Ment Health Fam Med (2017) 13: 625-636

Research Article

Identity and Autobiographical Narratives: Towards an integrated concept of personal history in psychiatry

A Novac
University of California, Irvine, 400 Newport Center Drive, Suite 309, Newport Beach, CA 92660
M Cheng Tuttle
Harvard Medical School, 55 Fruit Street, Boston, MA 02114
R Bota
University of California, Irvine, 101 City Drive Orange Ca, CA 92868
J Brown Yau
Compassionate Care ALS, Boston, MA 1335 Bounty Way, Laguna Beach, CA
BJ Blinder
University of California, Irvine 400 Newport Center Drive, Suite 706 Newport Beach, CA 92660

ABSTRACT

A converging, multidisciplinary literature on the significance of autobiography, personal history and the self in psychiatry and neuroscience has emerged. With the growing emphasis on "individualized medicine," the authors are making a case for the in-depth study of personal narratives and individual scripts, as research subjects of interest, towards an "individualized" psychiatric treatment approach. The authors are proposing the term Identity Narrative (IdN) to define an emotional and cognitive framework that serves as an implicit memory scaffolding for the gradual development of complex autobiographical narratives. Along with the autobiographical narrative, IdN constitutes autobiographical memory, which continues to mold itself throughout life and defines an individual's identity and the self. A person's IdN is built of implicit scripts and key points which draw content from external narratives (human history) and personal experiences. IdN parallels lifelong growth and development; it is of special importance in psychological treatment and healing; and it is embedded in a larger biological substrate of social affiliations. The authors propose the "implicit re-routing hypothesis of IdN" by which life events of: (a) sudden insight and awareness; (b) high emotional valence and (c) high frequency of repetition; (d) prolonged duration are likely to become re-routed into a person's implicit memory and thus become part of the IdN. Clinical implications are discussed.

Keywords: identity narrative, autobiographical memory, implicit memory, implicit scripts, key points, default mode, communication (language) beltway, biology of social affiliations, implicit re-routing hypothesis.

Introduction

An ever-increasing emphasis on individualized medicine over the past decades has been reflected in a rising interest in autobiographical memory and personal history in psychiatry. Recent pieces published in *The New York Times*[1] and *The New* Yorker [2] have brought public attention to the significance of personal narratives, both in an individual's identity and in promoting resiliency, factors of high priority for psychiatry. In this paper we are reviewing the multidisciplinary literature on autobiography, its relationship to implicit memory, and the neurobiology of self. We will then discuss the impact on the field of psychiatry.

Human history starts with telling of stories. In some languages the word for the discipline of history and the word for story are interchangeable ["Geschichte" (Ger.), "L'histoire" (Fr.)]. Tales, fables, creation myths and cosmogonic myths are present in all cultures to provide a narrative for the origin of the world [3]. On an individual level, the telling of stories is among the first activities between mother and child. The first stories, together with the first experiences in life, create proto-narratives-- the beginning of a life story. From then on, humans develop an elaborate autobiography, a personal narrative that contributes to the emergence of the Self. In this contribution, we refer to the term *Self* as used in the current neuroscience literature [4-7].

The term Identity Narrative (IdN) is derived from various sources. In Sanskrit, "gna" means knowledge, and "gnarus" and "narrare" in Latin mean "to tell [8]." Humans remember their own past in story form. Narratives can be "external," the stories about people and places in society (which is history), and "internal," personal experiences, which make up a person's autobiographical memory. The meaning of identity here is derived from contemporary philosophical writings, linked to "appearance" and "being" of an object [9,10].

[13]There are degrees, hues of appearances given by components of an identity or the "atoms of appearing." In the same vein, we are using the term "implicit scripts" of memory as component units of IdN.

The biological roots of the self as a holder of Narrative Functions

Historically, William James [13] intuited the "total self" as "duplex" in nature, with one characteristic being awareness ("knower") and the other, experience ("known"). Extensive psychoanalytical contributions over the past 100 years have covered the relationship between the self, personal history, and the surrounding world. Such concepts are also centered around the idea of a personal story, a narrative governing the cohesiveness of the self. Some examples include: Freud's highly personalized "secondary elaborations" [14], which become encoded as memory; "self-representation" as an experiential memory that defines a person's identity as described by Hartmann [15]; ego defenses that have a role in adaptation to the external world [16]; Winnicott"s "average expectable environment," a good enough environment [17]; Stern's **R**epresentations of **I**nteractions that have been **G**eneralized (RIGS) [18]; Bowlby's internal working model [19-21]; the vicarious incorporation of a close person's experiences into one's autobiographical self referred-to as "the living in history effect" [22]; and a person's narrative of the self and an implicit narrative as differentiated by Meares [23], which is automatic and creates an "invariant organizing principle" of a person [24].

More recently, both animal studies and human psychology contributions have pointed to the bonding and social significance of the acquisition of an internal organization [5,6,19-21,25-27]. From an evolutionary point of view, Damasio [28] classified the self into three major levels: (A) The proto-self, which represents the neural aspects of mental life, localized mainly in the brain stem. In the animal literature, Panksepp [5,6] has previously described the proto-self to constitute the origins of "drives." Damasio refers to the proto-self as the embodiment of the self. (B) The core self, which includes elaborate feelings and emotional reactions, engages with the outside world or its objects. It is also charged with the processing of emotions [7]. (C) The autobiographical self includes the encoding of events in a person's life in a specific sequence. The individual sequencing of autobiographical memory provides time-specific relevance to memory [29,30].

Developmentally, life lessons (a form of narratives) are viewed as incorporated basic assumptions, moral values [31,32] and patterns of logical thinking acquired in a step-wise manner [33,34]. A large body of literature to include developmental, attachment and memory studies has pointed to the significance of personal narratives and autobiographical memory in the development of internal organization and personal identity [5,6,18,19,22,25,30,33-40]. While the review of these contributions remains beyond the scope of this paper, of special interest are recent neuroscience reports linking self and self-awareness to midline brain structures [5,6,41-50]. Other contributions have pointed to the same anatomical areas as overlapping with the subcortical-cortical midline structures (SCMS) described in theoretical contributions [4,6], and the neuroimaging-derived concept of the default system [51]. The latter refers to the activation of midline brain structures during a state of relatively stable mental inactivity, and has been more recently linked to to psychopathology of personality disorders [52].

The Neuroscience of Narratives as Memory

In order to understand how narratives are encoded, it is important to recapitulate some basics about memory. Brain projection of activity is contingent upon the degree of engagement in a task. This is the basis of representational plasticity and map expansion [53,54]. Narratives exist thanks to memory formation of meaningful sequences of events and the ability to memorize previous experiences. Explicit memories are pieces of information that are readily available for voluntary recall. Implicit memories are present, but an individual has limited awareness of them. Explicit and implicit memories were, in general, believed to function in a partitioned manner. A clear example is the famous patient HM, who underwent a bilateral medial temporal lobe ablation in the 1950s with permanent anterograde amnesia. Over time, implicit, new memory acquisitions still continued to occur [55]. Contrary to previous assumptions, a body of literature suggests that there is in fact continuous exchange between explicit and implicit learning [56,57]. *Explicit* memories include the subtypes of episodic (historical) and semantic (facts) memories. Autobiographical memory is a form of historical memory. *Implicit* memory includes automatic/procedural memory often used in specific skills and priming, the skewing of response upon supra and subliminal recognition. Implicit memories influence episodic memory and the decision-making process [58-60].

Among the many stages in the formation of explicit memories, two processes, consolidation and reconsolidation, have a particular role in the processing and reuse of previous experiences. By means of consolidation of memories, retained information is transformed into long-term memory. This process requires protein synthesis [61,62]. Other chemical processes are involved at the synaptic level as well. For instance, repetition of certain electrical activities at the synaptic level leads to long-term potentiation (LTP), a process accompanied by protein synthesis [63].[14] Reconsolidation is another memory mechanism by which each memory, when recalled, is reshaped and modified according to new informational input from the time of recollection [65]. Thus, memory of past events can be modified, re-actualized and distorted based on current (contemporary,

[13] Noteworthy are also: the Eriksonian meaning of ego identity[10,11]; and a recently reported functional brain connectivity identity derived from functional connectome studies[12].

14 More recently, both long-term memory storage and its underlying synaptic plasticity have been found to be mediated by a prion-like transregulational regulator, the CPEB3 (cytoplasmic polyadenylation element-binding protein)([64]).

in time) experiences. This function of memory is empirically familiar to psychotherapists. Both consolidation of secondary elaboration and deconstruction of previously held beliefs may occur by means of reconsolidation. Furthermore, reconsolidation may be the basis of the human capacity to revisit, elaborate and change one's awareness about the past. Each time a memory is retrieved, it is reworked through protein reconfiguration, but not with *de novo* protein synthesis. In summary, new memorization [61,62,66,67] requires the participation of the hippocampus and amygdala, and it requires protein synthesis. Reconsolidation does not require *de novo* protein synthesis. If protein synthesis is chemically blocked, no new memory can be developed, but reconsolidation (reworking) is preserved[68]. One could argue that the continuous process of memorization and reconsolidation can be seen in the restless human tendency to deconstruct old forms and find new meanings [9,69-71].

Identity narrative (IdN)

IdN and autobiographical memory

In this contribution we are proposing the concept of Identity Narrative (IdN) to designate a set of non-declarative, implicit memories and response patterns acquired prior to the emergence of autobiographical memory (AM). IdN is a dimension of AM. IdN continues to coexist and facilitates the development and reshaping of AM throughout life.

Humans acquired the unique ability to examine a present moment experience and reframe such an event in the context of one's personal past. Humans have a sense of continuity in time, which is uniquely possible due to the existence of AM. Autobiographical memory gradually arises during preschool years. It is a form of declarative (explicit) memory[15]. Squire [72] distinguished between declarative (conscious recollection) and non-declarative (without conscious sense of "pastness") memory. Tulving's contributions [73,74] on memory have delineated the differences between declarative semantic memories (facts) and declarative episodic memories (events). He also described a subtype of episodic memories, the autobiographical memory (AM). The main features that differentiate AM from episodic memories have been outlined in a large body of research and more recently summarized in contributions by Fivush [75] and Nelson & Fivush [76]: (1) Self-definition: AM includes a sense of continuity, an autonoetic (a sense that events happened to oneself) experience, and is intimately related to the self-concept; (2) AM defines the self in relations to others, e.g., in the social context. Memories create a cultural and social bond with others. Thus, AM varies with culture and gender, as it contributes to a person's social identity, and it provides for a culturally canonical biography [77]; and (3) Self-regulation: The ability to create coherent narratives of one's emotional experience has an emotional healing effect. As we will see below, awareness of past events and the construction of elaborate narratives of personal events create meaning and promote processing of adverse experiences. Children who participate in adult-guided reminiscing show a higher level of understanding and self-regulation [78,79].

Yet, the literature on AM does not cover any implicit memory component. We propose that IdN is an necessary dimension of autobiographical memory. It is encoded information beginning with early experiences which are gradually retained as implicit memories. It provides AM with implicitly encoded predictable patterns of reactions to the environment which first develop in a dyadic relationship with caregivers. IdN develops beginning with the time of childhood amnesia but continues to expand and reshape throughout life. IdN creates an early narrative, "a way of being," rather than "a way of remembering." This way of being is created by parental interactions, attachment and life experience, including social and cultural experiences. Earlier contributions have also revealed prenatal stimulations to be encoded in the fetus's brain [80]. There is evidence that life-events, especially interactive experiences from ages 0 to 3, are in fact stored and influence a person's development and future personality [81]. Unlike autobiographical memory, which is specific to humans, evidence of IdN is believed to emerge in animals. Animal studies [27] have demonstrated that exposure to adverse experiences in very early age results in changes in the rats' reactivity in adult life without an apparent direct recollection (by observable behavior) of the events.

In humans, IdN facilitates the gradual rewriting of life experiences into an autobiography during and after pre-school years and allows for lasting personal memories and behavioral characteristics. It is a neuro-cognitive implicit memory scaffolding by which explicit memory can become "self" or "the way a person is." Autobiographical memory, a specifically human characteristic, additionally provides awareness about oneself.

There is a neurological basis for the exchange between explicit and implicit memory. Explicit memories can actually be converted into implicit memories, but the process is lengthy and requires repetition and practicing. An example is the acquisition of skills in sports or playing a musical instrument, where certain tasks start out voluntary, generated by activation of motoric areas of the cortex and become semiautomatic or automatic, as they are associated with activation of cerebellar and subcortical areas [57]. Skills related to performing a musical instrument or the mastery of a physical skill are not purely motoric. They require complex associations that arise with great precision and involve large-scale cortical activations. Yet their activation is beyond conscious awareness. Such implicit information is perceived by a subject as arising seamlessly out of one's "nature." Other mechanisms, like " re-entrance" [82,83], and its anatomical substrate, the cortical/subcortical re-entrance pathways, also have significant importance in the implicit-explicit memory exchange. Their detailed description is beyond the scope of this paper (Figure 1).

IdN specializes in the organization and holding of autobiographical information. In this way it promotes patterns that are personally predictable and thus may promote stable human relationships, an adaptive social trait. IdN is also

[15] Declarative (explicit) memories are episodic and semantic. Non-declarative (implicit), outside the conscious awareness are classified into procedural and priming.

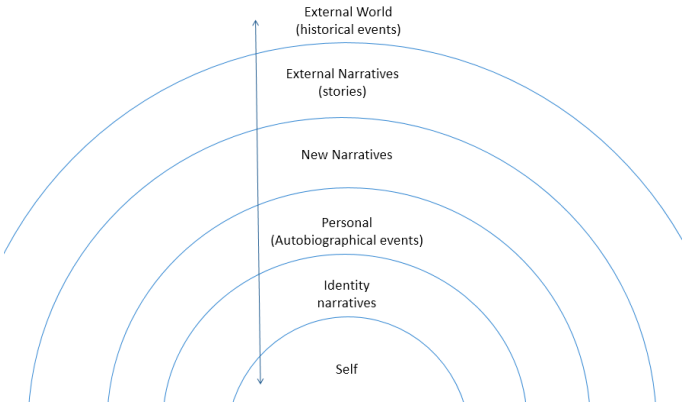

Figure 1. Representation of continuity of narrative domains.

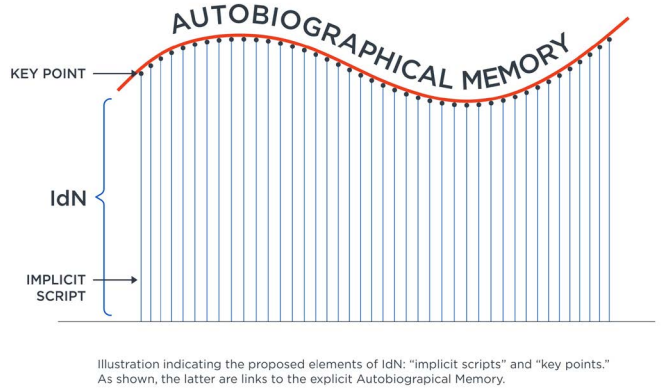

Figure 2. Illustration indicating the proposed elements of IdN: "implicit scripts" and "key points". As shown, the latter are links to the explicit Autobiograpical Memory.

an implicit record of one's early experiences and patterns of interaction, on which incoming information is recruited, implanted and built to create an autobiography. In this way, an autobiography becomes deeply rooted in a person's identity.

We propose that IdN is composed of many sequences of implicit memories, *implicit scripts*, which are implicit memory units acquired in time. They can be partially recalled, mainly as memory traces. They connect through "*key points*" to a working memory of events (Figure 2). Such *key points* are memories of experiences proximal to the implicit scripts, which can be explicitly recalled.

Thus, IdN is a necessary feature of a person's development through which some aspects of the self develop earlier to actively prepare the process of maturation through language and AM. Due to its implicit, automatic-like nature, IdN makes the acquisition of main features of AM possible: The autonoetic experience, "remembering that it happened to me" [74]; linking past to present and the ability to "own" the changes in one's own self [84]; and the ability to observe, in an organized manner, a personal chronology [85,86].[16] These are functions of AM but without an IdN, autobiographical events would not likely be owned and would be perceived merely as varied episodic memories.

The period of childhood amnesia is one of the most significant indications of an implicit component (IdN) in the formation of autobiographical memory. Childhood amnesia, the first three to five years of life, for which most people have little or no recollection, is the period during which IdN is formed and built by a gradual acquisition of implicit, experiential memories. AM starts when childhood amnesia ends, sometimes between ages of three to five. The literature points to the specific factors that favor an earlier onset of autobiographical memory in some cases and thus a shortening of the amnestic period. Cultural factors and gender differences[17] [87-90]; emotional factors, including increased emotional awareness [88,91,92]; acquisition of cognitive self with emphasis on details and distant memory[18] [93]; interactive style and verbal exchange with caretakers[19] [94]; and event segmentation, the division of events into smaller episodes [95], have all been found to influence childhood amnesia and the extent of autobiographical memory. Pre-school children whose mothers have a reminiscing style have an earlier age of first memory [96-98]. All these further create a fluidity and continuity between early experiences, the creation of the IdN, a proto-narrative, and the ensuing emergence of AM. IdN is a network of relatively stable memory coordinates onto which conscious autobiography is mapped.

There is evidence throughout life of a two-way exchange between autobiography and IdN. Acquired life experiences are all filtered by a person's existing IdN. They may be stored as implicit scripts and may or may not be eventually incorporated into IdN. Below we will cover some of the factors that favor incorporation of scripts into IdN.

Clinical implications: The Shaping of the Identity Narrative

Life events interact with autobiographical and Identity Narratives to create changes throughout an individual's lifespan.[20] We are reviewing five specific instances:

1. Attachment, language and IdN

Besides being crucial in accomplishing an output of autobiographical narrative, language also participates in the provision of meaning and awareness for life events. In humans, language development is both a marker of and a vehicle for the accomplishment of one of the most significant evolutionary functions in species survival, that of attachment. As seen in figure 3, interactive speech engages large bilateral hemispheric areas, a feature that overlaps with numerous brain processing functions [99-111]. Elsewhere, we have proposed the designation of a *communication beltway* of brain activation [112] (Figure 4)[21].

Patterns of attachment can be viewed also as types of IdN. The study of attachment, by means of the Adult Attachment Interview (AAI) relies on eliciting composite memories, parts of autobiographical memory and earlier life narratives [114]. This is accomplished by analyzing the coherence and cooperation of speech and communication patterns, which have

[16] The timeline may be part of an implicit organization of IdN.

[17] European-Americans have a shorter amnestic period compared to Asian-Americans.

[18] Cognitive self develops at approximately the first 24 months of age.

[19] More elaborate exchange about the events leads to more recall.

[20] Clinical experience may suggest that Winnicott's "average expectable environment" is necessary in adults as well to create an optimum non-threatening living environment in a pluralistic society that promotes the personal evolution of IdN.

[21] The term, "communication beltway," mirrors terms such as "core," "belt," and "parabelt," describing the neural activity of tone perception in the auditory cortex113.

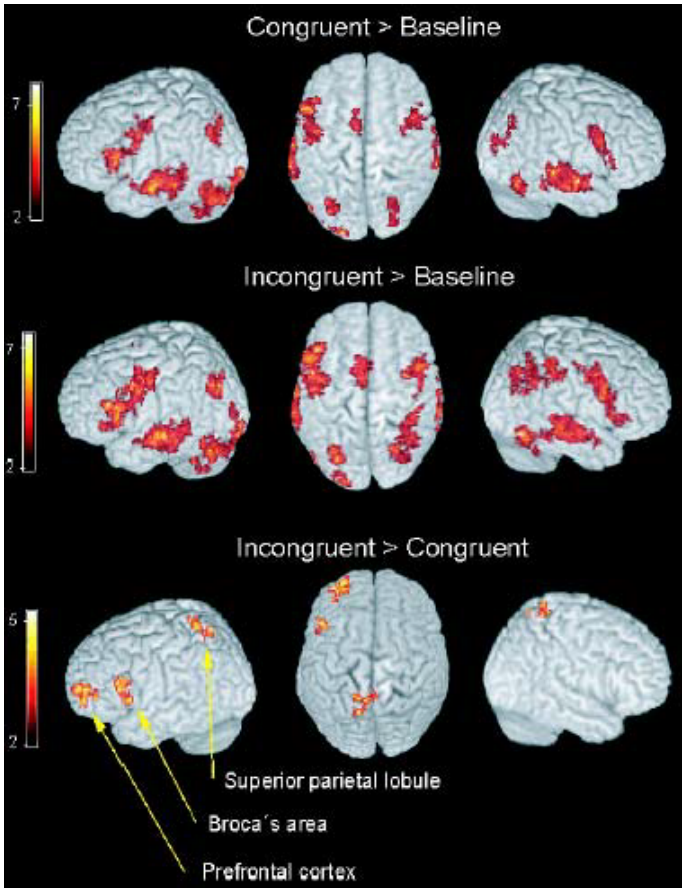

Figure 3. From Anderson et al. (Permission pending) [170].

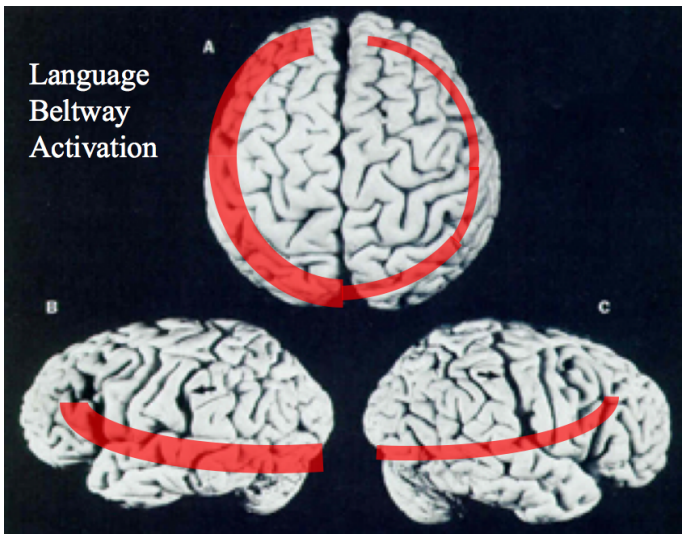

Figure 4. Schematic presentation of communication beltway.

been shown to be accurate markers of attachment. For instance, unresolved/disorganized attachment (U/d) produces speech that becomes temporarily disorganized and disoriented in discourse or reasoning while recollecting traumatic events. Such lapses in monitoring have been described as speech equivalents of dissociations.[22]

[22] The Adult Attachment Interview uses as a benchmark the four linguistic maxims of Grice115 for optimal interactive speech: balanced in quality (present evidence), quantity (be succinct), relations (relevant to topic), and manner (be clear and ordered). For instance, in adults, minimal or no violations of Grice's maxims predicts secure attachment. Specific violations of Grice's maxims have been quantitatively determined for subtypes of insecure attachment, e.g., dismissive, angry/preoccupied, disorganized/disoriented115,116,117,118,119.

Animal studies on attachment are promising in elucidating the neurobiology of IdN. In animals, maternal absence from the nest increases cortical desynchrony in pup rats [120]. Maternal presence produces amygdalar deactivation (equivalent to what is seen in human down regulation of emotions) in pups [121]. In rats, social relationships have been demonstrated to create stress buffering via the HPA axis [122,123]. In rats, learning processes are part of the acquired attachment patterns, which occur via the olfactory system and arise within a developmental schedule [124], supporting an animal model for enduring personality features shaped by environment. Thus, implicit type of learning and associated neural activities serve as a reshaping of the immature brain. Such learning creates enduring individualized behavioral patterns, hence, a possible animal model for the development of IdN.

2. Traumatic stress

Adverse life events and traumatic stress have a profoundly modifying effect on a person's IdN. Traumatic events are known to result in hyperconsolidated traumatic memories. Such hyperconsolidation has an evolutionary role in danger recall as a survival mechanism [125-128]. Traumatic memories have features of implicit memories. In the presence of reminders of trauma, they are first to be recalled and become explicitly expressed. Neurobiologically, this is a byproduct of stress-related catecholamine hyper-release, which has a memory-consolidating effect [129]. The resulting unprocessed traumatic memories have a high emotional valence and tend to be reactivated beyond an individual's control. Hyperconsolidation of the unprocessed traumatic memories [130], explains the re-experiencing (uncontrolled obsessive recollection, nightmares) of traumatic events, one of the most painful symptoms for individuals with PTSD. In neuroimaging studies, traumatic re-experiencing is accompanied by a right hemispheric dominance and activation of subcortical areas. This provides the implicit quality of traumatic re-experiencing [131]. Traumatic memories are also non-verbal, emotive and somatic in their experience, accompanied by a low activity of the left-sided brain regions charged with time discrimination [132,133]. For an individual with PTSD, the traumatic narrative dominates the IdN. Overall then, adverse life events and traumatic stress have a profoundly modifying effect on a person's IdN.

3. Psychotherapy

An IdN can also be gradually enriched with new health-promoting experiences. For the initial purpose of psychological healing a reinterpreting of personal history is required. The discrepancy between historical truth and personal narrative truth has been previously covered [134-137]. This discrepancy may be at the base of a natural healing process necessary for survival. It becomes particularly significant in the progress of psychotherapy, as different competing narratives evolve [136]. In the end, a new narrative "truth" is created which overrides for instance any previous trauma-related identity of an individual. In this way, adaptive variations between the historical truth (the trauma) and the new narrative truth (rebuilt IdN) provides one

aspect of healing over time. In essence, the curative effect of psychotherapy is ultimately a reshaping in autobiographical narrative and its implicit component, the IdN.[23]

Long-term exposure to a variety of modalities of psychotherapy may create a new, regulated IdN (a new way of being) that layers over previous symptomatic aspects of the self. The newly formed memories, which include the activation of regulatory circuits, may act as extinguishers by overriding older, maladaptive narratives. Similar to the *extinction* process (which includes a suppression rather than erasure of past activations), exposure to certain noxious social circumstances may reactivate aspects of the old unregulated IdN [53,138,139].[24]

In clinical practice, one of the most poignant instances of narrative change is the process of trauma recovery during prolonged exposure therapy. Through numerous repetitions of describing the trauma, the memories are processed with a progressive dissipation of the emotional pain [141,142]. Psychotherapy is a model through which new narratives become part of a person's IdN. It has evolved out of ancient shamanic, religious (e.g., confession, dream interpretation), and social practices. Such practices mobilize pre-existing pathways of change in development, attachment and learning. A body of literature on the mind-brain connection, the neurobiology of psychotherapy and associated brain processing mechanisms ("transprocessing") has emerged [30,143-145]. Through psychotherapy, a variety of dysfunctional components of an autobiographical narrative and *implicit scripts* with high emotional valance are processed and relearned in a more adaptive manner.

4. Childhood and adult play

Play has been described as a proto-emotion [5,7,146] that emanates from the "core self," which seems to originate in the animal brain stem. It transcends species, and it has been proposed that by means of interactive play with parents and peers, young animals acquire and practice new living skills [147]. Play may serve as a vehicle for acquisition of adaptive *implicit scripts* of an IdN during growth, development and even adulthood.

5. Life Experience: the implicit re-routing hypothesis

Like play, exposure to real life also promotes adaptation and survival. We hypothesize that through reshaping of narratives and implicit memory rerouting, IdN fulfills two major survival functions: a) Psychological survival, an adaptive down-regulation of memory and remembrance, to create peace of mind; b) Physical survival, which requires an up-regulation or enhancement of memory, *to remember* danger. The latter can trigger the fight/flight response for rapid physical escape of danger.

In order to survive in the long run, humans have an inherent biological need for peace of mind. The need for early optimal environments to create the sense of stability (which contributes to long-term peace of mind) has been extensively documented in the developmental literature [17,16]. Psychological survival is in fact a process by which humans naturally tend to gravitate towards peace of mind. Such peace of mind may have an evolutionary value, as it favors a continuous desire to live and procreate. This is accomplished in part by acquisition of narratives (stories) about life from one generation to another [92]. IdN contributes to an implicit sense of familiarity and diminution of fear of the unknown. Consistent with recent memory studies, it is more adaptive and less socially disruptive to interpret experiences and memorize them in a personally biased manner. A personally biased memory fits an individual's IdN, thus maintaining harmony between a person's basic assumptions and the social environment [148-150]. A "Rashomon-like" [151], personalized recollection of reality is ultimately adaptive by decreasing anxiety of the unknown. The same applies to groups and organizations. For example, rumors, gossip, and urban legends may have a similar role to maintain a predictable, less threatening perception of a social environment [150,152]. Similarly, ego defense mechanisms, which often justify one's own actions, are also part of an individual's implicit memory pool contained in the IdN, with a role in maintenance of social homeostasis. By doing so, an individual develops a sense of control, self-worth and competence [153], characteristics consistent with growth and survival within a certain social context. In this sense IdN, the implicit memory component of autobiography, is part of a drive of *social preservation.*

In sum, the process of internalizing life experience gravitates between two poles of adaptation: (a) on the one hand, the preferential recollection of danger for future survival; and (b) on the other hand, the ability to distort reality and diminish recollection, in order to survive psychological torment. This is accomplished by narrative reworking [154], hence the proposed designation of "implicit re-routing hypothesis of IdN."

C.Formation of IdN

Concomitant new narratives develop, and a reshaping process occurs throughout life. We are suggesting several possible mechanisms: (a) A paradigm shift in narrative is the acquisition of new insights and knowledge, e.g., a sudden insight about a question in mind (the "Eureka" or "Aha!" moment) [155]; insight induced by hallucinogens [156]; (b) Life experiences with high emotional valence and of profound personal significance [157]. As seen in trauma, memory consolidation influenced by emotional gradients from catecholamine system activation may also occur in intense emotional experience without trauma. An inverted U-shaped pattern of catecholamine-related consolidation exists. At low and high levels of norepinephrine activity, there is significant negative interference with memory storage. Within a mid-range level of adrenergic activation, a linear relationship between emotional valence and memory storage exists [158-160], thus possibly favoring memory

[23] In the management of patients with trauma, most treatment modalities for PTSD seek a reduction of psychological pain by reshaping the IdN and providing mood regulation. Processing traumatic memories modifies identity narratives to allow for a safer, hypo-symptomatic IdN.

[24] The old information is still stored and could be reactivated during states of regression, a fact demonstrated by clinical experience140.

retention of a life event into the IdN.[25] Many an experience or skill that is adaptively developed, practiced, or retained through an emotionally-laden experience become IdN. Such experiences are perceived as "owned" (they are part of autobiography), as they become IdN. In the end, some life experiences become part of autobiography, while others are retained as routine episodic memories. (c) Through repetition and practice throughout life, a number of new memories become part of *implicit scripts* (Figure 2). For instance, formalized education leads to long-lasting changes in attitude, self-awareness and even behavior, most likely by creating new *implicit scripts* and hence reshaping of IdN towards a new personal and/or professional identity. (d) Prolonged exposure. Long-term relationships with people, groups (facilitated likely by mirroring) and places lead to a gradual incorporation of experiences and associated memories into the IdN and autobiography. Figure 2 illustrates the relationship between autobiographical memory, IdN, implicit scripts and *key points.* Sometimes evocation of a sensory memory (taste, smell), an explicit memory, may activate an *implicit script* which triggers an entire sequence of AM[26]

Conclusions

In this review we propose that autobiographical memory, a characteristic specific to humans, is built on a platform of implicit memory, the IdN which is encoded early and rapidly into the underlying brain structures of the self during the period of childhood amnesia. It continues to be reshaped throughout life. IdN probably precedes AM evolutionarily and constitutes an ontogenetic scaffolding for the gradual "uploading" of the autobiographical self. Besides containing numerous details essential for a person's identity, IdN and AM also hold information about health, knowledge about one's genetic make-up and awareness of diagnosed psychiatric conditions. These all influence outcomes in psychiatry. In this regard, IdN and AM are crucial in the development of a personalized approach to psychiatric diagnosis and treatment.

Besides the study of attachment, development and psychotherapy, Identity Narratives also have a direct implication in future studies of psychopathology. Most psychiatric symptoms deeply impact IdN. Conversely, IdN holds information of the "particulars" of psychiatric manifestations in each patient. Currently, a significant value has been placed on individualized treatment approaches as part of *personalized* medicine [162]. While an attempt to develop more sophisticated diagnostic criteria in American psychiatry has continued [163,164], facing economic pressures and constraints, most clinicians continue to employ practices governed by simplified and minimalistic approaches [165-167]. In the future, expanding diagnostic formulations into an *autobiographical* subcategory heading would enhance diagnostic sophistication and personalized treatment. Still to be developed, such a subcategory would be broad enough to include events of gradual incorporation into autobiography: (a) frequent paradigm shifts, like sudden insights; (b) life experiences with high emotional valence and profound personal significance (including trauma); (c) repetitive and practiced events in life (including education and skills); (d) singular life situations of prolonged exposure. Information such as that proposed in the DSM 5 Appendix [168] regarding "Identity" and "Self-direction," [169] would further fit into our proposal of an autobiographical and identity assessment of each psychiatric patient [171]. Inclusion of such diagnostic expansion may improve long-term predictors of treatment response and outcomes.

[25] A recent study demonstrated that in rats, traumatic experience prior to the formation of contextual memories resulted in subsequent long-term aversion, anxiety, cortisol and glucocortical receptor changes. This constitutes a model for implicit memories, albeit of a traumatic nature(27).

[26] This process was described by Marcel Proust in Remembrance of Things Past(161). It is the exposure to the taste of the Madeleine, an explicit "key point" (not just its mental recollection) that brings back the author's childhood experience, the Sundays spent with his aunt.

Competing interests

The authors report no competing interests.

References

1. Feiler B. The stories that bind us. The New York Times 2013.
2. Levy A. The price of a life. The New Yorker 4/13/15; 54-63
3. Eliade M. Myth and reality. Long Grove, IL. Waveland Press, Inc. 1998.
4. Northoff G, Bermpohl F. Cortical midline structures and the self. TRENDS in Cognitive Sciences 2004; 8:102-107.
5. Panksepp J. Affective neuroscience: The foundation of animal and human emotions. New York, Oxford University Press. 1998a.
6. Panksepp J. The periconscious substrate of consciousness: affective states and the evolutionary origins of the self. *J Conscious Studies* 1998b; 5:566-582.
7. Panksepp J, Northoff G. The trans-species core self: The emergence of active cultural and neuro-ecologic agents through self-related processing within subcortical-cortical midline networks. *Consciousness and Cognition.* 2009; 18:193-215.
8. Abbott H. The Cambridge Introduction to Narrative. Cambridge, England: Cambridge University Press. 2002.
9. Badiou A: Second manifesto for philosophy. Cambridge, MA:Polity Press. 2002
10. Erikson E: Identity: Youth and crisis. New York:WW Norton. 1968.
11. Levesque RJR. Ego identity. *Encyclopedia of Adolescence*. 2014; 813-814.
12. Finn ES, Shen X, Scheinost D. Functional connectome fingerpriting: identifying individuals using patterns of brain connectivity. Nature Neuroscience 2015; In press.
13. James W. Principles of physiology: Briefer course; 43 New York. MacMillan. 1892.

14. Freud S: Totem and Taboo. Resemblances Between the Psychic Lives of Savages and Neurotics. New York. Moffat, Yard and Company. 1918.

15. Hartmann H. Comments on the psychoanalytic theory of the ego. Psychoanalytic study of the child 1950; 5:74-96

16. Hartmann H, Rapaport, D: Ego psychology and the problem of adaptation. *J the Am Psychoanalytic Assoc.* 1958; xi 121.

17. Winnicott D (Ed by Caldwell L, Joyce A). Reading Winnicott. New York. Routledge 2011.

18. Stern D. Interpersonal World of the Infant: A view from psychoanalysis and developmental psychology. New York:Basic Books. 2000.

19. Bowlby J. Attachment and Loss, Vol. I: Attachment. London:Hogarth Press 1969.

20. Bowlby J. Attachment and Loss, Vol II: Separation. New York:Basic Books 1973.

21. Bowlby J. Attachment and Loss, Vol III: Loss. New York:Basic Books 1980.

22. Brown NR, Lee PJ. Public events and the organization of autobiographical memory: An overview of the living-in-history project. *Behav Sci Terrorism Political Aggress* 2010; 2:133-149

23. Meares R. Episodic memory, trauma, and the narrative of self. *Contemporary Psychoanalysis* 1995; 31:541.

24. Brandshaft B, Stolorow R.Varieties of therapeutic alliance. *The Annual of Psychoanalysis*. 1990; 18:89-114

25. Stern D.The first relationship: Infant and mother. Cambridge:Harvard University Press. 1977.

26. Suomi S.Early determinants of behavior: Evidence from primate studies. *British Med J*. 1997; 53:170-184.

27. Poulos AM, Reger M, Mehta N. Amnesia for early life stress does not produce the adult development of posttraumatic stress disorder symptoms in rats. *Biol Psychiatry.* 2014; 15: 76(4): 306-314.

28. Damasio A. Self Comes to Mind: Constructing the Conscious Brain. Random House, NY. 2010.

29. Blinder BJ. Psychodynamic neurobiology. In: Beitman B, Blinder BJ, Thase M, Riba M, Safer D, eds. Integrating Psychotherapy and Pharmacotherapy. Dissolving the Mind Brain Barrier. New York:W. Norton and Co, 161-180, 2004.

30. Blinder BJ. The Autobiographical Self: Who We Know and Who We Are. *Psychiatric Annals.* 2007; 37:276-284.

31. Piaget J: The moral judgment of the child. New York: Free Press. 1965.

32. McLean K: Late adolescent identity development: Narrative meaning making and memory telling. *Develop Psychol* .2005; 41:683-691.

33. Carlo G, Koller S. A cross-national study on the relations among prosocial moral reasoning, gender role orientations, and prosocial behaviors. *Develop Psychol.* 1996; 32:231-240.

34. Haidt J, Koller S, Dias MG. Affect, culture, and morality, or is it wrong to eat your dog? *J Personality Social Psychol.* 1993; 65:613-628.

35. Fonagy P, Target M. Playing with reality: 1. Theory of mind and the normal development of psychic reality. *The Internat J Psychoanal.* 1996; 77:217-233.

36. Northoff G, Bermpohl F, Schoeneich F, et al: How Does Our Brain Constitute Defense Mechanisms? First-Person Neuroscience and Psychoanalysis. Psychotherapy and Psychosomatics 2007; 76:141-153.

37. Pally R: A primary role for nonverbal communication in psychoanalysis. Psychoanalytic Inquiry: A Topical Journal for Mental Health Professionals 2001; 21:71-93.

38. Mahler MS. On human symbiosis and the vicissitudes of individuation. *J Am Psychoanalytic Assoc.*1967; 15:740-763.

39. Jacobson E. The self and the object world. New York. International Universities Press, Inc. 1964.

40. Blos P. The second individuation process of adolescence. *Psychoanalytic Study of the Child*. 1967; 22:162-186.

41. Holstege GR, Bandler R, Saper CB. The emotional motor system. In G. Holstege, R. Bandler & CB Saper (Eds.) Progress in brain research: Vol 170. The emotional motor system (pp 3-6). Amsterdam: Elsevier. 1996.

42. Strehler BL. Where is the self? A neuroanatomical theory of consciousness. *Synapse.* 1991; 7:44-91.

43. Damasio AR. The feeling of what happens: Body and emotion in the making of consciousness. New York: Harcourt Brace. 1999.

44. Parvizi J, Damasio A. Consciousness and the brain stem. *Cognition.* 2001; 79:135-160.

45. Craig AD: How do you feel? Interoception: The sense of the physiological condition of the body. Nature Reviews Neuroscience 2002; 3:655-666.

46. Craig AD. Interoception: The sense of the physiological condition of the body. *Current Opin in Neurobiol.* 2003; 13:500-505.

47. Panksepp J At the interface of affective, behavioural and cognitive neuroscience: decoding the emotional feelings of the brain. *Brain and Cognition.* 2003; 52:4-14.

48. Panksepp J. Affective consciousness: core emotional feelings in animals and humans. *Consci Cognit* 2005a; 14:19-69.

49. Panksepp J.On the embodied neural nature of core emotional affects. *J Conscious Stud.* 2005b; 12:161-187.

50. Denton D: The primordial emotions: The dawning of consciousness. New York:Oxford University Press. 2006.

51. Raichle ME, MacLeod AM, Snyder AZ, Powers WJ, Gusnard DA, and Shulman GL. A default mode of brain function. *Proceed Nat Academ Sci Unit Stat Am*. 2001; 98:676-682.

52. Kluetsch RC, Schmahl C, Niedtfeld I. Alterations in default mode network connectivity during pain processing in borderline personality disorder. *Arch Gen Psychiatry*. 2012; 69:933-1002.

53. Kilgard MP. Harnessing Plasticity to Understand Learning and Treat Disease. Trends in Neurosciences 2012; 35:715-722.

54. Kilgard MP, Merzenich MM. Cortical map reorganization enabled by nucleus basalis activity. *Sci* 1998; 13:279(5357): 1714-1718.

55. Milner B. The medial temporal-lobe amnesic syndrome. *Psychiatr Clin North Am*. 2005 28:599-611, 609.

56. Berry CJ, Shanks DR, Speekenbrink M, et al. Models of recognition, repetition priming, and fluency: Exploring a new framework. *Psychological Review*. 2012; 119:40-79.

57. Lotze M, Scheler G, Tan H-R M. The musician's brain: functional imaging of amateur and professionals during performance and imagery, *NeuroImage*. 2003; 20:1817-1829.

58. Cradd B, Dark V. Perceptual implicit memory relies on intentional, load sensitive processing and encoding, *Memory & Cognition* 2003; 31:997-1008.

59. Loftus EF, Davis D. Recovered memories. *Annu Rev Clin Psychol.* 2006; 2:469-98.

60. Loftus EF. Catching liars. Psychological Science in the Public Interest. 2010; 11:87-88.

61. Alberini CM. Mechanisms of memory stabilization: Are consolidation and reconsolidation similar or distinct processes? *Trends Neurosci*. 2005; 28:51-6.

62. Alberini CM. Transcription factors in long-term memory and synaptic plasticity. *Physiol Rev*. 2009; 89:121-45.

63. Lynch G, Rex CS, Gall CM. LTP consolidation: substrates, explanatory power, and functional significance. *Neuropharmacol.*2007; 52:12-23.

64. Fioriti L, Myers C, Huang Y. The persistence of hippocampal-based memory requires protein synthesis mediated by the prion-like protein CPEB3. *Neuron*. 2015; 86:1433-1448.

65. Duvarci S, Nader K. Characterization of fear memory reconsolidation. *J Neurosci*. 2004; 24:9269-75.

66. Alberini CM, Milekic MH, Tronel S. Mechanisms of memory stabilization and de-stabilization. *Cell Mol Life Sci*. 2006; 63:999-1008.

67. Alberini CM. Long-term memories: The good, the bad, and the ugly. Cerebrum, Epub 2010.

68. Taubenfeld SM, Milekic MH, Monti B. The consolidation of new but not reactivated memory requires hippocampal C/EBPβ. *Nature Neurosci.* 2001; 4:813-818.

69. Derrida J. Deconstruction and the other. In: R. Kearney, Dialogues with Contemporary Continental Thinkers. Manchester: Manchester University Press. 1984.

70. DiNicola V. Letters to a young therapist: Relational practices for the coming community. New York. Atropos Press. 2011.

71. DiNicola V. The unsecured present: 3-day novels & pomes 4 pilgrims. New York. Atropos Press. 2012.

72. Squire LR. Biological foundations of accuracy and inaccuracy in memory. In D. L. Schacter (Ed.), Memory distortions: How minds, brains, and societies reconstruct the past (197-225). Cambridge, MA: Harvard University Press. 1995.

73. Tulving E. Episodic and semantic memory. In Organization of Memory, ed. E. Tulving, W. Donaldson, 382-403. New York: Academic 1972.

74. Tulving E. Episodic memory: from mind to brain. *Annu Rev Psychol.* 2002; 53:1-25.

75. Fivush R. The development of autobiographic memory. *Annual Rev Psychol* 2011; 62: 559-582.

76. Nelson K, Fivush R: The emergence of autobiographical memory: A social cultural developmental theory. *Psychol Review.* 2004; 2:486-511.

77. Bernstein D, Rubin DC. Cultural life scripts structure recall from autoviographical memory. *Mem Cogn* 2004; 32:427-42.

78. Laible D. Mother-child discourse surrounding a child's past behavior at 30 months: links to emotional understanding and early conscious development at 36 months. *Merrill Palmer Q*. 2004a; 50:159-80.

79. Laible D. Mother-child discourse in two contexts: links with child temperament, attachment security, and socioemotional competence. *Dev Psychol*. 2004b; 40:979-92.

80. De Casper AJ, Spence MJ. Prenatal maternal speech influences newborn's perception of speech sounds. *Infant Behav Dev*. 1986; 9:133-50.

81. Kernberg O. Neurobiological correlates of object relations theory: The relationship between neurobiological and psychodynamic development. *Int Forum of Psychoanal* 2015; 24:1.

82. Heimer L. A new anatomical framework for neuropsychiatric disorders and drug abuse. *Am J Psychiatry*. 2003; 160:1726-1739.

83. Heimer L, Wilson RD. The subcortical projections of allocortex: Similarities in the neuronal associations of the hippocampus, the piriform cortex and the neocortex. In: Santini M, (Ed.) Golgi Centiennial Symposium Proceedings. New York: Raven Press, 1975; 177-193.

84. McLean KC, Pasupathi M, Pals J. Selves creating stories creating selves: a process model of self-development. *Personal Soc Psychol Rev*. 2007; 11:262-78.

85. Habermas T. How to tell a life: the development of the cultural concept of biography. *J Cogn Dev* 2007; 8:1-31.

86. Habermas T, Bluck S. Getting a life: the emergence of the life story in adolescence. *Psychol Bull* 2000; 126:748-69.

87. Fivush R, Buckner JP. Constructing gender and identity through autobiographical narratives. In R Fivush & C Haden (Eds.), Autobiographical memory and the construction of a narrative self: Developmental and cultural perspectives (149-168). Hillsdale, NJ: Erlbaum. 2003.

88. Wang Q. Culture effects on adults' earliest childhood recollection and self-description: implications for the relation between memory and the self. *J Personal Soc Psychol* 2001; 81:220-33.

89. Wang Q.The autobiographical self in time and culture. New York:Oxford University Press. 2013.

90. Wang Q, Ross M. Culture and memory. In Handbook of Cultural Psychology, ed. S Kitayama, D Cohen, 645-67. New York: Guilford 2007.

91. Welch-Ross MK. Mother-child participation in conversation about the past: relationship to preschoolers' theory of mind. *Dev Psychol.* 1997; 33:618-29.

92. Wang Q, Fivush R. Mother-child conversations of emotionally salient events: exploring the functions of reminiscing in Euro-American and Chinese families. *Soc Dev.* 2005; 14:473-95.

93. Nelson K, Ross G. The generalities and specifics of long term memory in infants and young children. In M. Perlmutter (Ed.), New directions for child development 10: [Children's memory]87-101. San Francisco: Jossey-Bass 1980.

94. Jack F, MacDonald S, Reese E. Maternal reminiscing style during early childhood predicts the age of adolescents' earliest memories. *Child Dev*. 2009; 80:496-505.

95. Zacks JM, Swallow KM. Event segmentation. *Current Directions in Psychological Sci* 2007; 16:80-84.

96. Eisenberg A. Learning to describe past experience in conversation. Discourse Processes. 1985; 8:177-204.

97. Fivush R. Owning experience: The development of subjective perspective in autobiographical memory. In C. Moore & K. Lemmon (Eds.), The self in time: Developmental perspectives (35-52). Hillsdale, NJ: Erlbaum 2001.

98. Reese E, Haden CA, Fivush R. Mother–child conversations about the past: Relationships of style and memory over time. *Cognitive Development* 1993; 8:403-430.

99. Hickok G, Poppel D. Dorsal and ventral streams: A framework for understanding aspects of the functional anatomy of language. *Cognition* 2004; 92:67-99.

100. Hickok G, Poppel D. The cortical organization of speech processing. *Nature Reviews Neurosci*. 2007; 8: 393-402.

101. Indefrey P, Levelt WJM. The spacial and temporal signatures of word production components. *Cognition*. 2004; 92:101-144.

102. Gandour J, Wong D, Hutchins G. Pitch processing in the human brain is influenced by language experience. *Neuro Report.* 1998; 9:2115-2119.

103. Gandour J, Wong D, Hsieh L. Crosslinguistic PET study of tone perception. *J Cognitive Neurosci.* 2000; 14:207-222.

104. Gandour J, Wong D, Lowe M. A cross-linguistic fMRI study of spectral and temporal cues underlying phonological processing. *J Cognitive Neurosci* 2002; 14:1076-1087.

105. Gandour J, Dzemidzic M, Wong D. Temporal integration of speech prosody is shaped by language experience: An fMRI study. *Brain and Lang* 2003; 84:318-336.

106. Klein D, Zatorre RJ, Milner B. A cross-linguistic PET study of ton perception in Mandarin Chinese and English speakers. *NeuroImage* 2001; 13:646-653.

107. Wong PC, Parsons LM, Martinez M. The role of the insular cortex in pitch pattern perception: The effect of linguistic contexts. *J Neurosci*2004; 24:1953-1960.

108. Wong PCM, Perrachione TK, Parrish TB. Neural characteristics of successful and less successful speech and word learning in adults. *Hum Brain Mapp* 2007; 28:995-1006.

109. Xu Y, Gandour J, Talavage T. Activation of the left planum temporale in pitch processing is shaped by language experience. *Hum Brain Mapp* 2006; 27:173-183.

110. Zatorre RJ, Evans AC, Meyer E. Lateralization of phonetic and pitch discrimination in speech processing. *Sci.*1992; 265:846-849.

111. Zatorre RJ, Evans AC, Meyer E. Neural mechanisms underlying melodic perception and memory for pitch. *J Neurosci.* 1994; 14:1908-1919.

112. Novac A, Bota R. Transprocessing: A proposed neurobiological mechanism of psychotherapeutic processing. *Mental Illness.* 2014; 6(5077):20-36.

113. Burton H, Firszt HB, Holden T. Activation lateralization in human core, belt, and parabelt auditory fields with unilateral deafness compared to normal hearing. *Brain Res* 2012; 1454:33-47.

114. Hesse E, Main M, Yost-Abrams K. Unresolved States Regarding Loss or Abuse Can Have "Second-Generation" Effects: Disorganization, Role Inversion, and Frightening Ideation in the Offspring of Traumatized, Non-Maltreating Parents in eds. Solomon MF & Siegel D, Healing Trauma, 57-106. New York: W.W. Norton & Co. 2003.

115. Grice HP. Logic and conversation. In Syntax and Semantics III: Speech Acts, ed. P. Cole & J.L. Moran. New York:Academic Press 1975, 41-58.

116. Hesse E, Main M. Disorganized infant, child, and adult attachment: Collapse in behavioral and attentional

strategies. *J Am Psychoanal Assoc* 2000; 48:1097-1127.

117. Main M. Metacognitive knowledge, metacognitive monitoring, and singular (coherent) vs. multiple (incoherent) models of attachment: Findings and directions for future research. In Attachment across the life cycle, ed. C. M. Parkes, J. Stevenson-Hinde, & P. Marris. London: Routledge 1991, 127-159.

118. Steele H, Steele M, Fonagy P. Associations among attachment classifications of mothers, fathers and infants: Evidence for a relationship-specific perspective. Child Development 1996; 2:541-555

119. van Ijzendoorn MH. Adult attachment representations, parental responsiveness, and infant attachment: A meta-analysis on the predictive validity of the Adult Attachment Interview. Psychological Bulletin 1995; 117:387-403.

120. Sarro EC, Wilson DA, Sullivan RM. Maternal regulation of infant brain state. Current Biology 2014; 24:1-6.

121. Moriceau S, Sullivan R: Maternal presence serves as a switch between learning fear and attraction in infancy. Nature Neuroscience 2006; 9:1004-1006.

122. Hostinar CE, Sullivan RM, Gunnar MR. Psychobiological mechanisms underlying the social buffering of the hypothalamic-pituitary-adrenocortial axis: A review of animal models and human studies across development. Psychol Bull 2014; 140:256-82.

123. Shionoya K, Moriceau S, Bradstock P. Maternal attenuation of hypothalamic paraventricular nucleus norepinephrine switches avoidance learning to preference learning in preweaning rat pups. Hormones and Behavior 2007; 52:391-400.

124. Sullivan R, Landers M, Yeaman B. Good memories of bad events in infancy. *Nature*. 2000; 407(38).

125. Cahill L, McGaugh JL. A novel demonstration of enhanced memory associated with emotional arousal. *Consciousn Cognition.* 1995; 4:410-421.

126. Dębiec J, Bush DE, LeDoux JE. Noradrenergic enhancement of reconsolidation in the amygdala impairs extinction of conditioned fear in rats--a possible mechanism for the persistence of traumatic memories in PTSD. *Depress Anxiety* 2011; 28:186-93.

127. Davis M, Walker DL, Lee Y. Roles of the Amygdala and Bed Nucleus of the Stria Terminalis in Fear and Anxiety Measured with the Acoustic Startle Reflex—Possible Relevance to PTSD. In Psychobiology of Posttraumatic Stress Disorder, eds. R. Yehuda & A.C. McFarlane. New York: *Ann NYAcad Sci.*1997; 821: 305-331.

128. Kensinger EA, Schacter DL. Amygdala activity is associated with the successful encoding of item, but not source, information for positive and negative stimuli. JNeurosci. 2006; 26(9):2564-2570.

129. McGaugh JL. Preserving the presence of the past. Hormonal influence on memory storage. *Am Psychologists* 1983; 39:161-173.

130. Cahill L, Haier RJ. Amygdala activity at encoding correlated with long-term, free recall of emotional information. *Proc Natl Acad Sci*. 1996; 93:8016-8021.

131. Rauch SL, Shin LM, Pitman RK. Evaluating the Effects of Psychological Trauma Using Neuroimaging Techniques. In Psychological Trauma, ed. R. Yehuda. Washington DC: American Psychiatric Press, Inc, 67-96. 1998.

132. Frewen P, Lane RD, Neufeld RW, Densmore M, Stevens T, Lanius R. Neural correlates of levels of emotional awareness during trauma script-imagery in posttraumatic stress disorder. *Psychosom Med.* 2008; 70(1): 27-31.

133. Levin P, Lazrove S, van der Kolk B. What psychological testing and neuroimaging tell us about the treatment of posttraumatic stress disorder by eye movement desensitization and reprocessing. J *Anxiety Disor* 1999; 13:159-172.

134. Eagle M. Psychoanalysis and "Narrative Truth": A reply to spence. *Psychoanal Contemp Thought* 1984; 7:629-640.

135. Shengold L. Narrative truth and historical truth. *J Amer Psychoanal Assn*. 1985; 33S:239-244.

136. Spence D. Narrative persuasion. Psychoanal. *Contemp Thought*. 1983; 6:457-481.

137. Spence D. Narrative appeal vs. historical validity. *Contemp Psychoanal*. 1989; 25:517-523.

138. Quirk GJ. Memory for extinction of conditioned fear is long-lasting and persists following spontaneous recovery. *Learn Mem* 2002; 9:402-207.

139. Schiller D, Cain CK, Curley NG. Evidence for recovery of fear following immediate extinction in rats and humans. *Learn Mem*. 2008; 15:394-402.

140. Novac A. The pseudoborderline syndrome - a proposal based on case studies. *J Nerv Ment Dis*. 1986; 174:84-91.

141. Foa EB, Hembree E, Rothbaum BO. Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences, therapist guide. New York:Oxford University Press 2007.

142. Rothbaum BO, Foa EB, Hembree E. Reclaiming your life from a traumatic experience: Client workbook. New York. Oxford University Press 2007.

143. Etkin A, Pittenger C, Polan HJ. Toward a neurobiology of psychotherapy: Basic science and clinical applications. *The J Neuropsych Clin Neurosci.* 2005; 17:145-158.

144. Pally R. The Mind-Brain Relationship. Karnac: London 2000.

145. Novac A. "Intergenerational Transmission of Trauma: A Neuropsychoanalytical Approach," Presented at Annual Meeting of the International Neuropsychoanalytic

Association (NPsA), July 25-28, 2008; Montreal, Canada.

146. Panksepp J, Biven L. The archaeology of mind: Neuroevolutionary origins of human emotions. New York:W.W. Norton & Company 2012.

147. Brown S, Vaughan C. Play: How it shapes the brain, opens the imagination, and invigorates the soul. New York:Avery (Penguin Group) 2009.

148. Mazzoni GAL, Loftus EF, Kirsch I. "Changing beliefs about implausible autobiographical events". *J Exp Psychol*. Applied 2001; 7:51-59.

149. Berkowitz SR, Laney C, Morris EK. Pluto Behaving Badly: False beliefs and their consequences. *Am J Psychol.* 2008; 121:643-660.

150. DiFonzo N, Bordia P, Rosnow RL.Reining in rumors. *Organizat Dynam*.1994; 23.1:47-67.

151. van Es R. Persistent Ambiguity and Moral Responsibility in Rashomon. In Film and Knowledge: Essays on the Integration of Images and Ideas, ed. Kevin L. Stoehr. North Carolina:McFarland & Co. 2002.

152. Novac A, McEwan JD, Bota RG. Negative rumor: Contagion of a psychiatric department. *Prim Care Companion CNS Disord*. 2014; 16(2).

153. Baumeister RF, Newman LS. How stories make sense of personal experiences: Motives that shape autobiographical narratives. Personality and Social Psychology Bulletin ("PSPB"). 1994; 20:6.

154. Novac A. Narrative and healing processes during psychotherapy: The reloading and implicit relegation hypothesis. *Academy Forum.* 2013; 57:2.

155. Kounios J, Fleck JI, Green DL. The origins of insight in resting-state brian activity. *Neuropsychologia*. 2008; 46: 281-291.

156. Grob CS, Danforth AL, Chopra GS. Pilot study of psilocybin treatment for anxiety in patients with advanced stage cancer. *Arch Gen Psych.* 2011; 68:71-8.

157. Alexander F. Fundamentals of psychoanalysis. New York:W. W. Norton & Company 1963.

158. McGaugh JL. Involvement of hormonal and neuromodulatory systems in the regulation of memory storage. *Annual Review of Neurosci.* 1989; 2:255-287.

159. McGaugh JL, Weinberger NM, Lynch G. Neural mechanisms of learning and memory: Cells, systems and computations. *Naval Res Reviews*.1985; 37:15-29.

160. Sapolsky RM. Stress and the brain: Individual variability and the inverted-U. *Nature Neurosci.* 2015; 18:1344-1346.

161. Proust M. Within a budding grove: [In two volumes]: Remembrance of things past: Part Two. NewYork: Thomas Seltzer 1924.

162. Diamandis M, White NMA, Yousef GM. Personalized medicine: marking a new epoch in cancer patient management. *Mol Cancer Res*. 2010; 8:1175.

163. Friedman R. The book stops here. Accessed 9/25/15 from the website of The New York Times 2013.

164. Insel T. Director's blog: Transforming diagnosis. 2013; Accessed 9/25/15 from the website of the National Institute of Mental Health.

165. Kapur S, Mamo D. Half a century of antipsychotics and still a central role for dopamine D2 receptors. *Prog Neuropsychopharmacol Biol Psychiatry* 2003; 27:1081-90.

166. Khan AY, Shaikh MR. Challenging the established diagnosis in psychiatric practice: Is it worth it? *J Psychiatr Pract*. 2008; 14:67-72.

167. Patten SB, Bilsker D, Goldner E. The evolving understanding of major depression epidemiology: Implications for practice and policy. *Can J Psychiatry* 2008; 53:689-95.

168. Diagnostic and Statistical Manual, 5th Ed. (DSM 5). American Psychiatric Publishing. Washington DC 2013.

169. Skodol AE, Morey LC, Bender DS. The alternative DSM-5 model for personality disorders: A clinical application. *Am J Psych* 2015; 172: 606-613.

170. Anderson JM, Gilmore R, Roper S, Crosson B, Bauer RM, et al. Conduction aphasia and the acruate fasciculus: A reexamination of the Wernicke-Geschwind model. *Brain Lang*. 1999; 70:1-12.

171. Novac A, Bota RG, Blinder B. Identity Narrative Density: Preliminary findings from scoring emotional valence of autobiographical events. Bull Menninger Clin 2017; 26:1-15

ADDRESS FOR CORRESPONDENCE:

A Novac, University of California, Irvine, 400 Newport Center Drive, Suite 309, Newport Beach, CA 92660, Tel: (949) 400-2990