

UNREAL REALITY in our dreams is consistent with Motor-mouth theory with DMT as the hallucinogen - Saccades play a role

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Summary. In our dreams, during REM-state-sleep (RSS), we hallucinate a reality of being out and about. I call this the Prime Hallucination (Prime-H). This essay contends that we do this using DMT (N,N-Dimethyltryptamine), a well-known hallucinogen with the common name, "Ayahuasca". DMT is endogenous to humans and other creatures, such as rats. It can be made by our retinas. In an earlier essay (Arenson, 2022) the Motor-mouth theory was proposed to account for RSS. It is contended that RSS was adapted by our brainstem and added to Non-REM Sleep (NREM) some 200 million years ago to add a motor maintenance function for ancestral chordates, which were then beginning to flourish and which depended on motor activity for their survival when awake. Dreams were not needed until words appeared, perhaps some 2 million years ago. Then, in order to provide motor maintenance for the articulation of words or meaningful calls, dreams were adapted into the RSS system. This, most common type of dream, is described by its name, "**holophrastic linguistic dreams**" (HLD-type). Words with a consistent phonology were so useful, every Homo species since then taught each generation of offspring to use them, and all needed a motor maintenance mechanism to align articulation among the members of each group, and so the HLD-type dream persisted. Assessing articulation in dreams takes advantage of the augmentations of reality that occurs because of the hallucinogen. Remarkably, the dreamer is usually blind to the augmented reality. Bizarreness during the dream experience is usually accepted as reality in dream sleep. Moreover, saccades, the eye movement of REMs by their generic name, may be triggers to onset RSS. Saccades come up frequently in the present essay. Others have observed that we hallucinate being out and about in our dreams and consider it normal while we dream, but few have considered this in depth, as is attempted here. Research on the biology of endogenous DMT in rats and humans is discussed. That the augmentation of reality by DMT convinces us, while in the dream, of an unreal reality, calls into question the central assumption of certain dream theories, particularly Content Analysis, which claims that the narrative report of a dream is in continuity with the dreamer's reality while awake in un-augmented reality. This continuity claim seems unlikely because waking reality is obviously different than dreaming reality, due to DMT.

Keywords: DMT & dreams, Prime hallucinations, Saccades, Holophrastic Linguistic (HLD-type) dreams, Anomalies, Continuity theories

1. Introducing the 'anomaly' of DMT as the activator of the Prime Hallucinator (Prime-H)

The sensation of reality in dreams may be subject to a hallucinatory impact as the result of a neurotransmitter ligand/agonist, DMT, full name: N,N-Dimethyltryptamine, with a Receptor cell, the Sigma 1. DMT is endogenous in H. Sapiens, and is sufficiently plentiful in our retina, and elsewhere. This essay contends that DMT causes the hallucinatory quality to the reality of dreaming. It appears that stimulation by a molecular bound pair of DMT ligand and receptor Sig.1R, then moves along retinal nerve (grey) or white matter channels into the brainstem circuits that originate and sus-

tain REM-state-sleep (RSS).

This hallucinatory quality may also hold true for waking reality although I am uncertain of the expected awake impact on us by DMT, if it is commonly present, which seems likely. It would be useful if this was examined. Perhaps we will find in us or our animal models, a naturally occurring molecule, naloxone-like, that blocks the effects of DMT while we are awake, in whole, or more likely, only in part, and with exceptions such as the Orienting Reflex, where DMT may enable swift safety behavior, and be life enhancing.

Motor-mouth theory allows a comfortable fit for each of the identified anomalies in the 2022 essay and in the present essay. I use 'anomaly' to designate a feature of dreaming, or one that is associated with REM-state-sleep, which we know exists but the current, received, dream theory ignores. The new anomaly to be discussed in this essay, is this: Is DMT the Prime Hallucinator (Prime-H) which causes in the dreamer a sensation of being out and about in reality? What is the impact on dream theory that when awake we acknowledge that our dream experience was an augmented reality, an unreality, a hallucination?

My conjecture is that REM-state-sleep (RSS) has existed for some 200 million years among chordates, which includes at least all vertebrates, and that is one of three sub-

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phylum among Chordata, from then to now (Wicki, 2023). So it also includes some intelligent species without backbones, like *Octopus Vulgaris*, attesting to the truly ancient origin of RSS, and by implication supporting the proposal that REM's purpose always has been motor maintenance, because motor activity is typically an essential function, and a common feature of movable life, if not precisely universal for life that can move about, and such a function probably would have been developed and maintained close to the beginning of movement, at least for multicellular creatures.

By the way, this octopus species apparently makes a very low frequency sound for some benefit to its kind, so it may dream during RSS to maintain the fidelity of the uttered sounds, in my schema. Do note that we have no way of verifying the existence of dreams in non-humans – notwithstanding M. Jouvet's fervent belief in cats that walk about while dreaming when their brainstem's atonia-on switch had been lesioned out surgically! But cats might dream to maintain the fidelity of their howls in the night, (outside my window). Find more on Jouvet below in the Discussion, section 5.1.3.

In the Motor-mouth theory a dream's images or events are treated as the orthography (equivalent to letters) of the speech sounds to be uttered in the dream report, which is the phonology. (I mean the speech sounds corresponding to that orthography). My first published paper gives many example dreams, although I was then calling the phenomena the "Metaliteral Statement" (Arenson, 1987).

I'll give you some history of events in the development of Motor-mouth theory, which really began when I was a young grade schooler, maybe 7 or 8, trying hard to avoid believing my lying dreams that I was standing at the urinal when I peed my bed, repeatedly, night after night. Eventually, I noticed the light was wrong in the bathroom of my dream and I became lucid and woke myself, but that took many anguished nights of trying to stop the dream from tricking me.

Some 30 years later, at the time of my first lecture on this dream type that I now call the Holophrastic Linguistic dream type (HLD-type), the world's dream researchers had 3 years earlier -- (2023 is the 40th anniversary) -- organized the Association for the Study of Dreams (ASD), and it was holding annual scientific meetings. I had applied to deliver a paper to the 1986 meeting in Ottawa, on my findings. I had no premonition of the Motor-mouth theory that dreams are an adaption for articulation maintenance when speech began in our Homo ancestors. That needed to incubate for 30 years more, before that idea occurred to me. My interest was fixed on the delightful, half hidden, punning that goes on in dream reports, when you listened for them and you knew something about the dreamers' life. Word play was going on. Punning was going on. It was always about concerns in their lives they were fully aware of, with no need for an unconscious source. It was obvious from that beginning that the unconscious was a superfluous fiction to the punning and word play going on in the brief dream reports I elicited. (Keep that bit about not needing an unconscious in dream theory, in mind. It became more glaring to me as the years passed.) The dreamer *knew* what the pun referred to in their life when the potential meaning of a pun in the dream report was pointed out. Indeed, if the dreamer did not get the 'aha' of recognition, my rule of thumb was that my guess was wrong and I urged them to ignore the suggestion.

A young psychiatrist among my friends in Winnipeg had already delivered a talk on this theory at grand rounds at

the Winnipeg General Hospital, one lunch time in the early 1980's. I was an unknown young lawyer to those in attendance so he had invited me to sit high up in the back row of the theatre, to take it in. They hardly let him talk. Some shouted their disdain and ridiculed the idea. They were so angry. "It is an affront", the loudest voices claimed. It was as if they were asked to touch a live wire.

The 1986 meeting was at Carleton University in Ottawa. I was invited by Professor Alan Moffitt, the meeting chair that year, to deliver a lecture to the meeting and I was introduced by him. The speech was published a year after that in the *Psychiatric Journal of the University of Ottawa* (Arenson, 1987) along with other talks. The journal is out of print but a source of the paper via the internet is in my references. Professor Dr. Moffitt was the head of the Laboratory of Sleep and Chronopsychology at Carleton and also that year he was president of ASD, which was soon to add "International" to make its current name -- the International Association for the Study of Dreams (IASD). After my talk, Prof. Moffitt took the initiative to offer me a place in his graduate program at Carleton. I had to say no. I did contribute some *pro bono* corporate legal work for ASD while Professor Moffitt was president, which helped me solidify connections with several scholars among Canadian dream researchers who were and still are vital to my access to dream science and its research findings (Harry T Hunt and Don Kuiken). Graduate school at Carleton was a temptation but it came too late for me: By then I was enjoying the recent success of winning a novel constitutional case for damages (*Manitoba Fisheries v The Queen*, 1979 SCR 101) and I was concerned about practicalities of supporting my growing family. It took me several years to clean up all the related cases after that decision of the Supreme Court of Canada. I didn't know it at the time, but the case also was influential in shutting down what was then a contentious academic debate on whether there ought to be a right to own property in Canada, then going on between the Federal and Provincial governments in the historic Charter of Rights negotiations. The Supreme Court had, in effect, just said "Yes". A book on property law in Canada includes this case and discusses my role and the impact of the case in several essays (Tucker, et al 2012). I stayed very busy in my practice until retirement in 2016 at age 73; although I was collecting dreams all along and I attended a number of IASD annual meetings, and delivered or participated in seminars at several of them.

In 2022 my theory of REM dreams of the HLD-type as an adaption to assess and maintain the motor operation of speech was published in the IJoDR. In those decades between 1986 and 2022 I concluded that the sub-vocal articulation of the word(s) in a dream report allows the brainstem to complete its function of motor maintenance. Word meaning depends on the stated or implied context in which the word is used, a cognitive function that the dreamer can engage if she chooses, as can the listener to the dream report. Usually, (always?) the meaning of the word is not material to its articulation. The brainstem knows enough without concern over meaning when a word is being assessed for articulation. The context that endows the meaning of the word articulated is, in fact, the true context of what was on the dreamer's mind at the time, but this is not relevant to articulation. One's brainstem wants the phonology of the utterance in the dream report to be close to the prevailing accents in that time and place, which comes to the dreamer during the day's linguistic thinking from her interactions with

other Homo and I presume what is heard is stored by the brainstem to use as its yardstick of articulation in that time and place. That night, the speech sounds are converted into images in the dream – often bizarre images are the result -- which are designed such that the speech sounds of needed words are used when the images are converted back into speech sounds as the dream is reported, allowing the brainstem to compare articulations. Also, to achieve the most faithful vocal production, our vocal mechanism must be relaxed and not stressed, and it is this requirement of relaxed vocal apparatus that may oblige and underpin the sanguine acceptance of the unreality and bizarreness of dreams brought about by DMT, the hallucinogen.

My thesis is that DMT creates this hallucination, as the Prime-H, and is the substance of this essay. Along the way, I will briefly consider the impact on the prevailing received wisdom of the prevalent dream theory, Content Analysis (CA). The issue which arises may be stated like this: The supposed continuity, on which Content Analysis relies, uses the dreamers' report to assign the dreams to categories. But this is undermined by the Prime-H. Dreamers may claim to see a continuity between parts of their dream report and events in their life, which is the underlying meaning of "continuity" as explained to them by the researchers, (see for example, Eichenlaub et al, 2018), but nowhere is account given or taken, nor an acknowledgment made, of the hallucination experienced by the dreamers by the augmented Prime-H reality when compared to their awake reality. To me, this defies the sense and meaning of "continuity", "hallucination", and "reality", which must be considered in union or used together in the context created, at least if one requires intellectual honesty to be present in any current dream theory, including Content Analysis.

In this essay I attempt a full consideration of the Prime-H, which was mentioned only in passing in the 2022 essay.

1.1. World-building in dreams needs the Prime-H, which operates the theatre of hallucinations in dreams

We routinely hallucinate parts or all of our dream reality. I will refer to this augmented reality as the prime hallucination (Prime-H). The Prime-H endows us with the illusion that we experience a dream of being out and about as if we are awake in reality, but it is not always or even usually faithful to the waking reality. The Prime-H is the hallucination that presents us with the RSS dreaming experience. The Prime-H is necessary for the most common dream type we experience, the Holophrastic Linguistic Dream, (HLD-type). The Prime-H discussion will not help explain the particular choice of dream content. Post traumatic dreams (nightmares) usually feature an eidetic (video-like) playback of the event that causes the psychic (and physical) injury. In my practice, I noticed a common feature. It happened just as they were about to be injured, regardless of the cause of the injury. Many of my clients were injured in auto accidents, but other accidental injuries were not uncommon. In an auto accident, where the clients saw a vehicle bearing down on them seconds before impact, it was common for them to have recurring nightmares of that scene. If they were asleep in a passenger seat, it was rare for PTSD nightmares to start, unless they were already vulnerable to PTSD from an earlier accident or from childhood or spousal abuse. I saw that to develop PTSD usually one had to see the injury com-

ing and to feel intense horror.

The Prime-H is capable of doing the bizarre world-building in dreams. DMT's false presentation of reality in dreams may come from storage in the human retina, by puberty. It exists there in the form of endogenous N,N-Dimethyltryptamine (DMT). The dream-world-building through hallucination may be essential to allow the language system to generate the needed images, regardless of their bizarreness – images that will lead the dreamer to use certain words or phrases that form the articulatory sample needed for the brainstem's assessment of the validity of the test word's articulation. My conjecture is that this was needed in the adaption of dreams to assess articulation, when speech began in Homo.

The process may go like this: First step is making the dream images such that the memory of the words phonology is converted to an orthography stand-in. Orthography, as I use it here, refers to visual form of the speech sounds in a word, as if by letters. This conversion to orthography allows the speech sounds of the words to be maintained in order but represented by the dream visuals that will be available to recreate the words to be tested when the dream is reported. The words chosen, or their speech sounds if several words are concatenated (run together), can be heard most readily when they are reported using Holophrasis. When awake, the dreamer reports the dream: that is, she recalls the dream images and reports the speech sounds that come to her, which willy-nilly, converts the images in the reverse direction from orthography back to their phonology (that she uses for those words). This second conversion occurs when the dream is reported; this is the orthography to phonology conversion. The Motor-mouth theory proposes that the dream's image calls up the phonology of the words represented by the images, and when spoken aloud or sub-vocally, gives the brainstem a reliable sample of the dreamer's articulation (of the pronunciation) of the word.

1.2. The dreamer experiences the Prime-H hallucination

If DMT induces the Prime-H (the prime hallucination) this leads us to experience a different reality but one that feels like reality during the dream. This is the effect of DMT. In the dream it feels "as if we are out and about" in waking reality, although when the dreamer is awake and thinking back on the dream, if the dream's presentation of reality was unreal in retrospect, that is usually conceded. That dream reality is usually accepted as the real reality during the dream, although judged later when awake, the subjective dream experience often is seen to contain bizarre events and experiences as compared to waking reality.

Note a lack of reciprocal treatment here: In the dream's version of reality, usually, the dreamer is not aware they are dreaming and they do not ask why the awake reality differs from the dream's reality then underway. But, when we are awake and aware, that is when we question the dreaming reality. I'm not sure that definitively answers the riddle of which reality is more real and less augmented, but the lack of awareness of the difference, while in a dream, suggests at least a *prima facie* ('sufficient in law' or 'on its face') advantage to the view from awakened reality. I acknowledge that DMT may also influence awakened reality, including this just mentioned *prima facie* conclusion.

That feeling that one is out in the real world is the cardinal sensation of reality in dreams. Some 75% of subjects who

slept in their lab (Foulkes & Vogel, 1965) reported when they were awakened that in the dream they felt they were out and about in the real world. Since these are dreams, and the dreamer is, objectively, asleep, that sensation of reality is, beyond peradventure, a hallucination. At present, no theory of dreams accounts for this false sense of reality, aside from merely acknowledging it.

1.3. Saccades, the eyeballs jerk

The ubiquitous saccade occurs as waking ones (w-REMs), and as sleeping ones (s-REMs), (Andrillon & Nir et al 2015). Saccades come up frequently in this essay, in different contexts, which is not surprising since REM is all about saccades! During awake, one main function of a saccade is to bring an object of interest into the fovea (Wong, 2014). Asleep at night, there are 4 or 5 REM periods (REMPs) where the eyeballs jerk part of the time, from a moment or two to a maximum of about 20 minutes each night. The total time each night for movement of the eyeballs is a small part of REM-State-Sleep (RSS). RSS overall is some 20% of sleep time and s-REMS are about some 12% of that or some 2 ½ % of a night's sleep (both REM + NREM) (Aserinsky 1971). I have previously noted that saccades may trigger dreaming, or reading, or tracking moving objects. In this essay, we can consider additional features due to the release of DMT from its retinal storage. Under certain circumstances while asleep – to be ascertained -- the s-REMs stimulate the release of DMT, which produce the onset of the Prime-H followed at once by a dream. This occurs during REM-state sleep (RSS). Also, it maybe that DMT flavors waking reality through w-REMS, and another version of the Prime Hallucination, call it “Awake-H”, may occur during waking state. My first guess for how it happens when we are awake is that a release of DMT occurs during the orienting reflex or orienting response (OR), which is also triggered by a saccade, a w-REM. It makes sense that a shot of DMT augmented reality -- here perhaps while awake we should call it “heightened” reality -- in circumstances that trigger the OR, may provide a life-saving edge through a widened or heightened awareness. That might be measurable in animal models where the OR can be triggered while the subject is under the necessary observation.

1.4. The holophrastic linguistic dream (HLD-type) is by far the most common adult dream

The “Holophrastic Linguistic dream” (HLD-type), appears to me to be the most common of REM dreams. That name describes the function of these dreams. They are comprised of images that stimulate the dreamer to choose certain words when reporting the dream. Moreover, the form of speech is the very early one where a word or two plus a gesture frequently conveys complex meaning. Toddlers still use this form. “Uppie”, they may say pointing to something on a high shelf to where they want you to lift them.

In the 2022 essay, I did briefly mention the Prime-H, referring to it as a “...peculiar hallucinoid experience of a dream, where one feels like they are out and about in the real world”, and I cited the 1966 report of Foulkes et al, which did mentioned the study but not the percentage of subjects. It was in a 1965 report by Foulkes & Vogel, a year earlier, where we get the detail about how many dreamers felt they were out and about in the real world, and the answer is 75% (Foulkes & Vogel, 1965). I refreshed my memory of the 1965 refer-

ence in Robert Van de Castle's reliable book “Our Dreaming Mind” (Van de Castle, 1994, p. 266, fn 66, Ch 10.).

In this essay, I propose that HLD-type dreams require the Prime-H for their intended function of providing the pronunciation of the word to be assessed by the brainstem during the dream (recall) report. My guess is that the report need not be spoken aloud. I assume the brainstem can use sub-vocal reports to assess the test words from the dream – to the dreamer, this may feel like the speech they heard or spoke in the dream.

I did previously ask “if the belief in spirits and an underworld that is associated with dreams in most every culture, originated and spread with the onset of dreams triggered by speech” (Arenson, 2022). That would be a fitting irony that this hallucinoid fallacy induced in us by the Prime-H might be at the root of the absurd beliefs in an underworld and in an unconscious.

1.5. Sigmund Freud believed dreams originate in the unconscious. In what context can that be true?

I consider the ancient myths of an underworld and its risible progeny the unconscious: It is to marvel that these two beliefs, not originated by Freud, but the latter at least was adopted by his theory on dreams, having maintained their hold since antiquity and now into our times, and in our contemporary culture going on for nearly a century and a quarter, without any physical evidence that either an underworld or an unconscious exist, nor any good theory of where they may be found in us. HLD-type dreams can co-exist with a mythic unconscious, although it gets along just fine without an unconscious. I can't think of any present value or need for the underworld except perhaps for some ceremonies by religions or cults. (I have no basis to object so long as this is a voluntary choice and they clean up their mess afterwards. Can it be worse than surfing the internet, for killing time?) Motor-mouth theory does depend on sensible theories of grammar and syntax to encompass the essentials of language use and comprehension. So, I note a mischief similar to the unconscious caused by the flagrant and more recent theory of a ‘language organ’, which neuroscience only recently was rid of when its author finally recanted, replacing it by a theory that is so (safely) beyond comprehension of nearly every member of Homo now alive that it probably must await the next iteration of Homo to decipher whatever meaning it has, and if any of it contradicts Motor-mouth theory. I'll be long gone, and so will you, dear reader but Chomsky may still be a curiosity.

1.6. The approximate meaning of language

As it is, and this is my serious point, Motor-mouth theory pictures a function for dreams that depends on acceptance of the common human experience of approximate meanings of language. It is obvious that other, non-human, species of intelligent creatures have meaningful calls and are on the road to using words that Homo perhaps began to tread some 2 million years ago (Arenson 2022). The communication of word meanings within a species is never entirely rule-bound. An argument can be made that it is not even substantially rule bound. Meaning of a word is always approximate at best, always hit and miss, because context is ephemeral and context controls meaning. Context is the forever key to meaning. The words in a dream report are like essays written by AI's. Unless one knows the context they

can mean many different things.

Great thinkers have argued against Freud's use of the unconscious in psychology. Consider the first one, a 19C debate between Freud (1899) and William James (1890), where James advocated against incorporating the "unconscious" in new theories of psychology, comparing it to the risk of creating a "tumbling ground for whimsies". But, perhaps *because* the unconscious has no objective existence, the belief in it is defended with tendentious arguments that are highly resistant to objective analysis or science. We saw shocking evidence of this type of blinkered resistance to reason in the Covid-19 vaccination debate that killed many who could have saved themselves. At least belief in an unconscious will not kill you, unless you also contend it has the wisdom to make decisions for you – such as rejecting vaccinations.

Foulkes, evidently, also doubted Freud on dreams. At around the time of the Foulkes & Vogel, 1965, report and the Foulkes, Spear and Symonds report, 1966, as I am told by Professor Harry T. Hunt who was then the editor of the International Association for the Study of Dreams (IASD) journal, "Dreaming", Foulkes told Hunt they referenced Freud, and in their 1966 report they used the vernacular of Freudian theory when discussing their findings and their conclusions. He told Hunt this was not because Foulkes or the others were convinced of the correctness of Freud's dream theory, the opposite. Foulkes expected to find disagreements between the Freudian theory of dreams and the findings in this study (Hunt, 2016, personal communication). Did Foulkes and his associates succeed in discrediting Freudian dream theory? I have no opinion. I cite these specific pieces of work (1965 and 1966 studies) of Foulkes et al only for the proposition that the experience of most dreamers during the dream was like being out and about in the real world, even when bizarre things were happening in the dream. I find the other considerations in that 1966 article about Freud's idea, and about the personality types of the subjects, and especially Foulkes use of Freudian language and concepts of interest and historical, but unhelpful on what I believe to be Freud's miss-use of dreams (with apologies to Freudian practitioners). In the 2022 essay, I referred to Freud's reference to PTSD among many of the injured in World War I, with his admission of the failure of wish fulfillment to account for the origin of dreams that came as such nightmares. I added that I was unaware of any proposed replacement for dream origins, but I acknowledge the benefits to certain clients of Freudian therapy, so, hang the theory. Freudian therapy is one of several used today that appear to help clients. I suggested that modifications in Freud's theory to accommodate the dream function as articulation maintenance instead of wish fulfillment should not imperil the useful existing practice, and I point to the great UK Freudian, Ella Freeman Sharpe, who wrote a useful book, still available on Amazon, about how she used the puns in HLD-type dreams to better understand her clients. She called these HLD-type dreams "poetic diction" (Sharpe, 1937).

1.7. Early dream literature on hallucinations

I have already mentioned the earliest study specifically on REM, which was, of course, Aserinsky and Kleitman's 1953 paper, announcing the discovery and naming of Rapid Eye Movement sleep. A flurry of research was stimulated, and one topic was hallucinations and dreams. Hallucinations have long been associated with sleep or its absence. Long

before REM was discovered it was known that sleep deprivation could drive people crazy, and among other signs and symptoms many would become delusional (West et al 1962). West quotes a professor of history from an 1893 text who, West says: "gave as clear a description of the effects of prolonged sleep deprivation as anyone might give today". He then quotes a Dr. White:

"One sort of treatment used for those accused of witchcraft (was) the 'tortura insomniae.' Of all things in brain disease, calm and regular sleep is most beneficial; yet, under this practice, these half-crazed creatures were prevented, night after night and day after day, from sleeping or even resting. In this way temporary delusion became chronic insanity, mild cases became violent, torture and death ensued. . ."(White, 1897)

Aristotle may have been the first to publish on the relationship of dreaming to hallucinations. Seventeen or 18 years after the discovery of REM, an overview of the relationship of REM to hallucinations appeared (Feinberg, 1970), which began with this reminder:

"It was Aristotle who first proposed the hypothesis that the hallucinations of madness result from aberrant functioning of those mechanisms which normally produce hallucinations during sleep, i.e. the mechanisms of dreaming."(Aristotle, De Somnis, cited, 1947)

Feinberg first describes the presentation of hallucinations in different psychopathological conditions, distinguishing firstly between hallucinations occurring in delirium and those in schizophrenia. Later he added the 3rd type: hallucinations occurring from using LSD-mescaline. He claims that the hallucinations have different characteristics. This one needs the eyes open. That one needs the eyes closed. One is associated with disorientation, another with a clear consciousness. One needs light, the other is better in darkness. And so on. Is Feinberg still right on these differences? I did not check, although I am interested in the mistakes in the early scientific beliefs about the relationship of REM to dreams that corrupted such conclusions. I do note that for decades after 1953 it was thought that the saccading eyeballs were the cardinal sign both of REM and of dreams. The belief grew up that to enter REM was to dream. But this understanding of the inevitable link of REM to dreams gradually came to be seen as false. In 1971, a year after Feinberg's paper, Aserinsky provided much refined data on the pattern of eye movements during a night of REM. He showed that the eyeballs jerked only some 12% of the time in REM or some 2 ½ % of total sleep time. He showed that some 21 times, in a night's worth of REM, the eye did not saccade for a time, and this observation was made during the 4 or 5 periods of REM as per the EEG, in that night's sleep (Aserinsky, 1971). Aserinsky did not dwell on the presence or absence of dreams during REM, with or without the saccading. But, at least since the findings of a group in Giulio Tononi's lab at Wisconsin Institute for Sleep and Consciousness (Siclari et al 2017), we now know that dreaming may occur during REM (as per the EOG plus the EEG) both when the eyeballs are saccading and also when they are not. Feinberg was limited by what they believed the new biology of REM sleep to be, in 1970, when he published a table that purported to test Aristotle's apparent hypothesis of an inevitable relationship between dreams and hallucinations. Of interest, Feinberg's said his results contradict the

Aristotelian prediction. Table 1 shows Feinberg’s table of results he viewed as contradictory for the schizophrenia leg:

Note that Feinberg et al believed that eyeballs had to be moving for dreams to occur and the reverse – if the eyeballs were not moving then dreams were not occurring. But, as implied by Aserinsky theoretical work in 1971 and confirmed by Siclari et al in 2017, dreams can and do occur during REM’s appearance on the EEG although eyeballs are not moving according to the EOG. Aristotle may have been more right than wrong to associate hallucinations of dreams with those in madness, if DMT causes both, as it appears it might, and Feinberg may have been more wrong than right, due to the mid-20th C misbelief that dreams are in nearly a one to one relationship with REM, (Foulkes, 1962).

Now stand back a moment; in their 1953 results, Aserinsky and Kleitman knew that in some 25% of their awakenings during REM they got no dream report. In retrospect, that might also show that dreams are independent of moving eyeballs. Eyeballs may move with no dreams and if so, then it is thinkable that dreams may occur without moving eyeballs; also it maybe that eyeballs and dreams do commonly occur together without necessarily being causally related in function – perhaps as a conditioned response –like Pavlov’s dogs salivating when conditioned to feeding time by bells.

We do know that REM and dreams often coincide or overlap, regardless if one causes the other. One thing that is implied from these early deprivation studies is that REM clearly is biologically crucial and must occur at intervals in each 24 hours for good health. So why is there REM? This is another thread that draws me to the motor maintenance function as the purpose of REM, since it is hard to think of a function that is more essential to life in mammals than the motor capacity.

Feinberg’s focus began with Aristotle’s conjecture that hallucinations of madness are cut from the same cloth as dream hallucinations. Feinberg reviewed the work of the 1960’s decade now that REM was recognized. He explains that,

“There is much more mental activity occurring during sleep than was previously suspected. Awakenings from REM sleep lead to reports of mental activity characterized by visual imagery, bizarreness and implausibility and affective involvement of the dreamer.”

And, as he noted, there were reports of dreams in half or more NREM awakenings. The more recent view of dreams found outside of REM, it is up to 70% of NREM awakenings (Siclari et al 2017). If dreams during REM are the incidental invention of a clever brainstem adaption to assess and maintain articulation when speech begins, REM is not diminished in importance, it is elevated. What we will have

been or become, and the same for our cousin species, ascendant and descendant, if our motor function had withered for want of maintenance, or ever will?

One final point in Feinberg’s favor in his 1970 paper, it also must be noted that he did doubt his own view of the settled opinion from the 1953 discovery of REM, and the belief that grew up that REM and dreams came together. He said:

“In preparing this review, I was first struck by the necessity to indicate some complexities in issues which seemed more simple ten years ago. Of these, the most obvious is the problem of the relationship between dreaming and REM sleep (cf. recent reviews by Foulkes (1967) and Berger (1967). Ten years ago, most of us were prepared to accept these two variables as being in essentially one-to one correspondence... Today it seems clear that this is not the case.”

Ideas must change if the evidence changes. As to hallucinations in relation to dreams, I now ask is DMT responsible for hallucinations of sleep deprivation? It could be so.

2. The case for DMT as the PRIME hallucinator (Prime-H)

DMT is an obvious candidate for the cause of the Prime-H. DMT has been studied carefully after 1953 and at least since the 1990’s. Probably it is endogenous in mammals. In particular, it has been isolated in the visual cortex of rats and also in human brain tissue (Dean et al, 2019). These authors found that DMT was synthesized in situ. In this report of the 2019 study at the University of Michigan I also note that a cardiac event was induced in some rats and the researchers found that DMT production immediately increased (Dean et al, 2019). DMT production also has been known to increase in rodent brains when under environmental stress (Fontanilla et al, 2009). Although my interest in DMT was as the Prime Hallucinator in dreams, these findings suggest additional waking functions for DMT: For one, the sensation of the Orienting Response (OR) may be enhanced by DMT when the OR is activated as surely it is by stoppage of the heart. I return to this in several places throughout this essay, concluding in subsections of Discussion, in section 5.

Now contemplating that DMT is endogenous and available during dreams in H sapiens, it is also reasonable to contend that DMT is the cause of the ever-present availability of the Prime-H in dreams that beget the bizarre, enhanced, reality frequently experienced in dreams. It is bizarre, at least, when we recall the experience while awake, but typically it is a ho-hum conscious sensation as if this unreal reality is real, during the dream.

Table 1. Emergent Stage 1 and Rapid-Eye Movement Scores for Schizophrenic and Control Subjects*

Category	N	Percent Stage 1 Sleep	Eye Movement Density
Schizophrenics (all)	18	22.0%	.61
Hallucinating	9	22.2%	.67
Non-Hallucinating*	9	21.7%	.54**
Controls	10	24.7%	.68

** Significantly lower than value for hallucinating patients (p = .05, two tailed)

2.1. Was DMT first adapted by the brainstem to aid in the motor assessment of articulation maintenance or did it have an earlier role, perhaps in the orienting reflex?

In addition to DMT's possible production in the visual cortex, this hallucinogen can also be stored in our retina, although its largest concentration evidently is found in the air in our lungs. DMT that is present in our retinal cells can be carried from the retina into the brainstem, perhaps by projection white matter fibers. DMT is then an obvious candidate for the triggering mechanism of the Prime-H.

The early investigations occurred at least 30 years ago (Strassman & Qualls, 1994; Strassman et al 1994; Strassman 1995). Was DMT already present in our bodies when speech began – some 2 million years ago, I speculate, and the brainstem added dreams to assess the new motor activity of speech and added this task to the list of motor maintenance duties? Perhaps it was there for eons before to sharpen our sensation of awakened reality in some circumstances, like during the Orienting Reflex? What happens to our various capacities to navigate waking reality if DMT is blocked?

It is possible that DMT was only adapted when dreams began, to sharpen the assessment of articulation through dreams by soothing the dreamer during bizarre episodes often needed to form unusual visuals, the orthography, but without impacting the dreamer's phonology, thereby avoiding a stress-wrenching of pronunciation. Did the brainstem adapt to capture DMT from plant material, from where it grows, and thereafter adapt further by beginning to make DMT? What function does DMT play in the plants that produce it? Is this a clue to a form of plant behavior in respect to its changing reality? I think of many plants' capacity to turn towards the light. Many interesting questions arise that I have no answer for.

The fact that most DMT in us is found in the air in our lungs implies that it is ubiquitous in our environment, the world over, so, with fewer assumptions, Occam's razor favors it already being present and available to be adapted by the brainstem during the dreaming articulation testing then being adapted. The dreamer needs to believe it was all happening in the real world, if for no other reason than to avoid test-stress to which the voice is notoriously subject. A dose of DMT makes it easier for the HLD-type dream to feel like normal reality even in retrospect, when we awaken.

2.2. The origin of REM-state-sleep; it's purpose in motor maintenance, and it's adaption for speech to assess articulation

My proposal in essay 1 was and remains that the onset of REM-state-sleep (RSS) occurred 200 million years ago, and did then, and continues now, to perform motor maintenance in a broadening array of species, which today likely includes all the vertebrates and then some, with forms of RSS. To maintain the motor system in each species it needed a different combination of motor feats and features. When speech or meaningful calls occur, they are of limited use unless the word (or call) is pronounced the same way each time it is used (in that community at that time).

2.3. REM refers to saccades, both voluntary and involuntary

Saccades come up again. Before articulation of speech came along and needed to be maintained during RSS, the motor maintenance function was likely done, at least partly, with twitches of the atonic muscles it inspected each night. Atonia affects the voluntary muscles only, except for some dual purpose muscle activity, like saccades, whose muscles become atonic when the saccades are voluntary and become immune when the saccades are involuntary. I am unsure of the extent of this duality. REM seems to be able to disguise itself in some circumstances, but motor maintenance must be going on. The disguised REM function is most striking in some marine mammals.

For some large marine mammals, which spend part of their time on land, REM seems to disappear when they are at sea and returns when they are on land. Is this a clue? Some very large creatures – I think of whales and elephants here – appear to have almost no REM, which appears to contradict the motor-maintenance function that fits the smaller mammals. The absence of the brain signature of REM in these giants suggests to me that motor-maintenance is occurring through REM variations or substitutes. They may have the REM function hiding in plain sight in other behaviors. Whales, for example, seem to have little REM, although the studies are difficult and incomplete but does the rhythmic swing of their enormous tails produce a REM function as well as locomotion? The mutuality of a REM signal in brain waves and also or alternatively buried in the chemical signals of nerves of major motor movements offers a pleasing symmetry. Does the tail motion therefore create a REM equivalent or substitute at some times, if not always? Similarly, one may ask if elephants may activate motor-maintenance generally by swinging their trunks in a rhythmic fashion. If these activities produce biologically equivalent nervous activity to REMs seen in brain activity in the smaller creature, they will not be discovered until some researchers in close contact specifically searches for such equivalence.

The saccading eyeballs when we are awake can be activated voluntarily to read a page of text with the words arranged side by side or one above the other or we can make our eyeballs follow a moving object. Also while awake, the saccades provide a vital reflex for self-protection when the Orienting Response or Orienting Reflex (OR) is triggered, which Ivan Pavlov gave this euphonic Russian phrase: Что такое? Phonetically, Shto takoe? (What is it?). If the OR activates while awake, the eyeballs skim, searching for danger, jerking the fovea from aim to aim. I am unsure of the pattern of eyeball jerking if the OR is activated while in a dream, or if there is a pattern. I'd like to know, if you know.

The Tononi group coined an abbreviation for saccades in REM vs saccades while awake. They called them s-REMS and w-REMS, and I use that here (Andrillon et al, 2015). The s-REM motion of the eyeballs when we sleep is not smooth. The eyeballs jerk from position to position. Aserinsky thought a better name would be Jerky Eyeball Movement (JEM) but he was outvoted by Professor Kleitman, his theses supervisor. Two decades later, Aserinsky counted and measured the s-REMs. Aserinsky reported that s-REMs come on and go off some 21 times during a night's worth of REM-state sleep, stating,

“On the average there were 21 intervals of ocular quiescence, ranging from 1 to 5 min duration, in the REM phase of one night’s sleep.” (Aserinsky 1971)

Aserinsky calculated the duration of REM-state sleep (RSS) in a night’s sleep, and along with most dream researchers, conventionally called it 20% of sleep. That 20% of RSS occurs over 4 or 5 REM periods (REMP) when the eyeballs move, beginning some 90 minutes after Slow Wave Sleep (SWS) began that night, with a few moments REM duration then, followed by the second SWS period and then another period of REM, a longer one, increasing each cycle, up to 20 minutes in the last REM. All in all, the eyeballs are moving a little over 12% of the total time in RSS – that is >12% of the 20%, from which one can calculate that s-REMS are occurring some 2.7% of the entire night’s sleep. Keep in mind that some 78% of the so-called REM state is with-out eye balls moving during what is still confusingly called “rapid eye movement” sleep.

“Motor-maintenance state sleep” is my suggestion for a new name for the overall REM state sleep, abbreviated “MMSS”, which I keep promising to begin using in place of RSS.

2.4. A review of the science of DMT

Two sections below, in section 4, “PTSD nightmares...”, I turn to a possible role of saccades in Post-Traumatic-Stress-Disorder, in connection with DMT, by asking if blocking saccades will reduce PTSD -- because blocking saccades may result in reducing DMT’s transport -- but first I must share some information on the science of DMT.

This idea of DMT as the Prime-H agent came to me via the writing of psychiatrist, Rick J. Strassman M.D. (Albert Einstein College of Medicine, 1977; Psychiatry residency at University of California, Davis, 1981; Clinical Psychopharmacology at San Diego’s Veteran’s Administration Medical Center, 1982-1983), who lobbied for the scientific freedom to research DMT and LSD and other psychedelics in the treatment of mental disorders, and succeeded in gaining that permission and then did study the question at length. I am not aware, however, that he ever suggested that the Prime-H of dreams is the result of DMT, as I do here.

In many countries the study of psychedelics was rejected on cultural grounds by some who cried “wolf”, or perhaps worse, the threat of eternal perdition. The witch-hunt was enhanced in that era by propaganda films such as the classic “Reefer Madness” a 1936 movie about the supposed dangers of Cannabis use. In Canada in Oct. 2018, consuming this plant became legal nation-wide for both recreational and medicinal purposes. Canada’s constitution, unlike in the US, reserves criminal law to the national government. Some states, Oregon is one, legalized Cannabis earlier than that, but several more U.S. states have now made it lawful and others are considering it. Europe is now experiencing legalization in some countries. The government of Canada expected to make a bundle by taxing the product. Evidently, private fortunes were spent establishing legal farms and retail outlets to sell Cannabis. Some are already bankrupt. You now went to a shop down the street rather than skulking off to your dealer’s location. The illegal market adapted by offering home delivery, and without tax! Nothing much changed at first in consumption habits, if media reports are accurate. Its early days. Of interest to us sleep-dream researchers; did we sleep better or worse? Did we dream more or less? The data has not been published, if it is being

collected.

Strassman was 40 years early when he lobbied for access to study the properties of psychedelics, and he was abused by those holier-than-thou among his peers for his study of DMT. But, within 15 years or so, his idea of the role of DMT began to be vindicated beginning with the mid-1990s research, which since then has firmly established the basic properties and function that are associated with DMT. (Strassman, R. J., & Qualls, C. R. no. 1, 1994) (Strassman & Qualls, no. 2, 1994); (Strassman, 1995) (Strassman, 1996) (Su et al 2011) (Wang et al, 2016); (Zhao et al 2017) To extend the reach of that line of thought I propose that DMT accounts for the Prime-H phenomenon in HLD-type dreams.

The DMT molecule moves about the human nervous system by its agonist (DMT) a.k.a. the ligand, which, together with its receptor cell, the Sigma 1 Receptor does the job. (The receptor cells are abbreviated “Sig-1R”.) I begin by explaining “agonist”, “receptor” and the necessary “ligand” in this context with a metaphor: The receptor cell is like the delivery van, and the agonist, DMT, is the package from Amazon (of South America), which is to be delivered. The appropriate ligand means a Ligand that is capable of binding an Agonist to the Receptor, so in my metaphor the Agonist (DMT) is loaded into the Receptor delivery van, the Sig-1R, and there they join through their reciprocal ligand properties, and the combined parcel is taken to the brainstem destination via grey or white matter fibers from the retina, where it activates to implement a signal transduction. Three stages are involved: First there is a coming together and binding of Ligand to Receptor, then the delivery of both together, then the response through activation. These three stages may be defined like this:

“Binding of a ligand to a receptor changes its shape or activity, allowing it to transmit a signal or directly produce a change inside of the cell. Stages of signal transduction: ligand-receptor binding, signal relay, response.”

The sigma 1 receptor (Sig-1R or σ_1) cells are found in many parts of the body and nervous system, including in the retina, and together with its only naturally occurring agonist, DMT, these appear to be the molecules responsible for, or capable of, influence on the sense of reality while we are awake, and its counterpart, the hallucinatory reality, while we dream. T.P Su, a neuroscientist at the NIH Cellular Pathobiology Section, and his colleagues, say,

“We therefore speculate that Sig-1Rs may partially mediate the psychotomimetic effects of DMT, such as visual hallucinations in humans...” (Su et al 2009)

“Psychotomimetic” means it forms a kind of psychotic state or similar to a psychotic state. This, therefore, may be ‘normal’ in dreams. But, is it normal while awake?

Although Strassman and a few others have used human subjects with prior experience in the use of hallucinogenics, the heavy experimental work has generally been done on mice or rats. One group led by Prof. Wang, used mice in the physicians’ research work on eye disease. The striking points are the uniqueness of the Receptor cell, and the unique role of DMT. They say,

“(the) Sigma 1 receptor ... is a unique membrane protein with no homology to other mammalian proteins. (DMT) is the only endogenous Sig-1R ligand identified.” (Wang, et al 2016)

The Sig-1R (the Receptor) can be mobilized by a binding with its ligands and then, and only then, it can move to other regions in the brain or body to do its work.

Recently the Sig-1R has been recognized as having powerful curative potential in retinal degenerative disease, a leading cause of blindness. To avoid the hallucinatory effects of using DMT with the ligand to activate the Sig-1R, substitutes have been developed in the lab. The Sig-1R is already being used clinically to alleviate pain through “a synthetic, nonnarcotic benzomorpham with high affinity for Sig-1R.

...”to treat degeneration in retinal photoreceptor cells (PRC) and retinal ganglion cells (RGC)” (see Wang et al. 2016).

Apparently, when bonded to an agonist, the now formed Sig-1R pair can migrate inward along the neurons in the retina or in parallel white matter fibers, from the retina via the optic nerve to their point of origin in the mid-brain, the lateral geniculate nucleus (LGN) of the thalamus.

“The axons of the retina’s ganglion cells pass through the optic nerve, the optic chiasm, and the optic tractus. They wrap around the midbrain and cross the medial surface of the temporal lobe, and 80% of them then terminate in a synaptic relay called the lateral geniculate nucleus (LGN), located in the dorsal part of the thalamus. The LGN is thus the major target for each optic track” (Dubuc B., McGill University, Montreal, 2018)

Note that the axonal course, where the axons “wrap around the midbrain” include the brainstem regions of the Medulla, the base of cranial nerve XII, the hypoglossal nerve, which figures prominently as the likely origin of the tongue’s motor nerves involved in the articulation of speech that led to dream onset in Motor-mouth theory (Arenson, 2022).

Wang’s work claims that Sig-1R can restore visual function despite existing degenerative damage. When the ligand is a pain killer, it also kills pain. When the ligand is DMT it heightens the sensation of reality, although possibly with a unique property among mind altering drugs, there is no sensation of being drugged. Other effects are described by Strassman. There is an evident dose response. It feels like a more heightened reality, or an expanded awareness of reality, as the dose increases.

To say DMT is an endogenous molecule in humans means our genes code for it, but the largest quantity is found in the lung tissue, presumably from inhaling it in the ambient air. DMT has also been found in human urine, blood, and cerebrospinal fluid (Fontanilla et al, 2009)

It seems plain and obvious that a certain minimum dose of DMT while awake does endow an intense sense of reality that exceeds the usual experience, without creating the sensation that one is “stoned”...possibly unique among the hallucinogenic drugs to date. Strassman thought it might account for near death experiences, and for Schizophrenia, and for several ideas involving the pineal gland. He was summarily rebuffed as a flake by many scientists. In his writing he did not suggest that DMT was the Prime-H, the cause of the hallucinoid experience in dreams. Perhaps it crossed his mind, but the study of hallucinogenics was difficult enough for anyone hoping to be treated as a serious scientist. Adding a dream research issue was sure to lessen support and increase skepticism (as dream researchers well know :)

Still, Strassman is a Copernican figure. His illustrations may have been more or less off as was Nicolaus when he plotted the orbits of the planets, but Strassman also got the big idea of reality right – as Copernicus did by placing our star in the center of the solar system and relegating the Earth to one of its satellites– that this bound pair of protein molecules does endow or enhance or bend our experience of reality, at the same time, and more or less substantially, while awake and likely during RSS dreams.

2.5. Rick Strassman maintains a blog.

I quote from Prof. Strassman’s blog:

“No other psychedelic so reliably convinces the experient of the reality of what they are apprehending. This is in contrast to the usual sense, even on high doses of other drugs, that you are “on drugs” rather than “really someplace else.” ...

In an interview on 29 Mar. 2018, Strassman was quoted as saying,

“There are also still a lot of questions to answer, like the explanation for what DMT is doing in the body in the first place. It’s clearly important, Strassman said, as it is actively transported into the brain using energy. There are very few compounds that the brain absorbs this way, such as glucose and amino acids that are required for normal brain function, but can’t be made by the body on its own

“That makes you wonder if DMT might be involved in the regulation in every day normal consciousness as well,” Strassman said. “And something else that has been discovered over the past few years is that the enzyme and the gene that synthesize DMT are quite active in the retina. So it could be that DMT is regulating a visual perception in particular as well as regulation of consciousness.” (Dodgson, 2018)

Strassman was thinking of awake consciousness. It also could be said about dream consciousness, which produces a reality that differs from awake reality.

2.6. The HLD-type dream allows conversion of speech sounds of words into images, and back again in the dream report: phonology -> orthography -> phonology.

Let me recap: Articulation is a complex motor activity. It presented a brand new motor maintenance problem. How is the brainstem to assess the articulation of a word or a meaningful call within the existing regimen of REM inspections of the motor system? Twitch the voice mechanism during atonia? Have the dreamer talk aloud during sleep and listen to how it is said? My proposal is that the brainstem’s adaption was the invention of dreams, the HLD-type dreams that could be hallucinated during a dream or subvocalized on awakening or reported aloud on awakening. The HLD-type dreams make available to the brainstem circuits that are on the alert for this signal, the dreamer’s vocalization of the dream’s images, using simple speech, highly reminiscent of the earliest form of speech, Holophrastic. This is speech with as few as one word and a gesture, and rarely is more than a few simple sentences or an idiom. Toddlers still use it, at first: “Uppie” she may ask, while pointing at something of interest

on a high shelf. Holophrasis is said to be the most ancient form of speech. It is, perhaps, 2 million year old. Such an early form of speech is inferential evidence of the onset time of HLD-type dreams.

In the mid 1970's when I first recognized that this was a form of speech that was now used in the reporting of an HLD-type dream, this was the biggest clue that the phonology (i.e. the sound of the word), is being converted to the orthography (i.e. a visual form of that word, via the dream images) and, upon awakening, the dreamer could report by unwittingly converting the images (the orthography) back to the original speech sounds of articulation (the phonology), allowing the brainstem to hear and compare the uttered word with a stored copy to assess the fidelity of articulation of that word.

3. Did the brainstem adapt the DMT hallucinatory molecule to enable articulation maintenance when speech began?

Possibly, the obstacle to articulation maintenance was the difficulty in achieving a deep enough belief in the reality of the dream hallucination but it may not have been natural to believe in the reality of dreams without DMT. It may be we needed to create the conditions before we could believe in the Prime-H and we did that through this endogenous neurotransmitter, N,N-Dimethyltryptamine (DMT). In this view, the first step in the process of articulation maintenance depends on this belief in the reality of the unreality caused by DMT to enable the brainstem to "hear" and compare an articulated word based on a saved sample of that word, as spoken by the dreamer while in the community at that time.

One or more of bizarre features commonly occurs in our dreams but we ignore them under the influence of the Prime-H. Otherwise we might recognize and perhaps wake up due to the bizarreness we experience in nearly all dreams. Imagine how less consequential dreams would have seemed over the eons they have mystified us if we would routinely wake up in the dream when we recognized it had veered from waking reality or was nonsensical and then realized we were dreaming?

"Waking up" in the dream due to the unreality, in that scenario, might be similar to the onset of lucidity, but would not necessarily be lucidity, as usually considered. (This question is left for the lucidity experts.) The unreality may produce a sensation that begins like lucidity but becomes more like the unpleasant experience of pulling ourselves awake from a nightmare, for example, once we are awake enough to understand that it is a dream and not reality occurring (or re-occurring in the case of PTSD). In this section 3, I share some history and insights on the folk use of DMT.

3.1. Ayahuasca, "vine of the ancestors", a plant source of DMT

Ayahuasca is the name for the plant based brew derived from the Banisteriopsis caapi plant. This plant is native to the Amazon River region. It is used in sacramental teas such as Ayahuasca in shamanic rituals in South America. (Fontanilla et al, 2009). Ayahuasca's component of DMT is presumably given in a larger dose than is available in H. sapiens from our endogenous production. In this larger dose, Ayahuasca is a powerful hallucinogen and is used in ceremonies by seekers of mystical experiences. The functional extent or impact of DMT in our physiology is not yet clear,

but hallucinations and sensations of heightened reality are typical outcomes to be expected.

3.2. Saccades may draw the DMT into the mechanism of dreams

Again I return to saccades: Here I propose that the saccades of s-REMs, the jerky movement of the eyeballs, the s-REMS of his sleeping son that motivated Aserinsky's 1953 work to investigate, are, or accompany, the "go" switch that pumps DMT from the retina into the brainstem circuits where articulation, among other RSS motor maintenance functions, is controlled.

It seems likely to me that during the 78% of the night's worth of non-saccading REM, the brainstem focuses on maintaining the non-saccadic motor activities of the body's muscles and its motor movement capacity. Based on his 1971 paper, where Aserinsky counted the saccades turning on and off some 21 times a night during RSS, I conjecture that this represents the ordering of the maintenance activity of 21 processes, either those that do or those that don't involve eye movements, accounting collectively for all motor activities that the brainstem maintains each night during RSS.

3.3. Evidence is collected that the Prime-H is present during RSS

In the decade following Aserinsky's proposal that the eyeballs saccade during sleep, and then the discovery of RSS, the Foulkes group were one of the early investigators who also used EEG in the lab for overnight recordings. Waking their subjects when they were in REM, the researchers asked the subjects to report dreams. In their 1965 study, Foulkes et al also asked this question:

"were you ... observing the contents of your own mind, or did you feel that you were participating in or observing events out in the real world?"

Some ¾ of the subjects who were asked this question after reporting a dream agreed they felt like being out and about in the real world. In this study (Foulkes & Vogel, 1965) the authors explicitly tell us three quarters of the subjects agreed with that, and also we know it was verified by Van de Castle (1994 at p. 266, footnote 66, ch. 10) who had it from Foulkes, as reported, that 75% thought this. In the 1966 study Foulkes and other colleagues use the information to help place the subject in one of two personality types (Foulkes et al, 1966).

Other researchers have addressed the question and have noted the ¼ - ¾ dichotomy observed by Foulkes et al. Psychiatrist David Kahn took up the issue twice, the second time in his 2019 paper. (Kahn, 2019; Kahn & Hobson 2005a). In the 2019 paper he drew attention to a striking difference in the neurotransmitters present between REM and SWS (NREM): "Serotonin and norepinephrine are absent in rapid eye movement (REM) dreaming, and reduced in NREM dreaming." Of these two neurotransmitters, the absence of norepinephrine likely impacts on the Prime hallucination of dreams aka, the Prime-H. We also read about reduced Orienting Response...

"...Norepinephrine is both a neurotransmitter and a hormone, but it acts mainly as a neurotransmitter. Norepinephrine, also known as noradrenaline, plays an im-

portant role in your body's fight-or-flight response."
(Cleveland Clinic, 2022)

This absence or reduction of trigger molecules for the fight-or-flight response during dreams is consistent with the unique needs of the Prime-H to support reliable, non-stressed, assessment of articulation. This is also in order for dream reality to suppress arousal from the bizarre events depicted in most dreams.

Also, the change in levels of these neurotransmitters between REM and SWS (NREM) is all the more reason to treat NREM dreams as different until proven the same as REM state dreams. Although no longer can there be doubt that NREM dreams occur, (Siclari et al, 2017) and arguments pile up that the dream-types are different. (Montangero, 2018)

3.4. DMT makes the dream feel like reality and therefore improves the fidelity of the performance of the articulation

Why do we have the Prime-H? Why do we universally experience this hallucination during a dream? I argue here that it is due to the neurotransmitter, DMT. The purpose, I propose, is the brainstem's efforts to bring the articulation close to the awakened standard or fidelity for assessment purposes. DMT helps the dreamer, during the experience of the dream, give the best articulatory performance of the speech sounds in the words being tested, as if during awake reality.

3.5. Domhoff et al defend Content Analysis and its Continuity Hypothesis, but ignore the Prime-H.

The Prime-H is so commonplace that it appears to be unseen by the leading proponents of Content Analysis (CA). These days, GW Domhoff is one of several dream experts who speaks for CA, especially since the death in January 2014 of Robert (Bob) Van de Castle, a co-founder of CA. Professor Domhoff defends the Continuity Hypothesis, as he must if CA is to continue to be the dream theory du jour. He is justly well respected, but I disagree with the basic assumption of CA, the Continuity Hypothesis. I will explain.

My argument begins with the late, great, Bob Van de Castle. I met Bob through the IASD. I use his authoritative book (Van de Castle, *Our Dreaming Minds*, 1994) for work before that date. He was a careful scientist, also a fascinating character, and an open-minded thinker. He met and did a project on Extra Sensory Perception (ESP) with JB Rhine in 1951, after his undergrad. Later he did his Master thesis on ESP. After he had his PhD in clinical psychology in 1963 he went to Florida to work for Calvin S. Hall. Later, he ran the ESP contest each year at the IASD scientific meetings where we attendees could try our ESP ability (if any) as dreamers to match a piece of art that Van de Castle had someone project to us in the audience by ESP. (I had studied Rhine's work in high school and did a project on him. As a school boy, I saw the fascination.) Van de Castle came to prominence and fame as co-author of the theory of the Content Analysis of Dreams with Hall. He was grateful and loyal to Hall's memory and work. In his book he tells us that the Continuity Hypothesis was Hall's conviction and he implies that he, Van de Castle, takes no credit – smart fellow to duck, I thought!

My mention of JB Rhine, (b. 1895, d. 1980), whose research appeared to support belief in the existence of telepathy and ESP, also reminds me I always thought that Carl

Jung's "Collective Unconscious" appears as an earlier version of ESP, but the group version. So, if you subscribe to one, you ought to subscribe to the other, or explain why not. I am agnostic on the existence of one or both. I admit I get frustrated trying to understand Jung and gave up. Jung's theory lacks congruent roots in the biology of the brain, possibly unless one begins by accepting the unconscious and the underworld as more than metaphors, and I never could. Rhine's research methods and results at Duke University N.C., over 3 decades starting in the 1930's, faced different sorts of challenges. His thesis and research methods were plain and simple. Was he an honest scientist? I thought so, but others did not. And, it presented the problem of proportionality; extraordinary claims need extraordinary proof, originally attributed to David Hume: "A wise man ... proportions his belief to the evidence" (Hume, 1748). Rhine may yet be proved right. The future will decide this.

I am unaware of any serious work, let alone a consensus, on the origin, purpose or extent of the Prime-H in dreams among the many theories that have been proposed over the ages, except Motor-mouth theory that now puts forward the proposal that DMT is the root cause of the Prime-H and its purpose or function is to allow the voiced utterances of dream reports to be non-stressed, even if sub-vocal, for accurate assessment of articulation. I also believe that there is a near universal consensus that the Prime-H function is a common feature of dreams, although it goes unsaid for the most part, it is so uncontroversial. This may change if the Continuity Hypothesis is seen to be challenged by the Prime-H and Motor-mouth theory. Interesting times may be coming to dream studies.

4. PTSD nightmares: Will blocking saccades reduce PTSD by reducing DMT's transport?

Andrillon et al. (2015), from the Tononi lab, point out that each awake saccade (w-REM) occurs then gives rise to a discrete brief period of visual processing, during which new saccades are suppressed, until there is a visual response. I propose that the same is happening with sleep saccades, that is, an s-REM is the trigger leading to a brief visual epoch, which can (I'm unsure about must) become a visual bit of a dream while we sleep.

I mentioned above in sec 1.1 that to develop Post-traumatic Stress Disorder (PTSD) in accidents usually one had to see the accident developing to experience the explosive emotional release, (a "mass discharge" of the sympathetic nervous system) that might be due in part to the action of the DMT-Sig-1R, and whatever its antecedent causes, it seems to condition the person for PTSD's eidetic replay. This conditioning occurs while one is awake. In recurring nightmares I speculate that the DMT & Sig-1R bound pair adds a jolt of extra realism that exacerbates the sense of fear and helplessness, perhaps that is essential to tipping the balance into a PTSD related memory.

If the realism of PTSD nightmares and the flashbacks continue to be augmented by DMT forming the ligand relationship with the Sig-1 receptor cells, it may follow that if we had a synthetic agonist for Sig-1R to engage these cells and occupy them temporarily, or a Sig-1R antagonist, either one would disable this Sig-1R chaperone vehicle, thus blocking DMT from enhancing realism, and this might have a therapeutic calming effect. Possibly it could diminish the intensity of the PTSD nightmare as well as that of the wak-

ing flashbacks, assuming such a newly developed fake Sig-1R had no biological effect itself. As I read the literature, the effects of a Sig-1R + agonist barrage from the retina lasts only minutes at a time – 3 to 6 minutes for DMT says Strassman – so if we had a slow release fake Sig-1R to be taken nightly before bed, that might be enough for some symptomatic relief if awakened from a Nightmare, and easing that person back to sleep, where at present one becomes fearful of going back to sleep, or fearful of going to sleep in the first place, as happened to some of my clients, devastating them as we could anticipate from the old results of sleep deprivation mentioned in section 1.7 attributed to a Dr. White who reported in 1893.

The horror of PTSD nightmares is a compound of two features that are possible in dreams: (1) they are hallucinatory; (2) they are eidetic. The facts that such nightmare feel like they are occurring in the real world while one is in bed asleep (hallucinatory), and may be DMT enhanced replays of reality (eidetic), are responsible for the heightened agony of PTSD nightmares, made worse because we know how it ends, with us injured. These nightmares are the product of a conditioned episodic memory system. The nightmares or flashbacks are a distinct form of experience. An agent that blocks DMT by usurping its ligand function with the receptor molecule, the Sig-1R, might remove or reduce the essential hallucinatory ingredient.

Endel Tulving, (a Finnish trained neuropsychologist, who in 1972, at Toronto's Mt. Sinai Hospital and the Baycrest Centre, first described the episodic memory system,) postulates that episodic memory is an embellishment of semantic memory. It is noteworthy that episodic memory first appears by age 4 or sometimes later, unlike semantic memory which is enabled at birth. I quote him (Tulving, 1972);

“The theory holds that episodic memory evolved out of semantic memory: Semantic memory appeared long before episodic memory. Many nonhuman animals, especially mammals and birds, possess well-developed knowledge-of-the-world (declarative, or semantic, memory) systems and are capable of acquiring vast amounts of flexibly expressible information. Early humans were like these animals, but at some point in human evolution, possibly rather recently, episodic memory emerged as an “embellishment” of the semantic memory system. The details of this emergence are unknown, and one can only speculate about them...”

Specifically with saccades, there is an opportunity for better understanding of their role in a conjecture by Francine Shapiro, the psychologist who invented Eye Movement Desensitization and Reprocessing (EMDR), the most efficient treatment presently known for PTSD, in my view. She cites studies that apparently show that it is not necessary for a saccadic motion to be completed. I quote her, (Shapiro 1989) where she mentions the Orienting Response (OR),

“In short, when it comes to saccadic eye movements, the brain registers the intention, not the completed act. This finding is consistent with the hypothesis that the orienting response alone, and not any specific movement, is necessary for the activation of information-processing mechanisms.”

Two years later, Professor Don Kuiken's group at the University of Alberta in Edmonton, had established at least the plausibility and perhaps the likelihood of Shapiro's con-

jecture regarding the OR (Kuiken et al, 2001). Dr. Shapiro's remark stimulates my speculation: that Non-REM dreams occur when “the brain registers the intention” to saccade, but which does not lead to specific saccadic movement in this stage of sleep. These “intentions” may provide the substrate needed for the appearance of Non-REM dreams and, perhaps, PTSD nightmares. Research using the Siclari method to detect Non-REM dreams in PTSD sufferers might elucidate this (Siclari et al. 2017).

I did look into classes of drugs that are known to suppress saccades. The research results are confusing. It appears that the Selective Serotonin Reuptake Inhibitors (SSRI) and nicotine increase saccadic efficiency. If so, quit cigarettes and don't use Prozac to reduce PTSD because it increases saccades.

(N.B. I have no credentials in medical or psychological treatment. My views expressed in these essays are based on reflection from what I learned through my clients cases, and on what I read in the literature – Google Scholar was essential – and also from my several, able, mentors [for which, see essay 1, “acknowledgement”] and in my own dream research by the study of my own and others dreams.)

The newer Selective Norepinephrine Reuptake Inhibitor (SNRI) may offer some slowing of saccades. Some SNRI's also inhibit Serotonin reuptake, a two-for-one medication. The effect of the SNRI may be idiosyncratic, though. For example, one SNRI, Mirtazapine, was found to cause several cases of REM Sleep Behavior Disorder (RBD) – a condition where the usual muscle atonia is absent and one is not immobilized during REM-state sleep, so the muscle movement that may occur for other reason can lead to incorporating memory of the PTSD events into dreams at that time, with bad consequences – while the use of another SNRI, Clonidine, cured such a case. (Nash, et al, 2003) Clonidine is a Sigma 2-adrenoceptor agonist. The SNRI are agonist ligands for Sig-2R cells. I believe that Sig-2R are not chaperone cells. They do not migrate when bound to their agonist, as do the Sig-1R+DMT. Other ligands with affinity to the Sig-1R could block DMT by soaking up the available Sig-1R cell as agonists or antagonists. Wiki explains that “A receptor antagonist is a type of receptor ligand or drug that blocks or dampens a biological response by binding to and blocking a receptor rather than activating it like an agonist.” (Wikipedia, retrieved 180413),

If soldiers going into battle could have a prophylactic dose of a benign substitute ligand that would bind the available Sig-1R cells, we might see a reduction in PTSD in those who survive.

5. Discussion

The discussion is under two topics, (1) recapitulation, and (2) explanation. Next, I preview them:

(1) **Recapitulation** of Motor-mouth theory as set out in essay one, (Arenson, 2022) is useful to read, if not strictly necessary, in order to follow the argument presented in this second essay. Here, I do, again, mention the great Michel Jouvet's unfortunate but forgivable anthropomorphism that cats can dream and therefore they may be acting out their dreams, as he and others argue. His conclusion of dreaming cats lacks evidence and my motor maintenance conjecture needs fewer unproven assumptions (and his perhaps is unprovable in the case of cats, until they talk), so it is a better resting place until more evidence is assembled.

(2) **Explanations** of the Prime-H were sometimes offered

by earlier researchers, but in a limited way. Atonia complicated the picture but then clarified it. Then I consider Freud's dream theory. In retrospect, the unconscious was Freud's most glaring mistake, I argue. A magic trick, and an unbecoming one. Next, I address the Orienting Response, which behaves as if we are awake in dreams, and raises the question if this is also Prime-H effect, or an exception to it. Then, Motor-mouth theory offers great change in dream theory that could be termed the "Zeitenwende" in German, which, fittingly, is the original language of Freudian theory. And, lastly, a one-word dream report, "Chaos", that illustrates the method of interpretation of HLD-type dreams by appreciating the two observables of Motor-mouth theory: First, the holophrastic report; and Second, the *true context* in the thoughts of the dreamer at the time. The lesson offered here is that the Brainstem gets its motor-maintenance work done, regardless if the dreamer 'gets' her dream, or not.

5.1. Recapitulation

5.1.1 *Essay one (Arenson, 2022) should be consulted*

Motor-mouth theory, essay one, proposed that a brainstem articulation maintenance function is occurring during REM-state-sleep (RSS) and HLD-type dreams. To say it shortly, both waking saccades (w-REMs) and sleeping saccades (s-REMs) may activate the language network. What is the extent of such function as performed by the s-REMs? In my earlier work, I cited and briefly discussed some studies supporting language activation by saccades: (Andrillon et al 2015; Miyauchi, et al., 2009; Dehaene-Lambertz et al., 2018; Zhou & Shu 2017; Zhou et al 2018). If their findings are accepted, it helps anchor the Motor-mouth theory that says that linguistic dreams of the HLD-type were adapted to maintain the motor aspects of articulation during RSS. Motor-mouth theory proposes that dreams began in order to assess and maintain a consistency, the qualia of pronunciation of words, to allow speech to be effective at communication. We know that accent is localized in time and place, and only changes slowly or with distance.

When you report a dream using Holophrasis, use the fewest words or an idiom that will answer Pavlov's question: ("Shto Takoe?") 'What is it' in your dream scene that you wake up with. (This is not specifically an orienting reflex, but there is a parallel where one is triggered by a saccade, and the OR may well activate in a similar way that is used in deciphering a recalled dream scene.) It seems unlikely that the brainstem assessment of the articulation of the chosen words needs the dreamer to tell the dream aloud or even sub-vocally, when she awakens. It seems a good possibility to me that the brainstem has access to the dream report's phonology via a saccade. Saccades have many activation locations, it appears, and some are in the brainstem (Wong, 2014). Such a saccadic trigger location may allow the brainstem to experience the articulation in the set-up for the speech in dreams and in this way meets its maintenance needs. The speech in dreams is a hallucination, of course. The awake report of a dream is a report on a hallucination. Motor-mouth theory predicts that the brainstem takes no notice of the meaning of the words it is assessing when using the articulation present in the dream experience and report. Meaning of a word is context-dependent and is aside from articulation maintenance. Very few words change their

phonology (articulation) when their meaning changes – at least not in English.

The dreams images are constructed by phonology to orthography conversion of the words in mind at the time we fall asleep or enter REM or begin to dream. This occurs before or when the dreams images are created. When you report the dream, the conversion is reversed. Note that this process of converting a dream's images into phonology in the dream report often occurs at the expense of adding bizarreness or making the bizarre manifest in the dream report, judged from a narrative perspective in awake reality.

This use of Holophrasis feels most appropriate to report a HLD-type dream, because it captures the true context in a few words or an idiom. A pun often emerges by de-concatenation of the initial one or two word reports to yourself as you first awaken. Ask "what was that about?" Often the answers are a multi-syllable run-on word or several such words. The true context observable will be on a topic that was on the dreamer's mind, a concern at the time of the dream for some reason. Using holophrastic also avoids confabulation of a narrative arc in the dream report of a long scene, or especially between scenes. There is rarely, if ever, any actual arc of narration between scenes, at least one that existed before the report was under construction. The *true context* means the topic is of concern to the dreamer, and that usually will be grounded in true, awake, reality not DMT's Prime-H version, or so it seems to me.

Notice that the distortion of a word that refers to a concern, whether by de-concatenation or punny context, or other ways, all of which cooks reality in a dream, is likely due to the Prime-H, the underlying hallucinator.

5.1.2 *The relationship between bizarreness and hallucination, who is the judge?*

How do we know which version of reality, the dream or awake, provides the real reality? Which reality is associated with the absence of bizarreness? Is it the DMT reality or is it the un-augmented reality? I adopt the Revonsuo and Salmivalli definition of bizarreness. A dream with any of these three features will cause almost all dreamers to agree that their consciousness of reality during the dream was not the reality the awakened dreamer experiences (Revonsuo and Salmivalli 1995):

- Incongruity (an element inconsistent with waking reality)
- Vagueness (an obscure or indeterminate element)
- Discontinuity (an element suddenly appearing, disappearing or transformed).

Note that test requires the subject being awake to answer. This links "true reality" to the awake consciousness. I offer no suggestion on achieving a god's-eye view to better answer which version is the *real* reality. Is bizarreness only in the eyes of the beholder? We won't go there. It may be pointless to obsess over which is the *real*, un-augmented reality. My bias is that awake reality is the true one. I note that writing and reading in dreams are difficult to do, and rarely work well when present in dreams. Speech by you in the dream, or voices you hear in the dream, are commonplace, however. (They are, of course, hallucinations.) This question was addressed by me, an awake author, and it is read by you an awake reader. We, while awake, agree that

the *real* reality does differ from the augmented dream reality.

The hallucinatory impact of the Prime-H will exacerbate the slippery quality of meaning in dream reports as collected by dream researchers. Beware of Lewis Carroll's famous contribution to the meaning of words that may be manifesting Humpty Dumptyism. (Lewis Carroll, 1871). Images also may be twisted by the Prime-H but I deal with words here.

This leads to a typical error in Content Analysis, perhaps unintentionally set-up even though it helps them. It is sometimes made by the practitioners of CA who follow the classic Hall or Domhoff method, where they read or listen to the words of a dream report, and seize on one meaning among many possibilities, and are indifferent to the true context that the dreamer may have had in mind by the words in the dream report, had they but asked, or had they framed the question so that an option of self-reference was fairly offered as a choice.

5.1.3 Who says cats (or infants) dream?

Michel Jouvét performed lesion surgery on the brainstems in cats in order to deprive them of the atonia-on switch, (Sastre & Jouvét, 1979). Those that survived, then walked about in REM-state-sleep. It seemed to me they could more easily be seen as acting out the variety of motor activities that would have been assessed by a twitch if atonia still was working in them, but Jouvét chose to believe they were dreaming – and that opinion was adopted (Schenck et al, 1985, 1986) by the physicians who announced the discovery of REM Behavior Disorder (RBD). Schenck et al, vigorously claim the patients are acting out their dreams. They base this on, and accept, the claim that Jouvét's cats also acted out their dreams.

RBD experiments that attempt to match patients behaviors observed and videoed during episodes of RBD with that patients' dream reports are weakly negative, overall (Valli et al., 2012). Blumberg says the RBD impact on dreams is more likely to result in dream incorporation after a brief awakening, than dream enactment (Blumberg & Plumeau, 2016). I agree. This needs fewer assumptions than dream enactment – so Occam's razor applies. There is no advantage to dream science in claiming without evidence that cats dream; even less that they act out their dreams. Are their calls meaningful? Provide evidence of that and I'll be happy to reconsider if they dream. Jouvét's stature as a pioneer researcher of atonia remains worthy of great respect. Similar doubt applies to infant dreams. New-born human infants spend half their 16 hours per day of sleep time in REM. In his 1999 book on "Children's dreaming...", David Foulkes lays out the problem with presuming that "young children, infants or dogs" are capable of generating or experiencing an "ongoing dream narrative". He sums up on this point (Foulkes, 1999):

In the face of these conceptual and empirical problems, the persistence with which the possibility of infantile (and animal) dreaming is defended stems in large measure from an implicit equation of dreaming with perception. If an organism gives evidence that it can perceive a reality, then we are prone to imagine that it can dream one as well. ... (however) there is a big difference between seeing the real world and seeing a dream world. ... dreaming creates patterns that have never been experienced before...

I agree with that. But problems arise when it comes to placing the dream in one category or another in Content Analysis, firstly, as to the meaning of words when the dreamer is not asked for *context* which controls the original meaning of the words in their dream reports; and secondly, by the topic in this essay, as to which reality will be used to judge the supposed Continuity Hypothesis, the reality of the awake existence or the reality that results from the DMT's Prime Hallucination?

5.2. Explanation

5.2.1 Others researchers are aware of Prime-H

Of course, other dream scholars have long been aware of this Prime-H (however called) but nobody has proposed DMT as the source of the Prime-H where our reality is freshly cooked-up in a dream. It goes by different names or descriptions. For a contemporary example, we see Canadian neuroscientist/philosopher, Melanie Rosen, referring in her essay (Rosen, 2021) to what I call the Prime-H, but she describes it as a generator of "a sense of agency" inside the dream as it is experienced. Perhaps she will elaborate on her suggestion in future work. I find that "Agency" is now a vague term due to its many current users, but if she used her full phrase a "sense of agency" to mean the somewhat different "sensation of agency", it reminds me of a breakthrough use of "sensation", for a concept in the theory of consciousness (Ginsburg & Jablonka [1] 2007; Ginsburg & Jablonka [2] 2007). These two Israeli neuroscientists, Simona Ginsburg and Eva Jablonka proposed a model where consciousness begins when an organism begins to experience sensation. They refer to this sensation as "a global sensory state that we call *overall sensation*". They propose the existence of "an evolutionary route for the transition from sensory processing to unlimited experiencing, or *basic consciousness*." It is unlikely that they were thinking of the "basic consciousness" as including augmented reality, which would be dependent on a DMT-like substance. I hope they correct me, if they were.

Returning to Rosen's idea, to care for ourselves while awake we experience a sensation of agency as we go about our daily affairs. The Prime-H seems to aim for faking that same level of attention or arousal as might be expected in the ordinary, awake, real world. DMT can be seen to be designed to guard against our awareness of bizarreness in the dreams events. The dreamer, instead, feels a sensation of her usual normal as if she was out and about in the real world regardless of how much more extreme the events might seem to her (or us) awake. Also, take note that we can be scared out of our wits in real-life no less than in a dream. DMT is a great equalizer during dreams, in this regard. The Prime-H replaces or distorts our judgment of the likelihood of the dream events, during the dream. The Prime-H creates or allows a dream reality that is often very bizarre, but disregarded. Evidently, this DMT induced capacity for false belief is essential for the dreams function properly to occur, or we would not experience the hallucination of being out and about in real life. Since Motor-mouth theory posits that the dream's purpose is articulation maintenance, the meaning of anything spoken in the dream is a matter of indifference unless meaning affects the phonology of that speech. The motor apparatus of articulation is fully and absolutely responsible for phonology. The apparatus can be tweaked or

practiced by the brainstem, without regard for meaning. All theories of dreams that claim, or aim, or intend, to decipher meaning, fail on this basis. Searching for a dream's meaning just for the fun of it, or for the self-knowledge of what's on our mind, is not disqualifying, however.

5.2.2 *Motor maintenance assesses voluntary muscle response by detecting a twitch in response to a motor command, when atonia is on and working.*

Three years earlier than the recent Rosen paper, a study in Scotland also used the agency metaphor, (Speth & Speth, 2018) while discussing hallucinatory states during RSS dreams, which they treated as “embodied cognition”. I understand “embodied cognition” to mean when motor activity is occurring in the dream. Since speech is motor activity, any dream with talking or listening to talk, qualifies. Of course, then it begins to overlap with Motor-mouth theory and there are similarities between the Speths' view and mine when such dreams are considered. The main difference between us arises because we have different theories of the source and purpose of these RSS dreams, the HLD-type. Their theory seems to be aligned mostly to Hobson's activation-synthesis view of dreams (Hobson & McCarley, 1977), one of numerous theoretical versions of my category: ‘this is not a Freudian dream theory’, which includes Motor-mouth theory. In the present debate among dream researchers over the received wisdom, such theories do agree, as I do, that Freud's dream theory can't be right, (not necessarily for the same reasons) but none explain the anomalies, as is done by Motor-mouth theory, nor account for the Prime-H.

5.2.3 *During REM, RBD patients' voluntary muscles do not twitch, they vigorously react (De Cock et al, 2007)*

The Speth's cite a paper that was titled “Restoration of normal motor control in Parkinson's disease during REM sleep” (De Cock et al. 2007). I found in that paper specific evidence of the implicit conjecture in my earlier essay (Arenson, 2022) where I referenced the supposed “acting out” of dreams in patients with REM Behavior Disorder (RBD).

This element concerns twitching muscles during RSS in healthy subjects. Viewed from Motor-mouth theory, one can predict that the usual adult motor assessment during RSS will lead to twitching of the voluntary muscles during the atonic periods of RSS, at least in those without RBD. But this behavioral tell will be missing in those with RBD. With RBD one is immune to the atonia-on signal. With RBD's immunity to atonia, the RSS muscle activation signal sent for assessment purposes causes full muscle movement. Atonia usually filters most of the signal to the voluntary muscles so only a twitch gets through in those without RBD.

In those with RBD, who were now immune to the atonia-on signal, the same motor-maintenance operations resulted in fully activating that muscle, (leading the RBD discoverers to imagine that dreams were being acted out.) I cited a study that could not confirm the dream enactment conjecture (Valli et al 2012). But, I had no positive evidence, until the De Cock et al study observed this tell in their population of subjects with RBD who slept in their lab – the most disabled arm, hand or leg was moving most, a spectacular finding. As De Cock reports (at p. 454):

Movements were realized with the same strength, am-

plitude and speed as what could be observed in healthy, awake subjects. Despite the fact that the movements were in the normal range, their aspect was jerky, violent and often duplicated. While all patients had asymmetrical Parkinsonism when awake, they used more often the most disabled arm, hand and leg during RBD (P =0.04)

The De Cock report states further in their discussion (at p. 455):

Patients move their disabled side more often. This improvement is particularly remarkable if one realizes patients are off levodopa for 12–20 h. There is no bradykinesia, or clinical tremor as observed in untreated patients with Parkinson's disease. In addition the improvement is also observed in the most severely disabled patients.

Why is the disabled limb singled out for the activity? How is it able to move as observed? In the De Cock et al study we may be seeing the brainstem assessing and maintaining the motor system by working on the more disabled muscles preferentially –just what you would expect for REM, where brainstem circuits were adapted to maintain the fitness of the motor system. Here, Motor-mouth theory is supported in its view that the function of REM is to assess and maintain motor activity.

At the same time, another nail is hammered through the hand of a dream enactment explanation for RBD. There is no evidence of dream enactment that is not equivocal, and now, there is no theoretical expectation of any. Dream enactment is a false god and is hindering the development of RBD theory.

5.2.4 *Freud used the unconscious as the stepping off place to free association. It was a metaphor. No foot can find that step*

Notice that we are not obliged to buy into the Freudian or Jungian view of the unconscious as a function in our brains. It is enough for those theories if one views the unconscious as a metaphor. The unconscious was conceived as the storehouse of dreams. But that was then. Now, we need not believe any theory of the psyche containing a veridical unconscious. I see few claims of evidence of a biological mechanism that operates an “unconscious”. It is dreary that some philosophers make claims that rely on the unconscious with arguments using philosophical abstractions, such as the kind presented by D. C. Dennett, a much admired contrarian. His creation of “cassette theory of dreams” required a series of steps into the supposed unconscious warehouse that Dennett uses in order to “prove” his case – in which he claims that we make up dreams in the instant we wake-up – and that dreams are actually false memories created instantaneously on awakening (Dennett, 2005). Notice that he heavily relies on the unconscious: Dennett starkly illustrates the potential mischief of the unconscious to serious dream research.

For over a decade after this cassette theory appeared, Dennett's use of the unconscious had the effect of degrading the efforts of some serious dream researchers. As far as I know he reveled in that influence. So, it is useful to know that the cassette theory was rebutted. If not specifically mentioned, then by implication, Dennett's reasoning was apparently refuted when Siclari et al, (2017) reported evidence that allowed them to correctly predict, during the course of REM, that a dream of a face was occurring, with-

out awakening the subject. The prediction was possible because the special EEG set-up detected localized brain activity that they suspected was dream associated, and their technique included a focus on a specific brain region associated with visual experiences, which was in the fusiform face area located in the inferior temporal cortex, in the fusiform gyrus, and which is accepted to be the area of the brain that recognizes a face – a visual processing matter. Note that this information was present in the EEG record before the subject was awakened, and after awakening the predicted image of a dream of a face was confirmed by the dreamer's report, (Siclari et al 2017). So, the dream was not confabulated at the instant of awakening as required by Dennett's argument, and for which he needed a handful of instances of theoretical operations where he dipped back and forth into the unconscious to build the argument, now contradicted by evidence and therefore now proven to be wrong. So, this is a decade's long weeping injury caused to dream research that depended on the supposed existence of an unconscious.

One alternative to no unconscious is that there is an unconscious, and if so one can give Dennett his due and disbelieve Dr. Siclari's results and abandon dream research. On the other hand, we can abandon the unconscious and its misusers and mischief makers who wish to see us lose our grip on the public's interest in dream research. Ridding dream science of the unconscious will rid us of these clever but ultimately meaningless distractions, a win-win result. Phooey! I spit out the unconscious, along with Cassette Theory.

If more is needed, notice that no consensus exists on what brain organs or structures or operations provide the biological support needed for the putative operations of the unconscious. This type of flaw ended Noam Chomsky's theory of a biological organ for his supposed law of grammar, which, decades after it was shown to be anatomically absent in a variety of rapidly developing medical imaging techniques, finally he withdrew as a claim that all grammar originated in his Chomskyan language organ.

If Freud were alive today I believe he would forswear the unconscious, just as he forswore the notion of wish fulfillment as the origin of dreams in the face of PTSD's recurring dreams of trauma after World War I. There has been no gap in the efficacy of his therapy since then. Free association, the key step in analysis, functions just as well from the clients admissions of angst and anguish uncovered after a discussion with the analysand about his or her issues that brought them in. Ella Sharpe called the puns in dream reports Poetic Diction. She showed how useful the awareness of such puns was to this central technique of Freudian therapy – free association (Sharpe, 1937). I do not claim that she disbelieved the existence of the unconscious. If she were alive today, I do think she also would no longer believe it was needed except perhaps as a metaphor.

Recognizing DMT as the source of the Prime-H gives us an opportunity to reconsider whether we need to believe in the existence of an unconscious.

5.2.5 *The Zeitenwende may recast Content Analysis as a theory neutral method of organizing dream content*

Professor Katja Valli is another of my cherished mentors, although decades younger. She offers an interesting and novel alternative reading on Content Analysis (CA). She pro-

poses that one can save CA, not as a theory of dream interpretation, necessarily, but as a "theory neutral method" of organizing the content of dream thought (Katja Valli, Personal communication, 2018). This may be possible. A new set of categories may need to be developed. The categories are organized according to certain characteristics when dreams are told as stories, with a narrative arc. A list is found in Revonsuo and Salmivalli (1995). Researchers following CA use the story-like assumption of context to assign meaning to the words in a dream report. I view the story-like narrative as artefactual, and due to the dreamer having been taught to tell her dreams in that way. My view is: "No story here, folks. Move right along." The categories of Content Analysis are to my Cipher-method of listening for meaning – (where "Cipher-method" is a name I borrow from Freud's word in German, "Chiffriermethode") – like non-commuting operators in Quantum Mechanics. They are similar to the wave – particle duality, the two meanings of which can rarely if ever co-exist at the same time: One is based in a story arc and the other is based in the true context. That is part of a fundamental truth about words and their meanings. The categories of Content Analysis will need to be reconfigured if used with Motor Mouth theory. I also note that the German language, which gave Freud 'Chiffriermethode', has recently enabled Germany's Chancellor Olaf Scholz to coin a zinger, 'Zeitenwende', used recently by him to mean "an epochal tectonic change". Is this one? One must wait an epoch or two to know.

5.2.6 *"Chaos or (O)kay us", a dream report deconcatenated*

Early in this essay, I promised a new example dream to illustrate Motor-mouth theory: Here is a dream I heard from a college age woman I know well. The dreamer reported a night-full of dreams of situation-comedies based on current TV programs that were "off", that is, where the actors were "not behaving in character". She explained it as having lots of "Incongruity; Vagueness and Discontinuity" (my paraphrase).

She summarized it in these words:

"Chaos: It was just chaos".

The true context was a week-long visit with her Canadian maternal grandmother who was showing periodic signs of dementia. But, the visit was heartening and sweet and easy and she grew closer still to her aging grandmother, who was mostly lucid and was able to tell fascinating stories of the grandmother's youth and the dreamer's mother, despite having word finding problems from time to time. The dreamer was on her way to her home in Georgia, in the US south, where her sister lived and where she then lived with her caring father, where she had competed an undergrad degree, and where her life was hopeful and promising considered against the stories she heard of her grandmother's life as a girl and young woman. It seemed that "Chaos" could use a catachrestic de-concatenation into two words:

"(O)kay, us."

Her face lit up in recognition as she agreed with this. I call this the "aha". It is the best evidence that the *true context* has been found for the words that describe the dream images of your own or another's dream. Her life in Georgia, close to sib and father was "okay, us", and her future held

promise, and she was affirming this to herself in that dream.

Perhaps you can see from this example how attention to the simple, obvious, meaning at the level of speech sounds, while focusing on the fewest words in the report that can report that meaning was the key insight. When this idea first clicked for me, it led me to Motor-mouth theory, which often will eschew whole words as units of a narrative and view them as collections of speech sounds as they are articulated. This idea then led me to the hypothesis (and epiphany) that REM sleep originally began as an adaptation for, and was tasked with, motor maintenance, and when speech began, long, long after REM's motor maintenance function helped produce efficient motor activity, which became a hallmark of successful chordates (animals of a class including vertebrates and some invertebrates), then REM dreams began or were adapted to maintain the motor activity of speech through articulation maintenance, so that the utility, use, and value of the motor aspects of speech would be maximized just as motor activity in general had been, and so that everyone in the community was listening for and articulating the same pronunciation for words the dreamers had in mind as they slept during REM.

Partial prior discovery, acknowledged

I acknowledge that in his book "Inner Presence: Consciousness as a Biological Phenomenon" (Revonsuo, A. 2006), Antti Revonsuo, offered a wider view of the notion that hallucination is built into our perception; one that includes dreams but also waking perception. There, he "postulates the idea that everything our brain creates is a simulation, only during waking that simulation is based on sensory stimuli (the brain creates the world for each of us, differently) while in dreams the brain's internal activity is the basis of the simulation...He, however, does not speculate on what the neurochemical basis is". (Personal communication, Prof. Katja Valli, 2018)

Partially prior publishing (by me), acknowledged

This manuscript contains terms and ideas that have been partially published among several blog posts at Wordpress.com, in my blog "Dreams the Cipher Method", in particular, 47th Post, 14 April 2018. <https://dreamstheciphermethod.wordpress.com/2018/04/13/when-women-and-mice-are-awake-is-reality-partly-a-hallucination-if-so-it-may-explain-hallucinations-in-dreams-and-both-may-be-due-to-a-neurotransmitter-nn-dimethyltryptamine-dmt/>

Literature

- Andrillon, T., Nir, Y., Cirelli, C., Tononi, G., & Fried, I. (2015). Single-neuron activity and eye movements during human REM sleep and awake vision. *Nature communications*, 6, 7884.
- Arenson, KM., (1987). Linguistic devices in metaliteral dreams. *Psychiatric Journal of the University of Ottawa*. https://www.academia.edu/9123990/Linguistic_Devices_in_Metaliteral_Dreams
- Arenson, KM., (2022), Motor-mouth theory: The case for a REM dream type as probes for motor maintenance of articulation, *IjoDR*, vol 15, No 1 (April 2022), DOI: <https://doi.org/10.11588/ijodr.2022.1.82192>
- Aristotle. *De Somnis*. (1941) In: "The Basic Works of Aristotle", McKeon R. (Editor), New York, Random House,
- Aserinsky, E., (1971). Rapid eye movement density and pattern in the sleep of normal young adults. *Psychophysiology*. May;8(3):361-75
- Berger RJ., (1967). "When is a dream a dream", *Exp. Neurol.*19 (Monogr. Suppl.4):15, 1967
- Blumberg, M. S., Plumeau, A. M. (2016). A new view of "dream enactment" in REM sleep behavior disorder. *Sleep medicine reviews*. Dec 1;30:34-42.
- Carroll, Lewis (1871) *Through the Looking-Glass*, https://en.wikipedia.org/wiki/Through_the_Looking-Glass
- Cleveland Clinic, (2022), "Norepinephrine: What It Is, Function, Deficiency & Side Effects. <https://my.clevelandclinic.org/health/articles/22610>
- Dean, J.G., Liu, T., Huff, S., Sheler, B., Barker, S.A., Strassman, R.J., Wang, M.M. and Borjigin, J., (2019). Biosynthesis and extracellular concentrations of N, N-dimethyltryptamine (DMT) in mammalian brain. *Scientific reports*, 9(1), 1-11.
- De Cock, V. C.; Vidailhet, M.; Leu, S.; Texeira, A.; Apartis, E.; Elbaz, A.; Roze, E.; Willer, J. C.; Derenne, J. P.; Agid, Y.; Arnulf, I. (2007). Restoration of normal motor control in Parkinson's disease during REM sleep. *Brain*, 130(2), 450-456. Doi:10.1093/brain/awl363
- Dehaene-Lambertz, G., Monzalvo, K., & Dehaene, S. (2018). The emergence of the visual word form: Longitudinal evolution of category-specific ventral visual areas during reading acquisition. *PLoS biology*, 16(3), e2004103. <https://doi.org/10.1371/journal.pbio.2004103>
- Dennett, D. C. (2005). *Sweet dreams: Philosophical obstacles to a science of consciousness*. MIT press.
- Dodgson, (2018), A little-known hallucinogenic drug called DMT takes people to a place that feels 'more real than real' — here's what researchers know about it, *Business Insider*, NYC. 180329 <http://www.businessinsider.com/the-research-on-the-hallucinogenic-drug-dmt-2018-3>
- Domhoff, GW., (2019), *The Neurocognitive Theory of Dreams at Age 20: An Assessment and a Comparison With Four Other Theories of Dreaming*, *Dreaming*, American Psychological Association 2019, Vol. 29, No. 4, 265-302 doi.org/10.1037/drm0000119
- Dreaming*, ISSN: 1053-0797 eISSN: 1573-3351 Published: quarterly, beginning in March. This journal is a publication of International Association for the Study of Dreams
- Dubuc, B., (2018) "The Brain from Top to Bottom: Site developed, researched, and written by Bruno Dubuc, and Funded by Canadian Institute of Neurosciences, Mental Health and Addiction, retrieved 180413 http://thebrain.mcgill.ca/flash/i/i_02/i_02_cr/i_02_cr_vis/i_02_cr_vis.html
- Eichenlaub, JB., van Rijn, E., Gaskell, M. G., Lewis, P. A., Maby, E., Malinowski, J. E., Walker, M. P., Boy, F., & Blagrove, M. (2018). Incorporation of recent waking-life experiences in dreams correlates with frontal theta activity in REM sleep. *Social cognitive and affective neuroscience*, 13(6), 637-647. <https://doi.org/10.1093/scan/nsy041>
- Fontanilla, D., Johannessen, M., Hajipour, A. R., Cozzi, N. V., Jackson, M. B., & Ruoho, A. E. (2009). The hallucinogen N, N-dimethyltryptamine (DMT) is an endogenous sigma-1 receptor regulator. *Science*, 323(5916), 934-937.
- Foulkes, WD., (1962). Dream reports from different stages of sleep.. *The Journal of Abnormal and Social Psychology*, 65(1), 14-25. Doi:10.1037/h0040431
- Foulkes, D., & Vogel, G. (1965). Mental activity at sleep onset. *Journal of abnormal psychology*, 70(4), 231.
- Foulkes, D., Spear, PS., & Symonds, J. D. (1966). Individual differences in mental activity at sleep onset. *Journal of Abnormal Psychology*, 71(4), 280.
- Foulkes, D. (1967), "Nonrapid eye movement mentation", *Exp.*

- Neuro1. 19 (Monogr.Suppl.4):28,
- Foulkes, D. (1999) *Children's Dreaming and the Development of Consciousness*, Harvard University Press, location 110 of 1736, Kindle edition
- Ginsburg, S. & Jablonka, E. (2007).[1], The Transition to Experiencing. Limited Learning and Limited Experiencing. *Biological Theory*, 2(3), 218–230. Doi:10.1162/biot.2007.2.3.218;
- Ginsburg, S. & Jablonka, E. (2007). [2], The Transition to Experiencing. The Evolution of Associative Learning Based on Feelings. *Biological Theory*, 2(3), 231–243. Doi:10.1162/biot.2007.2.3.231
- Hain, TC., (2018) <http://www.dizziness-and-hearing.com>. Retrieved 27 Mar. 2018. <https://www.dizziness-and-balance.com/practice/saccades/slow%20saccade.htm>
- Hobson, J. A., & McCarley, R. W. (1977). The brain as a dream state generator: an activation-synthesis hypothesis of the dream process. *The American journal of psychiatry*.
- Holzinger, B., Saletu, B., & Klösch, G. (2020). Cognitions in sleep: lucid dreaming as an intervention for nightmares in patients with posttraumatic stress disorder. *Frontiers in Psychology*, 11, 1826.
- Hume, D. (1748), Wiki https://rationalwiki.org/wiki/Extraordinary_claims_require_extraordinary_evidence
- Hunt, HT., (1989). *The multiplicity of dreams: Memory, imagination, and consciousness*. Yale University Press, at p. 29, and p. 192
- Kuiken, D., (1995) *Dreams and Feeling Realization Dreaming*, Vol 5(3), 129-157. <http://dx.doi.org/10.1037/h0094431>
- Kuiken, D., Bears, M., Miall, D., & Smith, L. (2001). Eye movement desensitization reprocessing facilitates attentional orienting. *Imagination, Cognition and Personality*, 21(1), 3-20.
- Lemyre, Alexandre & Bastien, Celyne & Vallières, Annie. (2022). The feeling priming theory (FPT) of dreaming. *Dreaming*. 10.1037/drm0000202.
- Ligand-Receptor binding <https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/signal-transduction/a/signal-perception>
- Montangero, J. (2018) *Dreaming and REM sleep: History of a scientific denial whose disappearance entailed a reconciliation of the neuroscience and the cognitive psychological approaches to dreaming*, IJoDR v.11, No. 1. <https://scholar.archive.org/work/fo6dlrufoveedfjhdbzowjwbqpe/access/wayback/https://journals.ub.uni-heidelberg.de/index.php/IJoDR/article/download/42384/pdf>
- Morrison, AR., (1983). Paradoxical sleep and alert wakefulness: variations on a theme. *Sleep disorders: Basic and clinical research*, 95-122; Morrison, A. R., & Reiner, P. B. (1985). A dissection of paradoxical sleep. *Brain mechanisms of sleep*, 97-110.
- Miyauchi, S., Misaki, M., Kan, S., Fukunaga, T., & Koike, T., (2009). Human brain activity time-locked to rapid eye movements during REM sleep. *Experimental brain research*. Feb 1;192(4):657-67.
- Nash, JR., Wilson, S. J., Potokar, J. P., & Nutt, D. J. (2003). Mirtazapine induces REM sleep behavior disorder (RBD) in parkinsonism. *Neurology*, 61(8), 1161-1161.
- Nir, Y., Staba, R. J., Andrillon, T., Vyazovskiy, V. V., Cirelli, C., Fried, I., & Tononi, G. (2011). Regional slow waves and spindles in human sleep. *Neuron*, 70(1), 153-169.
- Revonsuo, A., & Salmivalli, C. (1995). A content analysis of bizarre elements in dreams. *Dreaming*, 5(3), 169.
- Revonsuo, A. (2006). *Inner presence: Consciousness as a biological phenomenon*. MIT Press.
- Rosen MG., (2021). *Sleeper Agents: The Sense of Agency Over the Dream Body*. *Human Studies*, doi:10.1007/s10746-021-09598-z
- Sastre, JP., & Jouvet, M. (1979). Le comportement onirique du chat [Oneiric behavior in cats]. *Physiol Behav*, 22, 979-89.
- Schenck, CH., Bundlie, S. R., Ettinger, M. G., & Mahowald, M. W. (1986). Chronic behavioral disorders of human REM sleep: a new category of parasomnia. *Sleep*. Jun 1;9(2):293-308.
- Shapiro F. (1989), Eye movement desensitization: A new treatment for post-traumatic stress disorder, *Journal of Behavior Therapy and Experimental Psychiatry*, v. 20., pp 211-217
- Shapiro, F. (1996). Eye movement desensitization and reprocessing (EMDR): Evaluation of controlled PTSD research. *Journal of behavior therapy and experimental psychiatry*, 27(3), 209-218.
- Sharpe, E. F. (1937). *Dream Analysis: A Practical Handbook of Psychoanalysis* (Maresfield Library). (2012-07-16). Karnac Books. Kindle Edition, (available at Amazon)
- Siclari, F., Baird, B., Perogamvros, L., Bernardi, G., LaRocque, J. J., Riedner, B., ... & Tononi, G. (2017). The neural correlates of dreaming. *Nature neuroscience*, 20(6), 872.
- Speth, C., & Speth, J. (2018). A new measure of hallucinatory states and a discussion of REM sleep dreaming as a virtual laboratory for the rehearsal of embodied cognition. *Cognitive science*, 42(1), 311-333.
- Strassman, RJ., & Qualls, C. R. (1994). (No.1) Dose-response study of N, N-dimethyltryptamine in humans: I. Neuroendocrine, autonomic, and cardiovascular effects. *Archives of general psychiatry*, 51(2), 85-97.
- Strassman, RJ., Qualls, C. R., Uhlenhuth, E. H., & Kellner, R. (1994). (No. 2) Dose-response study of N, N-dimethyltryptamine in humans: II. Subjective effects and preliminary results of a new rating scale. *Archives of general psychiatry*, 51(2), 98-108.
- Strassman, RJ.. (1995). Human psychopharmacology of N, N-dimethyltryptamine. *Behavioural brain research*, 73(1-2), 121-124.
- Strassman, R., (2018) blog, Retrieved 2018.04.13, <https://www.rickstrassman.com/why-wont-dmt-go-away/>
- Su, TP., Hayashi, T., & Vaupel, DB. (2009). When the endogenous hallucinogenic trace amine N, N-dimethyltryptamine meets the sigma-1 receptor. *Science signaling*, 2(61), pe12-pe12. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3155724/pdf/nihms313890.pdf>
- The Recovery Village | Editor Jonathan Strum, Last Updated: July 27, 2022 <https://www.therecoveryvillage.com/ayahuasca-addiction/>
- Tucker, E., Muir, J., Ziff, B., eds (2012) *Property on Trial: at ch. 10, "Manitoba Fisheries v. The Queen, The Origins of Canada's De Facto Expropriation Doctrine,"* by Phillips J., & Martin, J. pp. 259-302; and 501-503, published by The Osgoode Society for Canadian Legal History by Irwin Law
- Tulving, E. (1972). *Episodic and semantic memory*.
- Valli, K., Revonsuo, A., Pälkäs, O., Ismail, K. H., Ali, K. J., & Punamäki, R. L. (2005). The threat simulation theory of the evolutionary function of dreaming: Evidence from dreams of traumatized children. *Consciousness and cognition*, 14(1), 188-218.
- Valli, K., Frauscher, B., Gschliesser, V., Wolf, E., Falkenstetter, T., Schoenwald, S. V., Ehrmann, L., Zangerl, A., Marti, I., Boesch, S. M., Revonsuo, A. (2012). Can observers link dream content to behaviours in rapid eye movement sleep behaviour disorder? A cross-sectional experimental pilot study. *Journal of sleep research*. Feb;21(1):21-9.
- Valli, Katja, (2018) Personal communication, 18.04.18
- Van de Castle, R. (1994) "Our Dreaming Mind", Ballantine Books

- Wang, J., Saul, A., Roon, P., & Smith, S. B. (2016). Activation of the molecular chaperone, sigma 1 receptor, preserves cone function in a murine model of inherited retinal degeneration. *Proceedings of the National Academy of Sciences*, 113(26), E3764-E3772. <http://www.pnas.org/content/pnas/113/26/E3764.full.pdf>
- West, L.J., Janszen, HH; Lester, BK; Cornelisoon, FS, Jr. (1962). *The Psychosis Of Sleep Deprivation*, 96 *Annals New York Academy of Sciences*, 66–70. doi:10.1111/j.1749-6632.1962.tb50101.x
- White, AD., (1897). *A history of the warfare of science with theology in Christendom*: 119. D. Appleton and Co. New York, N.Y.
- Wikipedia, (2018) retrieved 2018.04.13, https://en.wikipedia.org/wiki/Receptor_antagonist
- Wikipedia, (2023) retrieved 2023.01.10, <https://en.wikipedia.org/wiki/Chordate>
- Wong, AMF., (2014). *Encyclopedia of the Neurological Sciences* || Eye Movements; Saccades. 249–251. doi:10.1016/b978-0-12-385157-4.00129-9
- Zhao, J., Mysona, B. A., Wang, J., Gonsalvez, G. B., Smith, S. B., & Bollinger, K. E. (2017). Sigma 1 receptor regulates ERK activation and promotes survival of optic nerve head astrocytes. *PLoS One*, 12(9), e0184421
- Zhou, W., Shu, H. (2017). ["Overlay study"] A meta-analysis of functional magnetic resonance imaging studies of eye movements and visual word reading. *Brain and behavior*. 7(5), e00683. <https://doi.org/10.1002/brb3.683>
- Zhou, W., Xia, Z., Georgiou G. K., Shu, H. (2018) ["Circuit formation study"] The Distinct Roles of Dorsal and Ventral Visual Systems in Naming of Chinese Characters. *Neuroscience.*; 390, 256-264. <https://doi.org/10.1016/j.neuroscience.2018.08.024>