverse neuroscience interpretations and Jadin’s (2012, p. 58) psychoanalytic “little bit of jouissance” which is nevertheless neces- sary to face the “demands of life (Not des Lebens)” which are such that “the nervous system needs to gather a reserve amount to face them.” In this light, it is interesting to stress that DA systems are activated not only by positive stimuli, but also by aversive, painful and stressful stimuli and events (Berridge and Robinson, 1998; Salamone et al., 2007). Indeed, both rewarding and aversive situa- tions require an increase in general motivation to energize actions and to ensure that they are executed properly. This fits with the clinical observation that jouissance can also be tied to actions which were (once) adequate not simply in obtaining pleasure (rewarding situations) but also in avoiding displeasure (aversive situations).

This brings an answer to our third point, namely that the effect of the DA is (also) on the level of the actions involved by the stimulus rather than (exclusively) on the stimulus itself. When Bromberg-Martin et al. (2010, p. 8) say that DA neurones are criti- cal in motivating effort to achieve high-value goals, he adds “and (in) translating knowledge of task demands into reliable motor performance.” As a result, the organism will search the stimulus and “learn actions to seek it again in the future” (our Italics). Fur- thermore, Berridge (2007, p. 408) proposes that the DA says the unexpectedly rewarding actions with “incentive value,” which “is a separate form of value added to neural representations of learned signals that predict hedonic reward and which translates the mere prediction into motivation. Incentive salience attribution makes a specific associated stimulus or action into an object of desire14 and can tag a specific behavior as the rewarded response the individual is motivated to perform. ” Representations of motor processes and cognitive processes are put into chunks in order to mark events

14This transition is conveyed through DA signaling, which appears to code for a so- called “reward prediction error,” which has been proposed to act as a teaching signal that underlies reinforcement learning (Schultz, 1998). However, Berridge (2007), on the basis of a series of empirical observations, refutes the causal role of DA in (reinforcement) learning and proposes that, in order to explain why mesolimbic dopaminergic neurons so diligently fit seemingly obeying prediction error equations, they code an informational consequence of learning signals, reflecting learning and prediction generated disturbances in the brain rather than causally. Salamone et al. (2007) also distinguish a possible role for DA in learning from its motivational or reward role.

15We can’t help but point out that even Berridge’s word choices become properly psychoanalytic at times.

An answer to our third point, namely that the effect of the DA is (also) on the level of the actions involved by the stimulus rather than (exclusively) on the stimulus itself. When Bromberg-Martin et al. (2010, p. 8) say that DA neurons are critical in motivating effort to achieve high-value goals, he adds “and (in) translating knowledge of task demands into reliable motor performance.” As a result, the organism will search the stimulus and “learn actions to seek it again in the future” (our Italics). Furthermore, Berridge (2007, p. 408) proposes that the DA says the unexpectedly rewarding actions with “incentive value,” which “is a separate form of value added to neural representations of learned signals that predict hedonic reward and which translates the mere prediction into motivation. Incentive salience attribution makes a specific associated stimulus or action into an object of desire and can tag a specific behavior as the rewarded response the individual is motivated to perform.” Representations of motor processes and cognitive processes are put into chunks in order to mark events.
as salient and induce appropriate action patterns (Salamone et al., 2007). Although the neural mechanisms of priming are not fully
known, “generation of incentive salience is the dynamic process for
which mesolimbic DA neurotransmission may be most essential”
(Berridge, 2007, p. 412).

Taking all this together, we think we have reasons to see parallels
between Freud’s experience of satisfaction and the dopaminergic
attribution of incentive salience to reward-related actions. A dis-
tinctive feature between the Freudian model and the DA models
is that in the Freudian model the instigation (for motor acti-
vation) is more readily understood as coming from within the
organism, originating, e.g., from some homeostatic imbalance
situation, pushing to go find reward, while in the DA models
the instigation is induced by some perceived stimulus, potentially
announcing a reward. However, one could conceive of both mod-
els as three-way connexions both implying all three, the bodily
need, the perceived stimulus or object16, and the motor pathway
to grasp it or interact with it. Indeed, Berridge (2007, p. 414, 413)
states it as follows: “the mesocorticolimbic circuitry (…) medi-
ates the integration of learned signals with hunger/satiety states
to dynamically transform the motivational value of stimuli” or
even more directly: “physiological deprivation states (…) moti-
vate and direct (behavior) chiefly by enhancing the motivational
and hedonic values of their relevant external incentive stimuli
and that is a function for which mesolimbic mechanisms may be
important.”

This last sentence resonates with “when the state of urgency
or wishing re-appears, the cathexis will also pass over on to the
two memories and will activate them,” the two memories being
the rewarding object or incentive stimulus and the motor pat-
tern of its associated behavior. As indicated, the precise role
of DA release in this dynamic is to fuel the organism by cre-
ating a state of motivation to seek reward, and this again is
strikingly close to the definition of jouissance we have proposed
in the framework of the experience of satisfaction, namely the
motor body tension instigated by the wishful activation. We
can also hear quite directly the neuroscience connexion between
reward and motivation in Freud’s (1955/1920 p. 23) statement:
“The compulsion to repeat and (drive) satisfaction which is
immediately pleasurable seem to converge here into an intimate
partnership.”

Excess of body tension: induce excess to the point of exhaustion
If jouissance is to be understood as equivalent to a state of motor
activation, then, by consequence, it is also equivalent to an increase
in body tension. Indeed, any action intention, be this action
actually executed, or simply imagined, remembered, prepared,
anticipated or even prevented (e.g., Janinor and Decety, 1996; Decety,
1996; Gallese, 2000), leads to a slight increase in mus-
cle tension (ex. Yue and Cole, 1992). The actions which are
actually executed are only a fragment of all motor activations
continuously mobilising the body and causing muscle tension.
This idea of jouissance as (the benefit from) a state of motor
activation, therefore leads us directly, following a physiologi-
cal logic, to the idea of sustained high levels of body tension,
corresponding to what seems to be put forward by Lacan as cen-
tral in the concept of jouissance, namely the implication of the
body.

What then about Lacan’s proposition of the closeness between
jouissance and the notions of excess and pain? It is interesting, in
this respect, to remember the first observations implying the stim-
ulation of the nucleus accumbens. Indeed, in a well-known series
of experiments, Olds and Milner (1954) devised a system enabling
a rat to stimulate its own brain, by means of a lever connected to
an electrode implanted in the forebrain. Olds and Milner (1954)
describe that rats would continually press the lever in return for
receiving nothing more than a brief pulse of electrical stimula-
tion. It turned out that a similar effect was also produced when
the electrodes were implanted in the nearby nucleus accumbens
(Olds, 1956). The rats would press the lever frequently to receive
stimulation and would work so vigorously to self-administer stim-
ulations to the point of exhaustion and the exclusion of all other
activities (e.g., eating drinking, sex, and sleep). When, in the wake
of certain surgical procedures, similar stimulations were possible
for some human patients, it was indeed also observed that these
patients preferred this self-stimulation above all other activities.
But, curiously, this stimulation was not associated with any exter-
nal sign of pleasure: no smile or relaxed face, or any other sign of
tangible happiness, or subjective expression of a pleasant sensa-
tion (Berridge and Kringelbach, 2008, p. 15). It is for this reason
then that the term “reward” circuit was chosen rather than “Olds
and Milner’s (1954) first description of “pleasure center.” What
is moreover striking is that is again the same neurophysiologic axis,
the NAS-DA, which is implied here and that it reveals itself as
an axis which could, if circumvented (or “perverted,” ex. by self-
stimulation), easily lead to excess to the point of exhaustion
and self-harm.

To further strengthen this idea that the same mechanism, so
vitally important in driving the organism and in tagging adequate
actions, is also the mechanism which easily shifts toward harmful
effects, let’s go back to the role of the NAS-DA in inducing body
tension. Indeed, the situation of self-stimulation is artificial and
therefore not common. However, let’s remember that DA is not
generally released during the consummatory phase, but in advance
of it, inducing a state of motor tension leading the organism to
move toward the rewarding stimulus. In that sense it is interesting
to note that, e.g., Kupfermann et al. (2000) comment that this
anticipation, or motor tension, translated by the mesolimbic DA
firing, can be interpreted as a deficit, inducing an anxiogenic state
of tension, rather than being already rewarding per se. For all these
reasons, we contend to say that in the same way as for jouissance
where the boundary between enjoyment and pain seems flimsy,
the mesolimbic NAS-DA functioning might be so built that it
is in a constant unstable balancing between reward and anxiety.
Moreover, in both cases it is the part of the body tension which
actually can go into effectively executed action, and therefore into
discharge, which limits the build-up of tension, and therefore of
pain or anxiety. This then could be some physiological counterpart
of the psychoanalytic idea of pleasure functioning as a limit to
As concerns the history dimension of symptoms, as proposed in other theories (e.g., Koob et al., 1989; addiction is not simply due to the desire to experience the positive sensitive. The data suggest that sensitization may involve more than a simple up- or down-regulation of biochemical processes, but it may involve changes in patterns of synaptic connectivity in brain reward systems, changes that may be similar to those seen in other neural systems in association with other forms of experience dependent plasticity (Robinson and Kolb, 1997, 1999). This is accomplished by an increase in spine density on the distal dendrites of these cells. These neuroadaptations in DA/accumbens systems specifically, then produce a pathological motivation for drugs, called compulsive "wanting." Several points of this incentive sensitization theory are important in the current perspective. First, as a consequence of the dissociation between liking and wanting, the authors stress the fact that this theory does not simply account for the addiction by the positive and/or negative reinforcement value of the drugs, i.e., the addiction is not simply due to the desire to experience the positive hedonic effects of the drugs and/or to avoid aversive withdrawal symptoms, as proposed in other theories (e.g., Koob et al., 1989; Markou et al., 1993). The incentive-salience theory explicitly shifts the hypothesis away from the conjunctural reinforcement aspect toward the structural alterations aspects. For example, Robinson and Berridge (2000, p. 396) state: "Perhaps the most remarkable feature of sensitization is its persistence. Once they have been sensitized, animals may remain hypersensitive to the psychomotor activating effects of drugs for months or years." In other words still, it is clear that the wanting circuit not only operates as a driving, and sometimes rewarding, system, but it is also sensitive to long-lasting adaptations, i.e., to historical imprint. This, then, is coherent with the historical dimension of jouissance defined by "this mark, consisting of the drive presenting itself with a certain insistence, in its status of referring to something memorable because it was remembered" (Lacan, 1986/1959–1960, p. 209).

Further, the incentive sensitization theory also includes several aspects, which makes this theory a truly psychological theory. First, the theory of Robinson and Berridge (2000, p. S105) fully acknowledges the functional status of representations in this incentive salience process, e.g., "It is further hypothesized that the psychological process that leads to "wanting" involves the attribution of attractive salience to stimuli and their representations, a process we call incentive salience attribution. (...) We have suggested it is the process of incentive salience attribution that transforms the sensory features of ordinary stimuli or, more accurately, the neural and psychological representations of stimuli, so that they become especially salient stimuli, stimuli that "grab the attention," that become especially attractive and wanted, thus approach and guiding behavior to the goal." This role for representations is also logical in an action-centred rather than a stimuli-centred perspective, since it is known that preparation of an action as well as anticipation, imagination, remembering etc. of that action share a common motor imagery (Decety, 1996) and that this imagery could be the substrate of its representation (Jeannerod, 1994). Second, these representations can also be unconscious. For example, in addicts, doses of drugs that are too low to produce any conscious experience of pleasure can activate implicit wanting as indicated by an increase in drug-seeking behavior. Robinson and Berridge (2000, p. S104) propose: "the incentive-sensitization theory holds that drugs can activate positive core processes of motivation in the absence of conscious awareness, so that positive effects may not be indicated on any scale of subjective affective intensity. Indeed, the neural system responsible for incentive salience attribution can sometimes produce wanting, in the absence of conscious awareness of wanting itself (Robinson and Berridge, 2000, p. S105; see also Berridge, 1996, 1999). For example, the brief subliminal (i.e., unconscious) presentation of faces expressing positive emotions can activate implicit wanting increasing subsequent consumption of a beverage (Berridge and Winkielman, 2003). Robinson and Berridge (2000, p. S106) add: "Activation of this system (...) can act sometimes as an unconscious motivational process." In other words, the incentive salience theory can account for an unconscious representation unconsciously inducing an intentional body investment or motor tension – which is, in our opinion, also a highly psychoanalytic idea. The sensitized pathways, the neuroadaptations in the wanting system, are not simply sitting there, but form an active past, which has the continuous potential to press for action, i.e., which "unsubdues, pushes ever forward." In this incentive salience framework, the clinical link between wanting and jouissance is quite direct: when the wanting system is activated implicitly, it can instigate and guide behavior without a person necessarily having conscious emotion, desire, or a declarative goal (Robinson and Berridge, 2003, p. 36). This kind of perplexity pertains clinically to a whole variety of behaviors which people persist in having, even if they are neither plausible, reasonable nor desirable, and even if they are negative or destructive. This is keenly observed in clinics: addicts maintain their consumption while they "may report they are miserable, their life is in ruins, and that even the drug is not that great anymore. They are themselves bewildered by the intensity of their own compulsive behavior!" (Robinson and Berridge, 2000, p. S106). Often the addict describes his behavior as simply an overwhelmingly strong craving that cannot be denied. Strikingly, these are the very type of clinical observations which have originally led to the necessity of thinking the concept of jouissance in psychoanalysis. Moreover, addiction has often been the terrain par excellence for the psychoanalytic description of jouissance (Braunstein, 1992; 14And the authors add this very psychoanalytic observation: "Indeed, addicts probably have no more insight into what motivates their daily behavior than do the rest of us which is arguably, not much."
In other words, it seems that the parallels between the different dimensions of the psychoanalytic concept of jouissance and the different aspects of the NAS-DA physiology are quite striking. At the level of the body, the NAS-DA has been proposed to function as a basic drive system much in the same way as described by Freud; jouissance then arises when this system goes awry, namely when the action is invested in and for itself, which is structurally bound to happen, as is shown in the phenomena of, e.g., autoshaping. The NAS-DA is also the body system which tags actions which have brought (unexpected) reward and as a result of this tagging, a new encounter with the incentive stimulus will fuel a reserve of body energy motivating the organism to seek the reward (or to avoid the aversive situation). This highly resonates with Freud’s experience of satisfaction where either a bodily need, or a new encounter with “the Thing,” will reactivate the mnemonic mental image for action upon this “Thing.” The tension induced by this reactivation, again, we have referred to as jouissance. Third, the mesolimbic NAS-DA is also the axis which functions in a constant instable balancing between reward and anxiety, reflecting the flimsy boundary between enjoyment and pain described for jouissance. At the level of the (organism’s) history, the NAS-DA is the central element in the so-called incentive salience theory, which describes how neuroadaptations due to reward can sensitize selectively the wanting system while leaving the hedonics or liking unchanged. This theory could therefore account for Lacan’s historical dimension of jouissance defined as a mark referring to something memorable and commemorating an irruption of enjoyment. In both theories the memory traces relentlessly push for action, i.e., push for their repetition, which can explain the perplexifying persistence of behavior while it is no longer pleasurable, and even when it becomes damaging, such as in addiction. For all these reasons, jouissance could be described as an accumulation of body tension, fuelling for action, but continuously balancing between reward and anxiety, and both marking the physiology of the body with the history of its commemoration and arising from this inscription as a constant push to act and to repeat. Moreover, it seems that the mesolimbic NAS-DA is a reasonable candidate for its underlying physiological architecture.

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Bazan and Detandt
Jouissance and dopamine


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