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The vibrational state: a novel neurophysiological state?

Rodrigo Montenegro

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Abstract

This article presents a theoretical assessment specific to the field of consciousness research, more precisely associated with the study of the Vibrational State (VS) and accompanying states, such as the Out-of-Body Experience (OBE), the former currently being an under-researched state of consciousness when it comes to its neurophysiological correlates. It aims at informally presenting neurophysiological theoretical assumptions gathered over the years studying the VS as well as the OBEs through empirical observations, although briefly presenting current ongoing scientific experimental electroencephalographic research into the VS as well as prospective research and scientifically based neuroscientific theories in preparation, which taken together, may provide recommendations for future research associated with such states. We present succinct preliminary research data of the VS intending to postulate insight into the current limitations of VS studies. The purpose lay forward is that of elaborating a critical framework to technically define the VS as a peculiar neurophysiological state of consciousness, not only as an experiential one. Although this essay is merely speculative and mostly theoretical, it is inferentially based on experimental data, current neuroscience and sleep research knowledge. Nevertheless, it does not pretend to have reached the level of a structured hypothesis based on reproducible scientific evidences at any point, when those are presented. Some of the presented assumptions are certainly disputable and based on inductive, experiential-based, reasoning or limited data analysis. Nonetheless, the insights, taken forward, may provide research implications for the neurophysiological models accompanying future VS and OBEs research, including considerations regarding Isolated Sleep Paralysis (ISP), Lucid Dreaming (LD) and other correlated states. We further assume that such states are associated with the brainstem region, have possible common neurophysiological substrates, even though they are phenomenologically different states of consciousness, presenting state-dependent markers.

1 Introduction

It would be most satisfactory of all if physics and psyche could be seen as complementary aspects of the same reality. To us [modern scientists], unlike Kepler and Fludd, the only acceptable point of view appears to be one that recognizes both sides of real-ity — the quantitative and the qualitative, the physical and the psychical — as compatible with each other, and can embrace them simultaneously. – Wolfgang Pauli

The Vibrational State (VS) is defined as a non-ordinary state of consciousness spontaneously perceived during sleep or voluntarily induced through specific meditative techniques, as well as by entheogens experiences. The experience is often described by the proprioceptive perception of vibrations, such as "tingling" or "electrical" sensations. However, although such sensations are often mistakenly described as the VS, as a state of consciousness the VS is rather defined by the ending condition characteristic of such vibrations: final state universally designated as a powerful and intense sensation of being like a "dynamo" (Vieira, 1981, p. 128) or being in a profound, penetrating state of "resonance" (Vieira, 1986; Alegretti, 2008, p. 234).

Albeit the word *state* is employed to describe the subjective set of the VS subjective phenomenology, little is known about the neurophysiology of such state, despite its universal and historical description, at least since Socrates. Historically, in Phaedrus, which portrays Socrates' dialogues (c. 470–399 BC) with Pythagorean philosophers, Plato describes the experience of the throbbing of the entire soul (Phaedrus 251-a-e). A state of vibration brought up by an entheogen experience arising from Eleusinian practices (Hamilton, 1973; Rinella, 2000; Wasson, Hofmann and Ruck, 2008) equally described in modern DMT experiences (VS-DMT) (Callaway et al., 1999; Strassman, 2001; Tittarelli et al., 2015; Hamill et al., 2019) clearly suggestive of comparable VS phenomenology.

The experience described by Plato at the end of the initiation, leading to the perception of "pure light" (Phaedrus 250-c) is reminiscent of Buddhist's consciousness states concepts (Bhardo, in Tibetan), following experimental observation made since the 10th century by the Indian tantric teacher Nāropā. Such meditative practices described non-ordinary meditative states mostly associated with sleep, whose purpose was preparation for death. The *bhardo of dharmata*, for example, is thought to be experienced by maintaining the perception of "clear light" at the sleep onset (SO) and presents similar experiential vibration phenomenology, as do other practices such as the Yoga of Tummo, Pho-wa meditation and Kundalini Yoga (Evans-Wentz, 1958; Gardner et al., 1993). Practiced through the stimulation of "energy flows" or "wind flows" (Gardner et al., 1993, p. 104; Rinpoche, 2012) and driven through deliberate "pulsations" of subtle energies directed bottom-up (Gardner et al., 1993, p. 103; Rinpoche, 2012) through the meridians of the body, such practices were accompanying processes of ego-dissolution and led to the transference of consciousness out-of-the-body. Although such meditations practices have often utilized specific terminologies to describe such processes, the associated experienced are clearly allusive of similar but contemporary VS-induction methodologies, undeniably illustrating the meditation to prime the experience of "a body of light" or "illusory body" (Rinpoche, 2012). An incidence equally prevailing in modern VS accounts inducing Out-of-Body Experiences (VS-OBEs) through the projection of the astral body (Montenegro, 2015).

Although Western traditions provided phenomenological insight into sleep phenomena, since Plato described dreams of foretelling (Oneiroi, in greek) (Theochari, A., 2008) in "Republic" and Aristotle "De Insomnii" studied the ability of Lucid Dreaming (LD) (De Koninck, 2012) – a condition where the dreamer expresses increased awareness –, no description of the VS appears to be illustrated in Western societies until 1744. The notion seems to have been first brought by Swedenborg's journal of dreams and spiritual experiences describing the VS as "powerful tremor, from the head and over the whole body" (Swedenborg, 1918, p. 26), a condition re-counted to often progress to OBEs. However, despite the reference, little historical accounts of the VS are found until the twentieth century. A phenomenological standstill which might have been caused by the religious censorship following the otherwise notable work of theologian Quintus Septimius Florens Tertullianus (c. 155 – c. 240 AD) on sleep states, acknowledging dreams as a doorway to demonic influence (De Koninck, 2012).

The standstill might have been equally brought up by traditional notions of sleep, dating back from Hippocrates, which by promoting physiological explanations of the sleep phenomena (De Koninck, 2012) also led to a certain reductionism, in the name of scientific progress. For instance, Isolated Sleep Paralysis (ISP) – a healthy condition of sleep atonia, leading to the impossibility to move in sleep when we wake up, – was first referred in 1644 as an Incubus Night-Mare (Kompanje, 2008), without however being accompanied by descriptions of interoceptive vibrations (ISP-VS), until Everett first described them in 1963, as a reported condition of "tingling sensation over the body" (Everett, 1963, p. 284). Similarly, until the nineteenth century, most sleep studies, such as the work of Louis Ferdinand Alfred Maury (1865), who discovered the hypnagogic state at sleep onset (SO) – where the VS seem to be occasionally self-reported – does not seem to refer either to VS-like perceptions, despite lexicon limitations.[1]

Notwithstanding the development of the experimental approach at the time, research was mostly focused on apprehending sleep essentially from a physiological standpoint (Morin and Espie, 2012; Maury, 2013) and if such studies made valuable psychological observations, they remained mostly ascribed to such pursuits. Consequently, much less attention may have been given to phenomena such as the VS, which may have been simply dismissed as phantasmagorical hallucinations, as they are still today.

Self-evidently, the same condition might have subdued some of Sigmund Freud's conclusions on dreams. Although Freud recognized that faculties of the mind, such as the intellect, remained intact in dreams states (Freud, 2010, p. 89), specific capacities of consciousness in sleep, like the lucid dreaming (LD) states reported by Saint-Denys (1867) (Hervey de Saint-Denys, 2005) as the ability to direct dreams, were downplayed as preconscious wish (Freud,

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[1] The term "vibration" was mostly used at the time to refer to nerve activation, e.g., "cerebral vibration."

1965, p. 571). However, their analysis could have led to the description in such states of "electrical sensations," specific to the VS sensations reported in LD (LD-VS) (Levitan et al., 1999; Waggoner, 2009), with an acknowledged Rapid Eye Movement (REM) state prevalence, although the statistical relevance of such states in LD has received little formal quantification.

Descriptions of the VS started to flourish at the beginning of the twentieth century with the upsurge in OBE reports led by classical authors such as Muldoon and Carrington (1929); see also (Montenegro, 2015). A condition that might have culminated with a wider divulgation of the VS, as a state that can be induced, by Monroe in the 70s (Monroe, 1971). However, it is only in the late twentieth century that prominent researchers of institutions such as the American Journal of Psychiatry started to compile the statistical prevalence of the vibrations, which a randomized OBE survey reported to be perceived by 52% of participants ($n = 339$), and by 38% for VS-OBEs (Twemlow, Gabbard and Jones, 1982).

Nevertheless, whilst non-randomized surveys continued to report the statistical prevalence of vibrations to be between 30% ($n = 1115$) (Alegretti and Trivellato, 1999) and 56% (Buhlman, 2001), the neurophysiology of the VS in sleep states, to date, has never received the scientific attention it merits. Besides its distinct typology, the VS has, arguably, remained mainly associated with OBEs, and because of this probably remained mostly downplayed as a hallucinatory phenomenon (Cheyne, 2010) ascribed to psychiatric disorders of perceptions (Montenegro, 2015).

Finally, if modern investigations on states of consciousness have been polarized by a research mainly focused on neurophysiological correlates and cortical determinants of such states, and not of their associated phenomenology (Aru et al., 2019), it is somewhat surprising to see a similar reductionism in empirical studies of the VS. The VS is known in consciousness investigation circles for more than half of a century, with empirical studies reporting an increasingly refined characterization of such state. Such studies, however, remained impervious to a research of its neurophysiological correlates, despite acknowledging their importance. Without a doubt, until today, little is known about the VS from a neurophysiological standpoint, which would undoubtedly provide a deeper understanding of the conditions that would favor its triggering and could, as such, increment motivation for its induction.

Albeit preliminary data on the VS was provided by Alegretti (2008) and Rodrigues Pinheiro (2013), the current scope of the research related to the induction of the VS during the waking state (W-VS) does not meet those criteria that would allow the VS to be defined as a specific and novel neurophysiological state, taking into account modern concepts of state determination,[2] considering that the VS is spontaneously perceived in LD-VS and ISP-VS sleep states. A condition, in view of the assumption proposing the VS as a mechanism to explain OBEs (Vieira, 1986, p. 109),[3] considered of fundamental importance to allow for state differentiation.

The focus of this essay is precisely on the notion of state differentiation. More precisely, its objective is to delineate, at least theoretically, the experimental research needed to determine the VS as a novel and testable neurophysiological distinctive state. However, a review of known neuroimaging methodologies limitations or current neurophysiological theories that explain OBEs associated with this subject, specifically nosological, as well as notions related to their ontological reality, or its acknowledged relation with VS-DMT, would go beyond the scope and objective of this article. Also, those multidimensional characteristics that could prevail and may prompt such states are equally left aside of the present epilogistic analysis, to focus on the identification of possible neural correlates of consciousness in such states, although they could involve important causal attributes.

[2] These are referred to as the neurophysiological determining properties (neurophysiological markers) of each known stage of sleep: Wakefulness (W), R-stage (previously referred as REM), N-stages (3 Non-Rapid Eye Movement phases – N1, N2 and N3 stages).

[3] The relationship correlating subtle energies (e.g., chi, prana, orgone, etc.) to the induction of psychic states were hypothesised since the nineteenth century by many empirical researchers, such as De Rochas, Durville and Carrington (De Rochas D'Anglun, 1895; Durville, 1909; Carrington, 1921), and the relationship to OBE was incipient in research led by Crookall since 1960 (Crookall, 1978, 1980, 1998).

2 Preliminary analysis of the physiological characteristics of the vibrational state

What do we know of the VS as a neurophysiological state? If a comprehensive methodology establishing the modus operandi to achieve the VS has been published by Trivellato (2008; 2015), the knowledge of the VS as a neurophysiological state still remains in infancy. Sparse Electroencephalographic (EEG) VS data from an initial 2-session experiment was initially presented by Alegretti (2008) but did not offer enough technical information to provide a well-grounded critical appraisal. If the author acknowledged that the study lacked the desired scientific rigor, several observations of unusual brain patterns certainly lack a more detailed technical explanation to infer about the observed conditions.

For example, the referred "synchronization of several brain circuits" (Alegretti, 2008, p. 248), could refer to a diffuse polymorphic Theta activity associated with deeper drowsiness states (Stern and Engel, 2013). However, drowsiness was not reported.

The condition of "cerebral arrhythmia" (Alegretti, 2008, p. 248) remains an equally unclear depiction to provide any sensible specification, despite the author's communication attempts for clarification with Alegretti. If the neural terminology could be referring to a condition of partial seizure, related to asymptomatic ictal bradycardia episodes seen in seizure without syncope (Almansori, Ljaz and Ahmed, 2006; Bartlam and Mohanraj, 2016), they are very improbable and uncharacteristic of VS phenomenology.

The second study of Alegretti, mentioned in the same article (Alegretti, 2008), despite describing similar patterns, and more specifically the presence of high-frequency waves, does not offer technical data to allow in-depth analysis either. Further unpublished studies of Alegretti, presented in conferences, have been mainly concerned with energy detection, not neurophysiological brain activity, or the neurophysiological correlates of such state.

Rodrigues Pinheiro (2013) completed a subsequent Master dissertation study on the subject. The study specifically focused on the electrophysiological correlates and investigated 25 subjects, including 15 experienced participants with ten years or more of experience inducing the VS, as well as ten controls. Results analyzed 20 bipolar cortical channels of subjects and control attempting to reach the VS with an general limited significance analysis level of $p < 0.05$ for intergroup differences. An overall Gamma burst of up to 80 Hz ($p < 0.01$) was however observed in the experienced population and suggested a broader cortical Gamma during the VS (Rodrigues Pinheiro, 2013), although such hypothetical conjecture remains to be verified due to the limited spatial cortical reach of the 20 EEG channel setting to provide certainty of the fact. It was not observed in the research led by this author (Figure 1).

The relation to sleep stages, critical to state differentiation, was briefly mentioned. The study indicated the occurrence of light sleep with increased Theta waves (in 50% of the 30 s EEG segment) and the occurrence of sleep with the apparition of vertex waves 10% of the time during VS-induction (I-VS) by experienced subjects; however no further analysis was given. The condition of light sleep is in itself, otherwise atypical, taken in consideration the known arousal effect of Gamma waves and was not reported during I-VS in the W-stages in our study.

Whereas the report is consistent with current neurophysiological research, showing an increase in Gamma above the indicated threshold during VS, in a 128 high-density EEG channel investigation led by Montenegro (*in preparation*), a comparative study suggests differences in cortical areas with the referred schoolwork which might be prompted by differential I-VS techniques. More so, current research equally presents data showing a significant overall Delta increase concomitant to Gamma during I-VS (Figure 1), not reported by the previous study by Rodrigues Pinheiro (2013). This is a neurophysiological correlate that may be ascribed to an increased focused state (Montenegro, 2020a).

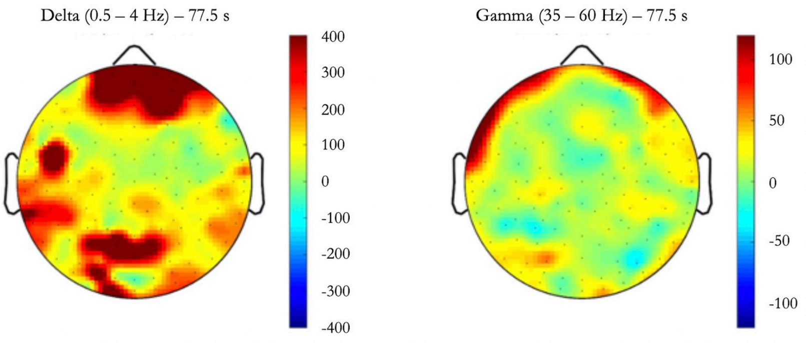

Figure 1 128 high-density EEG showing concomitant Gamma and Delta with percentage increased VS (unprocessed data) during one VS-session (in color in the pdf version of the article).

If the research in preparation delves deeper into the neurophysiological characteristics of the VS, providing a theoretical framework to suggest a specific neural signature (Figure 2) suggestive of prospective Event-Related Potential (ERP) or waveform, with specific Phase Amplitude Coupling (PAC) and Phase Locking Values (PLV),[4] consequently acknowledging the state to be mediated by specific neurotransmitters, the research still does not meet the criteria to ascertain state differentiation. A condition more specifically formulated subsequently.

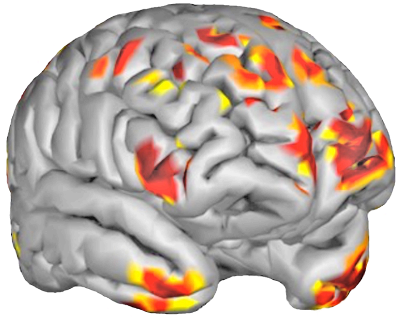

Figure 2 Neuroimaging of cortical areas associated with the VS during VS-induction in a specific VS-session (in color in the pdf version of the article).

[4] PLV are EEG-data statistical analysis of task-induced changes in neural synchronization allowing measuring functional connectivity. PAC, on the other hand, measures the coupling of band wave synchrony.

Whilst the referred research indicates the VS to be an *objective* non-ordinary state with specific and novel properties, there was a preexisting need to establish the VS within the better-defined boundaries of the waking state. Initially, preventing LD-VS and ISP-VS state comparison. A limitation inherently steaming, as suggested by Abraham (2010), from the fact that I-VS are led by top-down cognitive correlates, which consequently need to be better dissociated from Spontaneous-VS (S-VS).

Furthermore, no specific methodology has been proposed to allow a better distinction between S-VS seen in the different phases of sleep. If the research proposed by (Alegretti, 2008, p. 244), suggesting the comparison of EEG results of experienced subjects, would permit for its possible spontaneous generation in deep levels of relaxation, the experimental data gathered would suffer from the proximity of the recording to the waking state. As such, if the experimental setting may provide consequent data, at this stage of the research, it would not allow for the analytical comparison between I-VS and S-VS in R or N-states, despite the experimental necessity referred above. A condition *sine qua non* to allow for further state differentiation beyond the known phenomenological similarities of such states, so as to obtain the necessary distinction with respect to their associated overlapping states (see the analysis in the section below).

Frontal low current electrical stimulation induction of a gamma activity might be better suited to the differential objective permitting an increased lucidity in R and N-states and consequent S-VS in predisposed subjects. A combined EEG research protocol including transcranial Alternate Current stimulation (tACs) and stage detection algorithms may allow for a programmed neurostimulation targeting cortical areas during certain neurophysiological threshold of sleep, allowing the stimulation of brain areas, such as the frontotemporal cortex, to stimulate the awareness of subjects and allow them to attempt at inducing S-VS or indeed I-VS. A condition not devoid of technical complexities and limitations, but certainly possible.[5]

[5] The electrical potential of such stimulation can be subtracted from EEG recording, allowing for a more objective data analysis. The neuromodulation could potentially occur during LD states or induced ISP, where Alpha lucidity is reported (Takeuchi, 1992), and confer neurophysiological state similitudes.

Nevertheless, another more pressing concern seems even more critical to address, in structuring a larger-scale and more in-depth investigation of the VS, allowing for the proposed state differentiation – one that would delineate a scientific neurophysiological theory of the VS as an original neurophysiological state. Undeniably, the facts suggest that most subjects lack the capacity of identifying an objective reference to measure their subjective states, or are inadequately trained to induce the VS. Although the VS is deemed to be easier to learn than OBEs, constituting theoretically a rather replicable phenomenon, empirical and subjective analysis of the VS suggests that 95.7% of subjects were unable to reach the VS without long-term guided training (Trivellato, 2014). Moreover, 30% of studied subjects thought to have achieved the VS without objective indications of the fact. The lack of experiential understanding of the phenomenology associated with the VS is a condition that might further compromise the statistical analysis of any replication study, although current technological trends of consumer EEG might help experiencers to characterize better the state with objectivity, albeit they might also be limited by the technological limitations of such devices to measure the VS.[6]

3 Neurophysiological markers of state determination

Defining the VS as an original state requires it to be unambiguously differentiated from acknowledged neurophysiological stages of sleep, i.e., distinguishing ISP-VS, LD-VS and S-VS, from W-VS. This can be achieved by understanding the differential neurophysiological markers of state determination associated with

[6] Analysis of the current market indicates most consumer grade headbands present technological limitations to measure high Gamma wave (e.g., above < 64 Hz) as they are reported. A condition led by the Nyquist frequency sampling theory, which defines EEG recording sampling threshold need to have sampling recording rate of at least double the frequency (e.g., 64 Hz) to allow accurate recording of half the targeted frequency (e.g., 32 Hz).

such states.

Sleep research has conventionally recognized three different states of being: W (wake), R (REM sleep) and N (non-REM sleep) stages. They consist of different states of consciousness or unconsciousness, with specific neurophysiological markers (biological sates) and associated variables characterizing each stage. However, although such states may express differences from a neurophysiological standpoint, they may present in some circumstances, relatively "similar" states of consciousness, as exemplified by dream activity in R and N stages (Suzuki, 2004; Manni, 2005). On the other hand, such states may be different states of consciousness, as exemplified by the differences in the W and R states (excluding LD), but nevertheless express neurophysiological similarities (Mahowald and Schenck, 1999; Fitzgerald, Gruener and Mtui, 2012). This is one of the reasons why the R-stage was also termed *paradoxical sleep*, as it presents EEG wave markers that are seen during the W-stage (e.g., Beta waves), although it is mostly a Theta predominant state.

The determination of the W, R and N stages is carried out using various criteria, and technical instrumentation measuring electrographic activity through a plethora of multi-parametric polysomnographic (PSG) equipment, including EEG, electrooculogram (EOG), electromyogram (EMG), electrocardiogram (ECG) pulse-oxymetry, and airflow/thermistor, allowing for the determination of the properties of each state. However, despite this technological predominance, behavioral assessments (e.g., conditions of the eyes, movements, reactivity to the environment) have remained necessary and are equally useful for state determination (Mahowald and Schenck, 1999), although an growing trend in using algorithms' scoring, which have reached high accuracy level regarding their agreement with manual human scoring.[7]

Defining the standard W, N and R stages is generally achieved by recording and analyzing voltage fluctuation differentials through electroencephalography (EEG) recording. EEG frequencies (Table

[7] Such software has high levels of validity only when they present an adequate sensitivity, so as to rule out other stages of sleep generally accessed by *F*-measure statistical analysis to consolidate their precision.

1) are combined with concurrent monitoring of muscle tone, measured by electromyogram (EMG) signals, and eye movement recording, ascertained by electrooculogram (EOG) signals.

Band	Frequency (Hz)
Delta (δ)	> 3.5
Theta (θ)	4-7.5
Alpha (α)	8-13
Beta (β)	14-30
Gamma (γ)	< 30

Table 1 Frequency bands as indicated in Niedermeyer's electroencephalography (Schomer and Lopes da Silva, 2011).

The natural state of wakefulness is characterized by Low Voltage Fast Activity (LVFA) and cortically synchronized EEG patterns for higher frequency ranges, evolving to Theta increment in the frontal cortex, more specifically with increased sleep drive. Wake frequencies range from Beta to Gamma during intense mental activity, while relaxed wakefulness states have predominant Alpha waves, depending on behavioral input. In general, the W-stage with eye closed is characterized by a dominant Alpha rhythm, most evident on the occipital EEG area. The overall W-stage expresses otherwise the presence of diverse patterns of concomitant non-exclusive brainwaves (Table 1), even for a same functional area.

Sleep, on the other hand, is more characterized by large-amplitude slower wave frequencies (N-stages), which is an overall EEG condition led by the reduced activity of the Ascending Reticular Activating System (ARAS). N-stages progress from light sleep (N1) to deep sleep (N3). N1-stages are characterized by low amplitude, mixed frequency EEG (4-7.5 Hz) with central EEG vertex sharp waves (V waves) (< 0.5 s duration), and present Slow Eye Movements (SEMs). N2-stages express fast bursts (≥ 0.5 s) of 11-16 Hz activity of sleep spindles, most apparent on central EEG, K complex waves, mostly manifest on frontal EEG. Slow waves (0.5-2 Hz) Delta activity characterizes N3-stages of deep sleep in at least 20% of the EEG activity with no eye movements, with ≥ 75 µV in amplitude in frontal EEG and sleep spindles (≥ 6 s).

R-stages, similarly, considered as light sleep, are characterized by bursts of Rapid Eye Movements (REMs), low amplitude EMG (atonia), sawtooth waves, most evident on central EEG, often preceding bursts of REMs and transient muscle activity characterized by phasic twitches. Figure 3 provides a hypnogram with typical brainwave patterns associated with each stage.

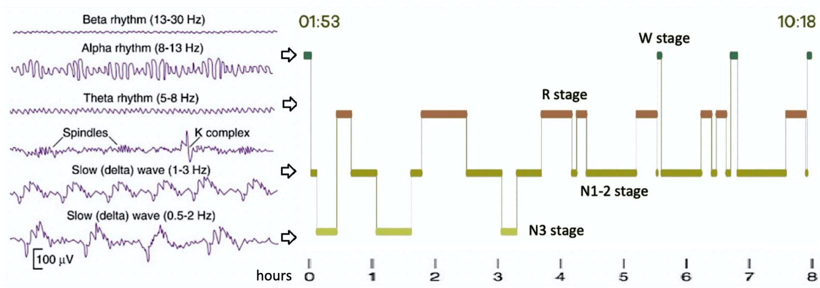

Figure 3 An adult sleep of 8-hours, with 21 minutes in W-stage (**4%**) through the night and typical EEG patterns associated with each stage (top picture), although associated with an increased R-stage pattern (4:16). N1-stages commonly express Low Amplitude Mixed Frequency (LAMF) **4**-**7** Hz EEG with Vertex Sharp waves (V waves) and N2-stages record sleep spindles with fast bursts ($> \mathbf{0.5}$ s) of **11**-**16** Hz activity and K-Complex. While N3-stages shows slow waves in $> \mathbf{20}\%$ of the epoch (0.5-2 Hz Delta activity). Spindles can persist into N3-stages. R-stages have bursts of Rapid Eye Movements (REM) with low amplitude EMG (atonia) and transient muscle activity (Phasic twitches) and might express similar EEG patterns to the W-stage. Here the average heart rate was **56** beats per minutes and an average breathing rate of 14 breaths per minutes, with a total of **24** position changes during the sleep duration.

Without entering too deep into the complexities of the conditions of state determination, it is essential to denote that such electrophysiological patterns induce electrical properties changes in the function of signal integration, modulating ions channels potentials and consequently determining synaptic and neurochemical properties of neurons (e.g., inhibitory or excitatory). The neurophysiological condition of state determination is therefore multifaceted, with a state definition that goes well beyond the EEG electrophysiological assessments. A complex variety of factors associated with state determinants are expressed in a wide variety of neurophysiological parameters at play, to name a few: field potentials, postsynaptic currents, state of synaptic distribution, neural anatomy, neural properties, resting potential, receptor gating, equilibrium. These parameters should be in principle taken into consideration in the analysis of the VS, if one wants to be able to explain its neural modulation.

Additionally, while a diverse set of neurotransmitters and neuromodulators modulate the prevailing and cyclic properties of each state, they may do so by operating on the same neural networks, remaining anatomically "interpenetrated" in their neuroanatomical functions (Hobson, Lydic and Baghdoyan, 1986, p. 371), but nevertheless expressing different states of consciousness. That neural condition is reflected in the expression of the pontomedullary reticular formation (RF) and reticulospinal neurons (RSNs) in the brainstem region, which allow for motor suppression during the R-stages (sleep atonia), while allowing for behavioral motor control in W-states and, as such, are a multimodal and state-dependent network (Takakusaki et al., 2015; Brownstone and Chopek, 2018).

Finally, state determination, as indicated, is defined by the distinctive determination of specific neurotransmitters delineating the prevailing properties of each network. If, as exemplified, the same neuroanatomical networks may convey different prevailing state-properties, with different states of consciousness, to an equal extent, the same neurotransmitters, such as 5-hydroxytryptamine receptors (5-HT), and others, play equal roles in W-states as they do in N and R-stages.

Wake/Sleep stage induction are mostly modulated by either Orexin, Histamine (H), 5-HT and noradrenaline (NA) for the waking promoting nucleus of the hypothalamus, while Gamma-Aminobutyric Acid (GABA) mostly modulates sleep states associated with the Ventro Lateral Preoptic nucleus (VLPO) (Figure 5).

Last but not least, state-dependent neurophysiological properties are likewise predisposed by genetic factors or transcriptome genes that drive the property of each state (genetic characteristics of state determination). Undeniably, functional physiological mechanisms accompanying healthy circadian sleep are associated with Transcriptional-Translational Feedback Loops (TTFLs) that initiate the wake/sleep cycle, a condition mainly regulated by the genetic function of three genes: Period (Per1, Per2, and Per3), Clock (Clk) and Cryptochrome (Cry1 and Cry2) genes), expressed in the neurons of the Suprachiasmatic Nuclei (SCN) (Figure 5). The circadian predisposition is further influenced by waking states and regulated by different neurotransmitters, such as Adenosine A1 receptors levels affecting sleep propensity, and is a condition which, amongst many others, allows for healthy circadian cycles to occur. As such, even though no evidence currently suggests a genetically causal drive for the VS or VS-OBE, we may assume that, as research progresses, one may discover similar genetic factors predisposing such states. Such a genetic profile could influence the spontaneous generation of the VS, as they predispose Gamma wave generation or Slow Wave Sleep (SWS) propensity in N-stages (Wulff et al., 2010) and ISP, the latter being influenced by Per2 gene polymorphism (Denis et al., 2015), a genetic outline specific to a circadian dysregulation prevalence (a condition known to lead to ISP proneness).

As mentioned, the above neurophysiological notions are relevant to determine and differentiate the neurophysiological properties of the VS, if it is to be defined as a novel neurophysiological state from a scientific standpoint. Two aspects are essential to consider in such respect. Firstly, if LD states have relatively better-known neurophysiology,[8] ISP states lack neurophysiological consensus and more specific properties to provide a well-established state differentiation and consequent distinction with the VS. Secondly, there are the complexities associated with transitional states, defined as overlapping, entangled neurophysiological states markers of relative transitional nature, where the VS is reported to occur, as explained below.

4 Transitional sleep states

The concept of state, as a condition of the mind, has considerably evolved since the discovery of REM (Rapid Eye Movement) sleep in 1952, by Aserinsky and Kleitman (Morin and Espie, 2012). Current research has grown beyond the limits set by the three known

[8] Although much more research has been carried for LD states, LD studies have suffered from limited samples with limited spatial EEG resolution and as such, have limited statistical power for determining the prevailing neurophysiology of LD, which is, to a certain extent, still in debate in terms of functional areas.

prevailing W, N1-3 and R-stages, to equally consider overlapping transitional states, some of which express clinical state dissociations. In fact, if neurological states' determination usually has prevailing conditions, sleep laboratory research has led to the observation that neurophysiologic markers may illustrate a condition of the interlocking of neurophysiological states into one another. Such condition is the cause of the extensive array of state dissociations (Mahowald and Schenck, 1999; Mahowald and Schenck, 2005) and parasomnias disorders such as confusional arousal, somnambulism (sleepwalking), sexsomnia and REM Behavior Disorder (RBD), among others. In the case of overlapping states, the otherwise normal and healthy transition between each state, gradually allows multiple state-determining markers to appear in concomitance (Terzano, Parrino and Spaggiari, 1988; Mahowald and Schenck, 1999), which are often inductive of clinical dissociative variations.

In wakefulness variations, such as in narcoleptic cases, dissociative states arise from wakefulness and are accompanied by sudden sleep and the experience of REM intrusion (Overlapping State-1; see Figure 4). The condition of cataplexy in Narcolepsy is the sudden transient episode of muscle tonus loss considered to be triggered by the sudden intrusion of the R-stage into wakefulness. A condition that has often been misdiagnosed as schizophrenia in the past. Hypnagogic or hypnopompic mental activity or hallucinations are considered dream/wake overlapping states variations (Overlapping State-2; see Figure 4) (Mahowald and Schenck, 1999; Manni, 2005). Somnambulism or confusional arousals, equally known as sleep "drunkenness," are N-stages sleep prevailing variations, generally experienced without lucidity, even though amnesia is not always complete (Overlapping State-2 variation; see Figure 4). R-stages prevailing variations are in turn perceived in drug intoxication or withdrawal states, but are more often documented in RBD, where the loss of muscle atonia occurring during the R-stage sleep leads patients to act their dreams.

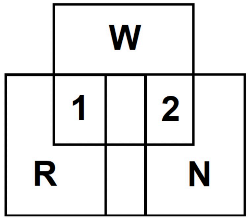

Figure 4 Overlapping neurophysiological states 1-2.

Such characteristics of interlocking states are relevant to the study of the VS state differentiation, explicitly so in LD-VS and ISP-VS. A reflection of the fact that ISP is mostly understood as the persistence of R-stage atonia into the W-stages (Overlapping State-1 variation; see Figure 4), although it has been suggested that ISP can be recorded at predormital SO (Takeuchi et al., 1992; Girard and Cheyne, 2006) (Overlapping State-2 with N-stage variation; see Figure 4). A condition, which in Recurrent-ISP (RISP), considered a pathological variation of ISP, may last for several minutes and occur several times through the night, unlike ISP. LD experiences are equally considered as an R-stage sleep prevailing state, with a mixed W-R-state (Mahowald and Schenck, 1999) (Overlapping State-1 variation; see Figure 4) allowing for the activation of functional areas such as the Dorso Lateral Pre Frontal Cortex (DLPFC) associated with decision-making, working memory and social cognition.[9]

Taken the relatively short forty years history of modern sleep research, we may assume that other transitional and overlapping states could still be discovered. Such might be the case for the state of *projective catalepsy*.[10] The cataleptic trance was referred to as a specific "state of motionless, of sustained immobility, without or

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[9] REM genesis is correlated with hypothalamic and amygdala activity associated with the transient inhibition of activity of the DLPFC, which explains the lack of emotional context and rationality during dreams. The dreamer becomes unable to refer to relevant information or questioning. Although such neurophysiological conditions of inhibition stimulate the expression of emotions and their spontaneous regulation, LD states, through the DLPFC activation, seem to promote such regulation in a much more evolutionary fashion.

[10] The term *projective catalepsy* was initially used in an attempt to distinguish it from ISP terminology, considering that ISP was initially perceived as a pathological sleep phenomenon.

without clouding of the sensorium," with patients exhibiting the appearance of sleep (Kinnier Wilson, 1928, p. 90).[11] The state was proposed as a transient state of partial consciousness disconnection and equally as a functional mechanism to explain S-VS predisposition, leading in some instances to OBEs (Vieira, 1986).

Swedenborg acknowledged the above view already in 1758, as an experiential state of "insensibility" (Swedenborg, 1884, p. 354-355), or *deep torpidity*, allowing OBEs, with similar assumptions early laid by Lancelin (1910) and Muldoon and Carrington (1929). Cornillier (1927) discussed the mechanism at the time of death. Reported by Eliade as "cataleptic consciousness" (Salley, 1982), many OBE experiencers have experimentally induced such state at the SO, as a bridge to OBEs (Lancelin, 1910; Muldoon and Carrington, 1929; Fox, 1962; Monroe, 1971; Vieira, 1981; Rogo, 1986; Montenegro, 2015), thus constituting *voluntary induced* pre-OBE-Catalepsy (OBE-C) as a possible mechanism to explain OBEs – the so-called mind-awake body-asleep *doorway of perception*.

Embryonic explanations related to such state did not lead, however, to the development of a genuine scientific theory, although the causal mechanism of insensitivity was briefly associated with the medulla oblongata and OBEs to the rhomboid fossa as from 1958 (Vieira and Xavier, p. 120, 129). Whereas these authors did not provide information to delineate the neurophysiological mechanisms of the inferred association, the underlying idea here, within the limited anatomical functions of the discussed areas, presumably signifies that mechanisms of motor inhibition at the SO, or naturally occurring during sleep, although not suggested by these authors, would predispose to OBE experiences. A more contemporary terminology would instead hypothesize the inhibition to be related to the mesopontine tegmentum and the medullary reticulospinal tract in the pontomedullary Reticular Formation (RF) (Figure 5), within the networks of the brainstem, which would exhibit specific state-dependent characteristics, mediating transient pre-OBE-states (Montenegro, 2020). This is an inhibitory motor hypothesis which

[11] The term catalepsy was at the turn of the last century interchangeable with the term cataplexy, or the sudden loss of muscle tone in the waking state, although the term catalepsy prevailed as a specific state of insensibility.

has been defended by the present author since 2005, as a naturalistic mechanism to explain the universally experienced prompting of OBEs in sleep (Montenegro, 2015).

The above consideration is of fundamental importance, as it does not only reflect the discussed hypothetical assumption proposing the VS as a mechanism to explain the OBEs, but the idea, further stipulated, that the inhibition of the functional areas, specifically associated with the pons (Figure 5), are supplementary to the neurophysiological mechanisms of LD-VS, ISP-VS, and VS-like sensations, although state-dependent, *transitional states variations*, leading to OBEs. As such, they have functionally *analogous* neurophysiological characteristics of motor inhibition and atonia, as seen in R-stages or ISP-states, although here hypothesized to be state-dependent.

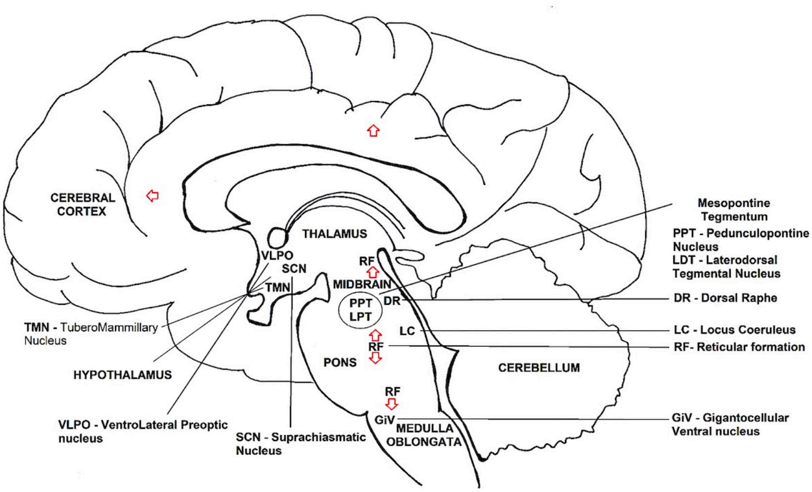

Figure 5 Sagittal sections of the brainstem composed of a complex network of interconnected regions from the thalamus/hypothalamus downward, forming the Midbrain, the Pons, and the Medulla Oblongata. Such regions are further comprised of different brain nuclei such as the Ascending Reticular Activating System (ARAS), reaching across all three areas with pathways to the Cerebral cortex (arrows) and forming a complex functional network that promote and control the sleep-wake cycles driven by the Suprachiasmatic Nuclei (SCN) transcriptome genes. The schematics also indicate other regions mentioned explicitly in this article.

More specifically, based on an unpublished investigation, briefly outlined below, we can presume that R-stages' variations could express characteristics of Sleep Onset REM Periods (SOREMPs), a condition where REM is uncharacteristically perceived at the SO. Although ISP-like variations, where similar mechanisms of R-stages atonia are at play, would express the same common neural denominators, induced OBE-C at the SO would be prompted through the voluntary inhibition of ARAS systems, as delineated subsequently.

R-stages variations would possibly be prompted through cholinergic hyper-activation (REM-ON) states triggered at the SO, associated with an inhibition of REM/OFF Locus Coeruleus (LC) nuclei, which within the mesopontine subcoeruleus (SubC) induces a very low amplitude EMG muscle tone (R-Stage atonia), modulated by GABAergic motoneurons of medullary pathway of the Gigantocellular Ventral nucleus (GiV) (Figure 5). However, while R-stages are usually modulated during the night, the induced R-stage REM-ON variation would be expressed at the Sleep Onset REM (SOREMPs), without loss of lucidity. This is a sleep state that seem to correlate to an OBE study conducted by Tart (1968), with a gifted subject, but also confirmed, to a certain extent, by an unpublished OBE-EEG preliminary investigation conducted by this author.[12] The state suggest a condition that is not unlike Wake Induced Lucid Dreaming (WILD) induction, albeit repetitively realized at SO and not throughout a night waking schedule, in the second half of sleep, where REM has a higher prevalence. Note that although WILD at the SO is not explicitly reported by research made in exceptional LD experiencers indicating a frequency of more than 3 LD per week, PSG-verified REM, substantiated

[12] Partial examination of the recorded EEG data for one session, in a preliminary analysis using automated sleep scoring with high accuracy and specificity of detection (*F*-measure R-stage 0.85 ± 0.01), performed on a subject attempting OBE at the SO, without known narcolepsy, Periodic Limb Movements Disorders (PLMD) or REM Behaviour disorders (RBD), indicated SOREMP for approximately 9 minutes, 10 minutes after the first cycle of light sleep (N1-2-Stages, not PSG categorised) without hypnagogy or loss of lucidity. Most sessions had a SOREMP prevalence, although some did indicate a direct incidence of REM without N-stages, almost without Sleep Onset Latency (SOL) (a 1-hour meditation was however performed before the attempt). All OBE's attempts had strong hypnic jerks associated with prominent head movements and were accompanied by intracranial sounds.

through Left-Right-Left Right-center (LRLR) eye movement signaling, is typically reported after the first cycle of N1 to N3-stages leading to REM (approx. 90 Minutes).[13]

It should be emphasized that although the SOREMP states in the above-mentioned unpublished investigation did present neurophysiological characteristics of the R-stage, they did not present the phenomenology ascribed to the powerful imagery perceived in LD, although the subject reported mentation, which could be associated with DLPFC functions. Moreover, the state presents phenomenological similarities with the reported perception of *dream yoga* and *clear light* phenomenon in LD (Johnson, 2017). Mild spontaneous VS-like sensations were also reported in one session although with weak intensity.

The R-stage seen at the SO in such states would otherwise be characteristic of PSG patterns seen in either Narcoleptic patients – which are known to elicit LD, – or is perceived in sleep-deprived population inducing REM rebound at the SO, although excessive daytime sleepiness symptoms generally correlated to narcolepsy were not reported by Tart (1968), or the other subject. As such, it is predicted that the hypothesized SOREMP variation, although presenting similar physiognomies, would not present the pathological characteristic of hypocretin deficiency seen in narcoleptic patients individually measured by PSG Multiple Sleep Latency Test (MSLT).[14] We may further enquire if such state expresses the same absence of normal sympathetic activation during SOREM reported in patients with narcolepsy in such state, when compared to normal R-stages periods.

The theorized correlation of OBE-SO to SOREMP, with a differential diagnosis to Narcoleptic SOREMP, is otherwise partially supported by the recurrent experience of hypnic jerks seen during OBE-onset attempts (Tart, 1967; Crookall, 1980, 1988;

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[13] Although one study by LaBerge reported a Mnemonic Induced Lucid Dreaming (MILD) 30 minutes after SO.

[14] Criteria by the America Academy of Sleep Medicine (AASM) established the pathological threshold for Narcolepsy type 1 with cataplexy, or hypocretin deficiency syndrome (Cerebrospinal fluid (CSF) measurement of ≤ 110 pg/mL) as a MSLT time of less than 8 minutes with a SOREMP, within 15 minutes of Sleep Onset (SO). In case of OBE subjects, SOREMP can be detected, but without loss lucidity or reported OBE, although frequent hypnic jerks were observed.

Montenegro, 2015), which generally happen during phasic R-stages,[15] although they correspondingly occur in N1-stage as sleep starts. In addition, if hypnic jerks might be associated with excitatory glutamatergic as an equal indication of R-stages, they may be equally indicative of increased gamma activity ($\pm 40\ Hz$). Nevertheless, such conditions need to be better differentiated and dissociated from PLMD, requiring further PSG verification, although research on the subject may be limited, taking into consideration that EMG patterns have poor normative quantification in sleep medicine research (Consens et al., 2005; Schenck, 2005). The association is however still relevant as hypnic jerks are hypothesized to be activated by instability coming from the brainstem reticular formation.

Furthermore, R-stages, assumed as transient OBE states of partial disconnection from the body, would explain how non-ordinary R-states, primarily linked to brain functions, in essence biological, could lead to dreams of telepathy or foretelling, as perceived in LD (Ullman, Krippner and Vaughan, 2002), which, in essence, are rather *psi* phenomena. To the same extent, a clearer understanding of the transient pre-OBE state could provide differential insight into the distinction between LD and OBEs states, analyzing their distinct typology through state differentiation (Montenegro, 2020b).[16]

Non-induced R-stage ISP variations, as a mechanism leading to OBE, would occur during ISP-sleep. Although ISP is known to parallel conditions of R-stage, as predormital hypnagogic-ISP or with SOREMP variations, they are statistically prevalent on average within 1-hour after the Sleep Onset Latency (SOL) or experienced during post-dormital hypnopompic-ISP (SOL < 6 hours) (Girard and Cheyne, 2006). This is a differential diagnostic and conditions which mostly fall outside the SOREMP MSLT pathological definition edge (R-stage ≤ 8 min of SO). Such ISP variation usually presents itself spontaneously during the first R-stage period (after the N-stages) and is mostly associated with a spontaneous increase in arousal during the

[15] R-stages are not exclusively tonic phases (atonia) and express transient muscle activity of phasic twitches, although hypnic jerks may not always be OBE related.
[16] Although LD and OBE have a clear differential typology, the condition is often oversighted in current research, but could provide neurophysiological differential insight (Montenegro, 2015).

R-stages offset (e.g., R-stage transitioning to W-stage, upon awakening) (Girard and Cheyne, 2006) and are also known to be triggered by pre-awakening in the N-stages (Takeuchi et al., 1992).

In its pathological variation, RISP is suggested to be mediated by 5-HT hypo-activation (REM-OFF) of the VLPO, although a loss of Orexin 2 (Hypocretin) has been proposed as a counter mechanism to explain it (Lu et al., 2006), with hallucinations suggested to be modulated by 5-HT_{2A} receptors (Jalal, 2018).

The relation is otherwise not new. ISP leading to OBEs (ISP-OBEs) is knowingly prominent in OBE studies, suggesting ISPs are predominant as an OBE induction state or post-OBE, leading to hypnopompic ISP, although the statistical analyzes were provided without PSG examination to ascertain ISP state determination. Even so, statistics of OBE induction associate it with ISP-OBE in 5% to 72% of cases (5% ($n = 400$) (Green, 1975), 52.57% ($n = 1115$) (Alegretti and Trivellato, 1999), 72% ($n = 16185$) (Buhlman, 2001), granting the last two statistics are non-randomized internet surveys and may explain the significant difference). It is equally of note that ISP-VS were reported by less than 41% ($n = 2397$) (Cheyne, 2002) of ISP experiencers, although little quantification of the phenomena is generally performed in sleep studies, for a further quantification of the relation.

Finally, it is worth noting that such type of experiential analysis has led ISP to be theorized as a mechanism to explain OBEs, although leading theories dismiss OBEs entirely as ISP states. The model is undoubtedly contemptuous of many of the aspects of OBE phenomenology, being inherently reductionist and mostly related to research referring to pathological conditions. The theoretical assumptions are, as such, weakened by trivializing OBE only as pathologies of hallucinatory character, but without PSG experiential analysis, as anecdotally provided here, or more questionably missing explanations for phenomena such as the VS. Either way, the fact suggests that experimentally induced ISP (Takeuchi et al., 1992) do not necessarily convey the transformative power of Near-Death-like Experiences (NDEs) or OBEs, ISP/RISP being mostly perceived as negative,[17] and although a small percentage of ISP-OBE experiences are perceived as positive,

[17] The review of such limitations goes beyond the scope of this article.

the condition remains unexplained. Non-pathological ISP-OBEs may as such stem from the referred motor inhibition during increased lucidity in the R-stage offset, with an unspecified neurophysiological predisposition to OBEs (Denis et al., 2015).

SO OBE-C would be associated with W-N-stages transitioning variations. While during W-stages, motoneurons are stimulated by norepinephrine (NA), the voluntary induction of "insensibility" or deep torpidity would hypothetically be prompted by conscious control of tonic immobility possibility mediated by norepinephrine LC neurons (LC-NA) and led by reduced processing of sensory information, while the experiencer would still keep lucidity.

In effect, the state would imply a direct inhibition of the post-synaptic potentials of interneurons of the ventral horn, inhibiting the spinal motor neurons, consequently generating muscle atonia mediated through glutamatergic RSN command. A condition that could be associated with induced or delayed histamine (H_1 and H_2) inhibition at the SO, modulating the TuberoMammillary Nucleus (TMN) which usually promotes excitatory waking effects and consequently preventing a full VLPO GABAergic inhibition and sleep (Figure 5). This is an overall inhibitory condition, otherwise modulated through the downregulation of ARAS brainstem systems, which, in effect, prompts the transitioning between W-state and sleep states, and vice versa.

At least three correlative conditions seem to attest further to the theory. First, the pre-existing state level of relaxation conveyed by psychological assessment of OBE experiencers in many studies provides further evidence of the initial level of the inhibitory state. Granting limitations of the relation, surveys report a predominant relaxing state pre-OBE in 41.3% to 79% of correspondents (41.3% $(n = 400)$, Green, 1975; $< 46.92\%$ $(n = 1115)$ (Alegretti and Trivellato, 1999) and 78% $(n = 339)$ (Twemlow, Gabbard and Jones, 1982)). Moreover, the relaxation state is often singularly denoted as being most unusual and out of the ordinary level of relaxation (Green, 1975, p. 50), as reported in *projective* catalepsy.

Second, not only LD is known to occur in N-stages, but awareness is equally experienced at the SO during N1-2-stages of sleep (Foulkes and Vogel, 1965). N-stages lucidity were equally reported in OBE induction studies by Tart (1967, 1968), and N-stage mentation was correspondingly seen in the reported investigation by this author. A condition that could be hypothetically associated with increased Theta-band activity in frontal lobes, known to correlate with the Default Mode Network (DMN) and could equally be prompted by increased proprioception and mind-wandering, as well as reduction of external stimuli perception which might further be associated with increased Theta from the dorsal pathway of the LC.

Third, the hypothetical neurophysiological state of induced catalepsy, dependent on behavioral context, is supported by recent studies indicating that voluntary inhibitory modulation and control of the sympathetic nervous system with increased epinephrine modulation (Kox et al., 2014), and as such the modulation of NA systems in the spinal cord is equally theoretically conceivable. Moreover, NA inhibition of LC neurons are recognized to produce cataleptic states in animal studies. The inferred anecdotal report suggests a state of profound inhibition without phasic twitches with a reported phenomenology associated with sensed presence, among others, in an overall state relatively distinct from the hypothesized OBE-SOREMP induced state, although still without S-VS, a condition ascribed to the relatively little number of attempts.

Finally, we may postulate that the VS could modulate the referred brainstem networks with equivalent inhibitory effects prompting OBEs. Albeit infrequently self-reported, the VS is reported to induce motor paralysis during W-states, with similar symptoms of cataplexy (Montenegro, 2020c). The condition might equally be associated with currently unknown factors associated with the Delta-Gamma PAC seen in W-VS (Figure 1).

Nonetheless, although the hypothesis of transitional states do not provide a specific explanation for the energy-like sensations, granting the correlation is entirely speculative at this point, we may assume that the VS sensations are associated with 5-HT being modulated by endogenous DMT-5-HT_2 bidding as further suggested by the OBE-DMT association theory (Strassman, 2001). This is a condition seemingly supported, although indirectly, by the mentioned VS research providing a fascinating outlook at similarities between EEG post-DMT ingestion and the neurophysiological correlates seen in VS-EEG (Montenegro, 2020a), a condition equally correlated with the reported perception of vibrations in post-DMT ingestion.

5 The VS as a transitional state: hypothetical assumptions

The neurophysiological organization of such overlapping and interlocking states provide a framework to hypothesize the VS arising from the LD state or an ISP state, and leading to the reported LD-VS and ISP-VS, including the OBE-C state hypothesis to be mediated by increased Gamma activity (e.g., < 64 Hz), with a similar signature to the one perceived in W-VS (Figure 6).

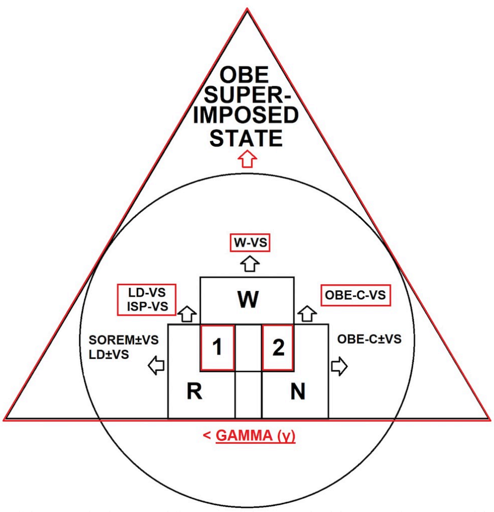

Figure 6 The hypothetical Gamma-wave associated to the VS variations: LD-VS, ISP-VS (W-R-stages variation 1) and OBE-C-VS, hypothesized as N-stage variations and conditions where the onset of the vibrations are seen (SOREMP±VS, LD± and OBE-C±VS) which may lead to the VS and/or the hypothetical superimposed OBE neurophysiological state.

Granting that such hypothetical assumption does not necessarily explain the S-VS occurrences, or indeed, lead to the perception of vibrations and may present different neural signatures, the assumption is nonetheless reasonable considering phenomenological similarities between W-VS, S-VS and VS-OBEs, which are mostly known to differ in experiential intensity, the latter ones reportedly being more intense.

The condition is plausible from a neurophysiological and experiential standpoint. LD states are associated with increased Gamma (40 Hz) (Llinas and Ribary, 1993; Voss et al., 2014) and the report of LD-VS "vibrations" could be, as such, incremented by Gamma waves as they are seen in W-VS above the 40 Hz threshold, leading to OBEs. Furthermore, in most cases, S-VS experiences lead to an increase in arousal and awareness during the experience. Such condition, if further verified, is indeed compatible with a possible increase in Gamma wave frequencies, known to correlate with consciousness and focused arousal (Wang, 2010; Buzsáki and Wang, 2012). Moreover, Gamma waves naturally occur both within R and N-stages, associated with an increase Gamma generation from the pontine nucleus, and although such neural correlates would not equally lead to the same VS typology, they might still induce vibrations-like phenomena – a phenomenon currently under-assessed in sleep research. Finally, Gamma increase is perceived in NDE after experimental cardiac arrest in animal laboratories (Borjigin et al., 2013) and equally reported at 60 Hz during OBE by Tart (1967).[18]

Such a neurophysiological state could hypothetically be followed by an EEG flattening, as recorded in three OBE studies (Tart, 1968; Osis and Mitchell, 1977), consequently being a state evolving from high Gamma to a low voltage Delta state, which might have similar physiological characteristics to N-stages.[19] This is a consciousness-state possibly constituting a transitory, relative cessation of synaptic activity, as reported in patients withdrawing essential care due to endemic illness, hypothesized here as a possible whole mark of a *spirited-away* OBE-state.[20]

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[18] The 60 Hz Gamma-wave was reported by Tart (1967) in the famous experiment with subject Miss Z., who, in one OBE attempt, correctly perceived a randomly generated 5-digit target number propped in a shelf, above her physical reach.

[19] Although as noted, OBEs may hypothetically arise from OBE-C, SOREMP and ISP-OBE without VS or the hypothetical Gamma increase, nonetheless, the theoretical framework suggests the OBE state is facilitated by Gamma waves.

[20] "Spirited away" is emphasized, as OBE projections may present different characteristics in the so-called *consciousness* projections where, as hypothesized, only

6 Discussion

To support the theoretical assumption of the discussed overlapping and transitional states, well-designed experimental studies are required, taking into account the neurophenomenology of such states, to provide causal neural validity. Altogether, such VS-overlapping states would need to be quantified by excluding the background neural activity associated with each of their own overlapping states (ISP, LD signatures versus ISP-VS and LD-VS and W-VS), to quantify their neural differences and identify their respective neural signatures based on neuroimaging data. If such neurophysiological overlapping states do occur, VS perceptions in each state would need to be assessed through a psychometric phenomenological tool, to allow for better state comparison with W-VS, where a relatively better typology is known. The possibility of this, however, remains still remote considering the current limitations in VS-replication.

Undeniably, if the framework considered here for the OBE-superimposed state is equally a theoretical assumption, it needs to be weighed scientifically against acknowledged OBE theories. In that respect, the proposal of a grounded neuroscientific theory would certainly be need, considering the current 35 theories explaining OBEs (year base 2020) (Montenegro, 2020b). Granting that the aforementioned theories may occasionally provide relevant pathological assessments, like the assumptions proposed here, such theory would need to take into consideration a more extended OBE phenomenology and provide an explanation for them. This author is currently analyzing 85 OBE phenomena, mostly not taken into account in such theories, to be further integrated into the theoretical and experimental scope of OBE's neuroscience state differentiation, based on phenomenology assessment (Montenegro, 2020b).

In addition, even though the theoretical assumption suggested in

some elements of the consciousness, such as visual characteristics, are "exteriorized" without the astral body, although with a different phenomenology than it is seen in remote viewing.

this article steam from naturalistic mechanisms and are speculative, the observations discussed in this article, unlike most of the aforementioned 35 current theories, proposing different theoretical but contradicting OBE models, are not established on pathological disorders or dissociative states. As such, they would at least have the merit, if accurate, to explain OBEs as a natural condition, as they are known to be, thus proposing a non-reductionist, neurophysiologically based theory, although it is acknowledged that the neurophysiological approach remains limited to clarify the referred mechanisms of S-VS, at least without also considering the concurrence of a *vital force*-related mechanism or metaphysical aspects.[21]

Nevertheless, despite the described neurophysiological restrictions, equally-weighted by the lack of information about such states, sleep state research methodology has immensely benefited from contrasting state determination (neurophysiological state determination) with state differentiation (neuropsychological state differentiation) (Mahowald and Schenck, 2005), for states that did not have previously well-defined standard voltage fluctuation differentials, or clear neurophysiology markers. Opposing the neurobiological components (data from neurophysiological research) with the neurophysiological and behavioral states (e.g., psychological, behavioral assessments, psychometric data) was undoubtedly a methodology that provided great insight in early sleep laboratories studies (Foulkes and Vogel, 1965; Foulkes, Spear and Symonds, 1966) and may still prove to help assess the new neurophysiological markers of the VS-states. It is equally undeniable that such methods have led to a better differential diagnostic evaluation of the pathological states of sleep (Crawford et al., 2014).

Finally, the complexity of the neurophysiological OBE state may prove, in itself, to be even more complex to define. Although specific differential neurochemistry may, as stipulated, arise from the research, past OBE research has undoubtedly exemplified the

[21] It does not mean either that such an *élan vital*, as termed by French philosopher and Nobel Prize (1927) Henri Bergson, as a vital impetus closely associated with consciousness, would not have a neurochemical base either. A condition which could be associated with 5-HT receptors modulation in the peripheral nervous system and muscle (Montenegro, 2020a).

possible existence of markers that could not be classified into any known sleep stage, even when studied by a leading authority such as Dr. William Charles Dement – an acknowledged pioneer in the field of sleep research.

OBE laboratory studies initially started in 1967, when Charles T. Tart reported complex EEG recordings with distinct neurophysiological EEG patterns of brain activity (Tart, 1967, 1968), which as indicated were partially replicated by this author. Other studies reported similar neurophysiological characteristics but were equally unable to conclusively classify OBE-states as light sleep or REM sleep (Tart, 1968; Hartwell, Janis and Harary, 1974). The neural signatures of such states were referred to as a non-dreaming, "non-awake," non-drowsy patterns (Tart, 1967; Tart, 1968; Hartwell, Joseph and Harary, 1974) and remained unclassified states if compared to the known neurophysiological standards for sleep stages. Furthermore, "alphoid" patterns were predominant in R-stages states (Tart, 1968, p. 10) and N1-stages were described to have poorly developed Theta waves, with unusual lower sleep spindles voltage (patterns typically seen in N2-stages), whereas underdeveloped Theta waves were seen in 64% of the subjects' sleep pattern spent in borderline states (Tart, 1968). This is a condition indicated to be akin to a state fluctuating between sleep and wakefulness, with well-developed Alpha waves above standard micro voltages norms (Tart, 1968). Even more puzzling conditions were reported describing a lack of Delta waves in N3 stages and stage 4 (old terminology for N3-stage) (Tart, 1968; Janis et al., 1973), all equally controversial sleep neurophysiological markers.

Other polysomnographic conditions had equally contentious results. For example, EOG activity decreased during OBEs, and although such changes were statistically significant (Tart, 1968; Janis et al., 1973; Osis and Mitchell, 1977; Gabbard and Twemlow, 1984), they were not reported in other studies (Hartwell, 1973). EMG fluctuations reported by psychiatrists Gabbard and Twemlow (1984), indicating synchronized EEG patterns, had no tonic-phasic variability during OBEs, contrary to the regular tonic and phasic autonomic functions, also reported by Hartwell, Janis, and Harary (1974).

If a lack of technical specification impairs the analysis of such findings, they grant the need for further systematic research of such states, with gifted OBE subjects. They certainly would require further replication to provide state-of-the-art contextual data analysis with a state differentiation context. Nonetheless, even if such findings were never replicated and remain with elusive descriptions, they nevertheless provide a preview of the complexities ahead, in the understanding of neurophysiological state differentiation in non-ordinary sleep states research. We believe that such complexities need to be integrated into the actual research frame of consciousness research, specifically if it is to be considered as a modern scientific research field capable of further developing in the future.

5 Conclusion

Fundamentally, future research will need to provide further neurophysiological determinants of a neural VS signature across the sleep stages, to reach the criteria of evidence needed to achieve state differentiation. The notion of state differentiation presented here is considered, as such, vital for the formulation of a theory that would scientifically validate the VS as novel state, possibly bringing OBE neuroscience at the forefront of consciousness research — bridging the existing gap in the current research divide between a purely phenomenological approach and a more neurophysiological one.

Certainly, it is hoped that future experiential analysis providing hard data of the neurophysiological correlates of the VS associated with OBE phenomena will stimulate the engagement of the scientific community in studying them in a new light, promoting neurophenomenology as a non-reductionist and essential scientific approach at the forefront consciousness research.

The research in question may equally provide insightful knowledge and lead to a more essential understanding of how to induce such non-ordinary states, through the design of scientifically based techniques taking into consideration neuroscience knowledge. This is a research field that may further provide useful data for the development of EEG-feedback headband (high quality consumer-grade products), which going forward, may stimulate the induction of the VS by providing neophyte VS-experiencers a way to objectify their subjective experience and measure the characteristics of their own subjective states, in full autonomy. Precisely so, if such headbands can characterize their experiences through a comparative analysis with the results obtained by more experienced VS practitioners.

Such research may also shift the current nosological framework associated with the OBE field. OBEs, ISP-OBE and VS are often described as hallucinatory states. However, research providing support to the notion of Gamma lucidity ascribed to the accompanying states may convey more convincing evidence to suggest that VS-OBEs and VS-ISP, leading to OBEs that are known to be experienced within a highly engaging and vivid frame of mind, are rather mind-expanding than hallucinatory experiences, contrary to current appraisal.

Similarly, if the transitional states to OBE are not assumed to be their unique neurophysiological triggers, the current theoretical framework nonetheless indicates that *Vibrational Meditation* training is essential to elicit OBEs with a high expression of awareness. Such type of mental training may increase neural potentiation leading to a neuro-plastic adaptation, consequently eliciting a higher frequency of spontaneous transformative states of being (Hebb's rule), as undeniably suggested by experiential research analysis (Vieira, 1986; Montenegro, 2015; Trivellato, 2015).

More importantly, such training could consequently help those emotionally affected by negative ISP experiences to transform them into more blissful, uplifting, and enlightening doors of perception to the OBE realms, as they are reported to be. The same condition could apply to help trigger OBEs starting from R-stages, equally providing a higher experiential understanding of the phenomenological differences between LD and OBEs, which are commonly mistaken as being the same experience.

Assuredly, future research will "challenge" the foundation of consciousness theories such as the microtubule proposed by Hameroff (Craddock et al., 2012), allowing to test, for example, neural microtubules post-translational stability and their electrical oscillation during VS or OBE, which in turn may foster understanding into brain-consciousness mechanisms. Future VS research might also be empirically tested through Diffusion Tensor

Imaging (TDI), allowing for tracking subcortical relays associated with VS-induction and through the use of Functional Connectivity MRI (fcMRI), mapping the networks changes associated to VS-OBEs. Again, this may provide insight into the nature of brain changes associated with the VS and their evolutionary possibilities.

Last but not least. A research focus on the VS may be better encouraged by research in the field of neurodegenerative diseases and the prevention of early dementia and Alzheimer, where such states could provide exciting applications. Undeniably, beside the broad role of Gamma wave in cognition and insight (Buzsáki and Wang, 2012), amongst others, decreased Gamma synchrony and reduced Gamma power have been known to be present in mild cognitive impairments and is existent in dementia onset and Alzheimer Disease (Herrmann and Demiralp, 2005; Koenig et al., 2005; Gillespie et al., 2016). The research into the VS could indeed provide immense benefit in preventing, if not reverting symptoms, of such pathologies, thus achieving a higher universal reach in its scope, more specifically so if EEG-neurofeedback training tools are provided to such necessitous population.

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Bibliography

Abraham, T. (2010). The Emerging Field of Neuroconscientiology: the Challenges Facing and Opportunities for Exploring a New Frontier of Conscientiological Research. Journal of Conscientiology, July-December, Vol.

13(49), pp. 41-54.
Alegretti, W. (2008). A Research Approach to the Vibrational State through the Study of Brain Activity. Journal of Consciousness, October-December, Vol. 11(42), pp. 221-255.
Alegretti, W. and Trivellato, N. (1999). Survey Research about the Projection of the Consciousness through the internet. (Eds) 1st International Forum of Consciousness Research and 2nd International Congress of Projectiology. Rio de Janeiro: IIPC Ed.
Almansori, M., Ijaz, M. and Ahmed, S. (2006). Cerebral arrhythmia influencing cardiac rhythm: A case of ictal bradycardia. Seizure, 15(6), pp. 459-461.
Aru, J., Suzuki, M., Rutiku, R., Larkum, M. and Bachmann, T. (2019). Coupling the State and Contents of Consciousness. Frontiers in Systems Neuroscience, 13(Article 43), pp. 1-9.
Bartlam, R. and Mohanraj, R. (2016). Ictal bradyarrhythmias and asystole requiring pacemaker implantation: Combined EEG–ECG analysis of 5 cases. Epilepsy & Behavior, 64, pp. 212-215.
Borjigin, J., Lee, U., Liu, T., Pal, D., Huff, S., Klarr, D., Sloboda, J., Hernandez, J., Wang, M. and Mashour, G. (2013). Surge of neurophysiological coherence and connectivity in the dying brain. Proceedings of the National Academy of Sciences, 110(35), pp. 14432-14437.
Brownstone, R. and Chopek, J. (2018). Reticulospinal Systems for Tuning Motor Commands. Frontiers in Neural Circuits, 12(Article 30), p. 10.
Buhlman, W. (2001). The Secret of the Soul: using Out-of-Body Experiences to understand our true nature. 1st ed. New York: Harper Collins, p. 271.
Buzsáki, G. and Wang, X. (2012). Mechanisms of Gamma Oscillations. Annual Review of Neuroscience, 35(1), pp. 203-225.
Callaway, J., McKenna, D., Grob, C., Brito, G., Raymon, L., Poland, R., Andrade, E. and Mash, D. (1999). Pharmacokinetics of Hoasca alkaloids in healthy humans. Journal of Ethnopharmacology, 65(3), pp. 243-256.
Chawla, L. and Seneff, M. (2013). End-of-life electrical surges. Proceedings of the National Academy of Sciences, 110(44), pp. E4123-E4123.
Cheyne, J. (2002). Waterloo Unusual Sleep Experiences Questionnaire – VIIIa Technical Report. [ebook] University of Waterloo. Available at: http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.394.7765.
Cheyne, J. (2010). Recurrent isolated sleep paralysis. In: Thorpy, M. and Plazzi, G. (2010). The parasomnias and other sleep-related movement disorders. 1st ed. Cambridge, UK: Cambridge University Press, p. 341.
Coffey, M. (2008). Explorers of the infinite: the secret spiritual lives of extreme athletes - and what they reveal about near-death experiences, psychics communication, and touching the beyond. 1st ed. London: Penguin Group, p. 288.
Consens, F., Chervin, R., Koeppe, R., Little, R., Liu, S., Junck, L., Angell, K., Heumann, M. and Gilman, S. (2005). Validation of a Polysomnographic Score for REM Sleep Behavior Disorder. Sleep, 28(8), pp. 993-997.
Cornillier, P. (1927). La Survivance de l'âme et son évolution après la mort - Comptes rendus d'expériences. 1st ed. Paris: Libraire Félix Alcan, p. 646.
Craddock, T., St. George, M., Freedman, H., Barakat, K., Damaraju, S., Hameroff, S. and Tuszynski, J. (2012). Computational Predictions of Volatile

Anesthetic Interactions with the Microtubule Cytoskeleton: Implications for Side Effects of General Anesthesia. PLoS ONE, 7(6), p. e37251.
Crawford, M., Espie, C., Bartlett, D. and Grunstein, R. (2014). Integrating psychology and medicine in CPAP adherence – New concepts?. Sleep Medicine Reviews, 18(2), pp. 123-139.
Crookall, R. (1978). What Happens When You Die. 1st ed. London: London Colin Smythe, p. 208.
Crookall, R. (1980). Case-book of astral projection. 2nd ed. Secaucus, N.J.: University Books, p. 160.
Crookall, R. (1988). The study and practice of astral projection. 2nd ed. Secaucus, N.J.: Citadel Press, p. 234.
De Koninck, J. (2012). Sleep, Dreams, and Dreaming. Eds: Morin, C. and Espie, C. (2012). The Oxford handbook of sleep and sleep disorders. 1st ed. Oxford: Oxford University Press, p. 871.
De Rochas D'Anglun, A. (1895). L'extériorisation de la sensibilité. 2nd ed. Paris: Chamuel Éditeur, p. 284.
Denis, D., French, C., Rowe, R., Zavos, H., Nolan, P., Parsons, M. and Gregory, A. (2015). A twin and molecular genetics study of sleep paralysis and associated factors. Journal of Sleep Research, 24(4), pp. 438-446.
Descartes, R. (1894). Le Discours de la méthode - bien conduire sa raison, et chercher la vérité dans les sciences. Paris: Libraire de la Bibliothèque Nationale, p. 135.
Durville, H. (1909). Le Fantôme des Vivants: Anatomie et Physiologie de l'Âme: Recherches Expérimentales. 1st ed. Paris: Librairie du Magnétisme, p. 360.
Evans-Wentz, W. (1958). Tibetan yoga and secret doctrines. 1st ed. Oxford: Oxford University Press, p. 432.
Everett, H. (1963). Sleep Paralysis in medical students. The Journal of Nervous and Mental Disease, 136(3), pp. 283-287.
Fitzgerald, M., Gruener, G. and Mtui, E. (2012). Clinical neuroanatomy and neuroscience. 6th ed. [Edinburgh]: Saunders Elsevier, p. 391.
Foulkes, D. and Vogel, G. (1965). Mental activity at sleep onset. Journal of Abnormal Psychology, 70(4), pp. 231-243.
Foulkes, D., Spear, P. and Symonds, J. (1966). Individual differences in mental activity at sleep onset. Journal of Abnormal Psychology, 71(4), pp. 280-286.
Fox, O. (1962). Astral projection – A record of Out-of-Body Experiences. Don Mills, Ontario: Citadel Press, p. 160.
Freud, S. (2010). The interpretion of dreams. New York: Basic Books, p. 677.
Gabbard, G. and Twemlow, S. (1984). With the eyes of the mind - An empirical analysis of Out-of-Body States. 1st ed. New York: Praeger Publisher, p. 272.
Gabbard, G., Twemlow, S. and Jones, F. (1982). Differential Diagnosis of Altered Mind/Body Perception. Psychiatry, 45(4), pp. 361-369.
Gillespie, A., Jones, E., Lin, Y., Karlsson, M., Kay, K., Yoon, S., Tong, L., Nova, P., Carr, J., Frank, L. and Huang, Y. (2016). Apolipoprotein E4 Causes Age-Dependent Disruption of Slow Gamma Oscillations during Hippocampal Sharp-Wave Ripples. Neuron, 90(4), pp. 740-751.
Girard, T. and Cheyne, J. (2006). Timing of spontaneous sleep-paralysis episodes. Journal of Sleep Research, 15(2), pp. 222-229.
Green, C. (1975). Out-of-Body Experiences. 2nd ed. New York: Ballantine

Books, p. 170.
Hackforth, R. (1972). Plato's Phaedo. 1st ed. Cambridge: Cambridge University Press, p. 207.
Hamill, J., Hallak, J., Dursun, S. and Baker, G. (2019). Ayahuasca: Psychological and Physiologic Effects, Pharmacology and Potential Uses in Addiction and Mental Illness. Current Neuropharmacology,, 17(2), pp. 108-128.
Hamilton, W. (1973). Phaedrus & The Seventh And Eighth Letters. Cambridge: Penguin Classics, p. 160.
Hartwell, J., Janis, J. and Harary, B. (1974). A study of the physiological variables associated with out-of-body experiences. (Eds.) J. D. Morris, W. G. Roll, & R. L. Morris; Research in Parapsychology: The Scarecrow Press, pp. 127-129.
Hermann, C. and Demiralp, T. (2005). Human EEG gamma oscillations in neuropsychiatric disorders. Clinical Neurophysiology, 116(12), pp. 2719-2733.
Hervey de Saint-Denys, L. (2005). Les rêves et les moyens de les diriger. Genève: Éd. Arbre d'Or, p. 264.
Hobson, J., Lydic, R. and Baghdoyan, H. (1986). Evolving concepts of sleep cycle generation: From brain centers to neuronal populations. Behavioral and Brain Sciences, 9(3), pp. 371-400.
Janis, J., Hartwell, J., Harary, B., Levin, J. and Morris, R. (1973). A description of the physiological variables connected with an out-of-the body study. 1st ed. (eds.) J. D. Morris, W. G. Roll, & R. L. Morris; Research in Parapsychology: The Scarecrow Press, pp. 36-37.
Johnson, C. (2017). Llewellyn's Complete Book of Lucid Dreaming. Kindle Edition: Llewellyn Worldwide, p. 379.
Kinnier Wilson, S. (1928). The Narcolepsies. Brain, 51(1), pp. 63-109.
Koenig, T., Prichep, L., Dierks, T., Hubl, D., Wahlund, L., John, E. and Jelic, V. (2005). Decreased EEG synchronization in Alzheimer's disease and mild cognitive impairment. Neurobiology of Aging, 26(2), pp. 165-171.
Kompanje, E. (2008). 'The devil lay upon her and held her down'Hypnagogic hallucinations and sleep paralysis described by the Dutch physician Isbrand van Diemerbroeck (1609-1674) in 1664. Journal of Sleep Research, 17(4), pp. 464-467.
Kox, M., van Eijk, L., Zwaag, J., van den Wildenberg, J., Sweep, F., van der Hoeven, J. and Pickkers, P. (2014). Voluntary activation of the sympathetic nervous system and attenuation of the innate immune response in humans. Proceedings of the National Academy of Sciences, 111(20), pp. 7379-7384.
Llinas, R. and Ribary, U. (1993). Coherent 40-Hz oscillation characterizes dream state in humans. Proceedings of the National Academy of Sciences, 90(5), pp.2078-2081.
Lu, J., Sherman, D., Devor, M. and Saper, C. (2006). A putative flip–flop switch for control of REM sleep. Nature, 441(7093), pp. 589-594.
Mahowald, M. and Schenck, C. (1999). Dissociated States of Wakefulness and Sleep. (Eds.) Lydic, R. and Baghdoyan, H. (1999). Handbook of behavioral state control: cellular and molecular mechanisms. 1st ed. Boca Raton: CRC Press, p. 699.
Mahowald, M. and Schenck, C. (2005). Insights from studying human sleep disorders. Nature, 437(7063), pp. 1279-1285.
Manni, R. (2005). Rapid eye movement sleep, non-rapid eye movement sleep,

dreams, and hallucinations. Current Psychiatry Reports, 7(3), pp. 196-200.
Maury, L. (2013). Le sommeil et les rêves Format Kindle de Alfred Maury. Kindle Edition: Ebox Editions.
Monroe, R. (1971). Journeys out of the Body. 1st ed. New York: Doubleday Editions, p. 280.
Montenegro, R. (2015). The out-of-body Experiences – An Experiential Anthology. 1st ed. Livros e Puplicações, p. 339.
Montenegro, R. (2020a). The neurophysiological correlates of the Vibrational State. Manuscript in preparation.
Montenegro, R. (2020b). State Differentiation and Neurophysiological Correlates of Out-of-the Body Experiences: towards a comprehensive theory. Manuscript in preparation.
Montenegro, R. (2020c). A brainstem OBE theory. Manuscript in preparation.
Morin, C. and Espie, C. (2012). The Oxford handbook of sleep and sleep disorders. 1st ed. Oxford: Oxford University Press, p. 871.
Muldoon, S. and Carrington, H. (1929). Projection of the Astral Body. 1st ed. London: London Rider & Co., p. 242.
Osis, K. and Mitchell, J. (1977). Physiological correlates of reported out-of-the body Experiences. Journal of the Society for Psychical Research, 49(772), pp. 525-536.
Recreational Use, Analysis and Toxicity of Tryptamines. (2015). Current Neuropharmacology, 13(1), pp. 26-46.
Rimpoche, S. (2012). The Tibetan Book Of Living And Dying. [Kindle] Peguin Random house.
Rinella, M. (2000). Supplementing the Ecstatic: Plato, the Eleusinian Mysteries and the Phaedrus. Polis: The Journal for Ancient Greek Political Thought, 17(1-2), pp. 61-78.
Rinpoche, S. (2012). The Tibetan Book Of Living And Dying. [Kindle] Penguin Random house.
Rodrigues Pinheiro, R. (2013). Correlatos Eletroencefalográficos do Estado Vibracional. Master of Psychobiology. Universidade Federal do Rio Grande do Norte.
Rogo, D. (1986). Leaving the body – A complete guide to astral projection. 2nd ed. New York: Prentice Hall Press, p. 190.
Salley, R. (1982). REM Sleep Phenomena During Out-of-Body Experiences. The Journal of the American Society for Psychical Research, 76, pp. 157-165.
Schenck, C. (2005). Clinical and Research Implications of a Validated Polysomnographic Scoring Method for REM Sleep Behavior Disorder. Sleep, 28(8), pp. 917-919.
Schomer, D. and Lopes da Silva, F. (2011). Niedermeyer's electroencephalography. 6th ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins, p. 1306.
Solomonova, E. (2018). leep Paralysis: Phenomenology, Neurophysiology, and Treatment. in E. (2018). S in Christoff, K. and Fox, K. (Eds). The Oxford handbook of spontaneous thought - mind-wandering, creativity, and dreaming: Oxford University Press, pp. 435-456.
Stern, J. and Engel, J. (2013). Atlas of EEG patterns. 2nd ed. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins Health, p. 457.

Strassman, R. (2001). DMT: the spirit molecule: a doctor's revolutionary research into the biology of near-death and mystical experiences. 1st ed. Rochester: VT: Park Street Press, p. 320.

Swedenborg, E. (1884). Heaven and Its Wonders and Hell From Things Heard and Seen. West Chester, Pennsylvania: Swedenborg Foudnation, p.574.

Swedenborg, E. (1918). Emanuel Swedenborg's Journal of dreams and spiritual experiences in the year seventeen hundred and forty-four. Bryn Athyn, Pa, p. 108.

Takakusaki, K., Chiba, R., Nozu, T. and Okumura, T. (2015). Brainstem control of locomotion and muscle tone with special reference to the role of the mesopontine tegmentum and medullary reticulospinal systems. Journal of Neural Transmission, 123(7), pp. 695-729.

Takeuchi, T., Miyasita, A., Sasaki, Y., Inugami, M. and Fukuda, K. (1992). Isolated Sleep Paralysis Elicited by Sleep Interruption. Sleep, 15(3), pp.217-225.

Tart, C. (1967). A second Psychophysiological study of out-of-the body experiences in a gifted subject. Parapsychology, 9, pp. 251-258.

Tart, C. (1968). A Psychophysiological Study of Out-of-the-Body Experiences in a Selected Subject. Journal of the American Society for Psychical Research, 62(1), pp. 3-27.

Terzano, M., Parrino, L. and Spaggiari, M. (1988). The cyclic alternating pattern sequences in the dynamic organization of sleep. Electroencephalography and Clinical Neurophysiology, 69(5), pp. 437-447.

Theochari, A., P. (2008). Artemidorus's Oneirocritica. Dream Analysis in the 2nd Century A.D. Hellenic Psychiatric Hospital, 5(2), pp. 83-85.

Trivelatto, N. (2014). Vibrational State: Qualitative and Quantitative Analysis. Journal of Consciousness, 18(59), p. 337.

Trivellato, N. (2008). Measurable Attributes of the Vibrational State Technique. Journal of Conscienciousness, 11(42), p. 165.

Trivellato, N. (2015). Estado Vibracional - Pesquisas, técnicas e aplicações. 1st ed. Évoramonte: International Academy of Consciousness, p. 507.

Ullman, M., Krippner, S. and Vaughan, A. (2002). Dream Telepathy - Experiments in nocturnal sensory perception. 1st ed. Charlottesville: Hampton Road Publishing House, p. 274.

Verene, D. (2016). Metaphysics and the Modern World. Cascade Books, p.143.

Vieira, W. (1981). Projeções da Consciência - Diário de Experiências Fora do Corpo Físico. 1st ed. Edi. IIP, p. 268.

Vieira, W. (1986). Projectiologia - Panorama das experiências fora do corpo. 1st ed. Rio de Janeiro: Edição do Autor, p. 928.

Vieira, W. and Xavier, F. (1958). Evolução em dois mundos. 1st ed. Rio de Janeiro: Federação Espírita Brasileira, p. 219.

Voss, U., Holzmann, R., Hobson, A., Paulus, W., Koppehele-Gossel, J., Klimke, A. and Nitsche, M. (2014). Induction of self awareness in dreams through frontal low current stimulation of gamma activity. Nature Neuroscience, 17(6), pp. 810-812.

Waggoner, R. (2009). Lucid dreaming. 2nd ed. Needham, Mass.: Moment Point Press, p. 320.

Wang, X. (2010). Neurophysiological and Computational Principles of Cortical Rhythms in Cognition. Physiological Reviews, 90(3), pp. 1195-1268.

Wasson, R., Hofmann, A. and Ruck, C. (2008). The Road to Eleusis: Unveiling the Secret of the Mysteries. 13th ed. North Atlantic Books, p. 151.

Wulff, K., Gatti, S., Wettstein, J. and Foster, R. (2010). Sleep and circadian rhythm disruption in psychiatric and neurodegenerative disease. Nature Reviews Neuroscience, 11(8), pp. 589-599.