Katja Valli

On Dreaming

Interview with Richard Bright (Editor: Interalia Magazine)

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Richard Bright: Can we begin by you saying something about your background?

Katja Valli: I trained in psychology and, very early on, when doing my Masters, I was already very interested in evolutionary biology, and studied it independently. In our psychology training, evolution was not mentioned, even once. It was also the same with sleep, I think we had only one forty five minute lecture on sleep. Sleep was an area that intrigued me and when it became time for me to choose a topic for my Masters I ran into Professor Antti Revonsuo, who was also interested in dreaming and evolution. I did my Masters on the biological function of dreams in 1999 and my Phd on the same topic in 2008. So, my background training in psychology indirectly linked to this interest in evolutionary biology, psychology, sleep and dreaming. All those combined, and twenty years later I'm still working on sleep, dreams, and evolutionary psychology.

RB: Your research focusses on sleep and dreaming. What function does dreaming serve?

KV: This is a tricky question, because we don't know. We don't even know whether it serves any function at all. Similarly, the function of sleep remains a mystery. When we study sleep we always ask 'What is the function of sleep?' instead of asking the question 'What is the function of waking consciousness?' We are actually doing the same thing with dreaming, we are asking 'What is the function of dreaming' instead of asking 'What is the function of having experiences during wakefulness?'

My take on the issue is, awake and sleep, and waking consciousness and dreaming consciousness, shouldn't be studied separately, but they are two sides of the same coin. If the waking consciousness has a function, and very few doubt it has, then I think that what the dream consciousness does is either reflect this function, or if dreaming has some sort of additional function then it must be very closely related to the wider function of waking consciousness. So, maybe dreaming is just the side effect of having experiences while awake, and we keep on having experiences while asleep because we can't shut down the brain while asleep. I think we still have to take into account the possibility that, even if dreaming originally acted as a side effect of waking consciousness while asleep, then maybe later dreaming became productive for another use, so that dreaming itself started to serve a biological function or an evolutionary function. But as to the question of what function dreaming serves, the jury is still out and I can't even guarantee that it has a function at all, that is, an independent function that it will do something that waking consciousness doesn't do, or that sleep doesn't do.

RB: As you say, it's not an independent function of waking consciousness, it's a continuation of.

KV: I think that the problem is that the question has always been framed as 'does dreaming have a unique function?', and then different types of functions have been suggested, but every time I look at these theories I ask, 'what do these add to the waking state, how well can the brain do these during wakefulness?' If we think in terms of natural selection, and in terms of survival and reproduction functions, selection operates during wakefulness. Sleep in itself is a state that puts the organism into a vulnerable position, so sleep has to add something to waking functions that is so

valuable that sleep was favoured. I think that the same could then apply to dreaming as well, that it could add something to the waking function. It could help someone perform better, or remember better, or function better than during waking hours, because that is when the selection occurs. But I don't think dreaming does anything unique that the waking consciousness does not do at all. Rather, resources are allocated differently during dreaming and waking, and dreaming only adds to the effectivity of functions that also take place during wakefulness. Another option is that dreaming has no function. Maybe it simply reflects what the brain does during wakefulness and then it does the same things during sleep. Conscious experiences cannot be completely turned off during sleep.

RB: What is the definition of an altered state of consciousness and what kind of states are there?

KV: First of all, an altered state of consciousness is notoriously hard to define, but I think what pretty much everyone agrees is that it needs to be temporary and reversible. If it's a permanent state, even though it's altered, then it's not a real altered state. For example, a comatose patient who never wakes up is not in an altered state because that person cannot return to the normal state of consciousness. The reversibility and the temporal nature are typically how an altered state has been defined against the background state of consciousness. For example, the global pattern of subjective experience is somehow different from the normal baseline consciousness. Then, of course, you run into problems, because how do we define what is a normal state of consciousness? We haven't really been able to define that. Also, what happens is that, sometimes when we have an altered experience, while we are having the experience we have no way of knowing that it is altered, that we are not in our normal waking state of consciousness. For example, dreams are so realistic that they fool us into believing that whatever is going on is occurring 'right now' in the physical realm. Only after we wake up do we realise that it was nothing but a dream. Thus, defining an ASC as a state that is temporarily different from normal state, and that during the experience the person him- or herself knows that s/he is in an altered state, is problematic.

Another way of defining an altered state could be to say that the relationship between the patterns of experience and the typical appropriate causes for that experience have changed, so that experiences can occur without their typical causes, like seeing something in a dream without the physical counterpart of the object. Or that, even though there is a stimuli in the external world the typical cause fails to create the presence of the experience. Also, we can then include the notion that the person understands or recognises that he or she is having, or has just had, an altered state of consciousness. It is not necessary that the person realises that while he or she is having the experience, but that later on understands that, compared to their normal state of consciousness, that experience was different.

A big problem is that it is difficult to define 'normal state' so then it becomes very difficult to define 'altered state', but my suggestion would be to state that in a given altered state the relation between the experience and the typical cause of that experience are somehow pulled apart.

Another thing about defining an altered state is that there is a huge variety of different altered states and coming up with a definition that would encompass all those states is quite difficult. There is dreaming, hypnosis, sleep walking and different types of sleep disturbances where the content of consciousness is untypical, there are drug induced states, mystical experiences, psychotic states, near death experiences and out-of-body experiences, so a definition should cover all the features these states have. It might be difficult to come up with a definition that encompass all the different types of altered state but maybe the definition that I have tried to use can cover most of these

different states – a definition where the experience occurs without an appropriate cause for the experience or where there is an appropriate cause but it is not followed by an appropriate experience. This would cover the majority of the different altered states that there are.

RB: You mentioned a mystical state, which some would argue is experiencing the *actual* reality rather than the *norma*l reality. Mystics universally speak of the '*direct*' contact with *Ultimate Reality* – the 'suchness', the 'isness', that is beyond words, symbols, names, thoughts, images. This would still come under 'altered states'?

KV: Yes, with a mystical state I would say that the person is somehow experiencing, for example, the presence of a higher being or experiencing that he or she can understand the whole universe and the mystery of life becomes clearer. I would say that this would class as an altered state. But are these people really experiencing the world "directly", and have access to the nature of Ultimate Reality, that's an open question.

RB: It is a temporary state, one cannot stay in it, but it can have a profound effect on the person experiencing that state.

KV: Exactly. It can be life-changing.

RB: I would like to ask you about the theories of dreaming. What is the Threat Simulation Theory of dreaming and how does it differ from the Social Simulation Theory?

KV: Threat Simulation Theory basically states that dreaming either evolved, or was later adapted to function as a rehearsal platform. What is being rehearsed are those types of threats and events that are being encountered in the waking life. The Threat Simulation Theory accounts for all different types of threats and we know that many of these are social. The largest category of threats in dreams is aggression, being chased, and it is typically reinforced by other dream characters, not animal characters but other human dream characters. Thus, one of the most prominent types of threats in dreams is social.

Also, when there is a threating event in a dream, whether caused by other humans or not, what can happen is that pro-social behaviour occurs as a response to the threat. For example, people can team up to defend themselves against a common enemy, or people can help each other out, but what the Threat Simulation Theory accounts for are only threats and only social interactions that take place within a threatening event. In itself, the Threat Simulation Theory doesn't say anything about neutral social interactions or positive social interactions, especially those that occur outside of a threatening event.

On the other hand, the Social Simulation Theory says that dreams are a rehearsal platform for social situations, for social perception and social interactions. It doesn't say anything about threats. Of course, social interactions can be positive or negative or neutral. Another problem is that if we talk about negative social interactions it overlaps with the Threat Simulation Theory, as many negative social interactions can be seen as threatening. So, the way we have tried to frame the Social Simulation Theory is that it should focus on explaining social perception and social interactions that are either positive or neutral, because if we want to practise getting along with other persons, and we can only get better at what we practise for, we need to practise positive interactions in order to rehearse 'maintaining or strengthening social bonds'. If we would instead rehearse negative interactions that would not make us better in constructive social interactions with other persons in our waking lives.

So, the biggest difference is that Social Simulation Theory tries to explain why we have neutral and positive social interactions in our dreams, while the Threat Simulation Theory tries to explain why threats are so common in dreams, whether they are of a social nature or not, and many of them are. Both are evolutionary psychological theories of dream function. Both explicitly state that dreams have a function, and it's a biological or an evolutionary function. If we think in terms of selection pressures for our species, of course the physical environment in itself has posed challenges, but it has been suggested that it's especially the social life that has driven the evolution of 'big brains'. So, both Threat Simulation Theory and Social Simulation Theory, in terms of selection pressures, are relevant, and they are partially overlapping theories. I hope that in the future we could actually try to combine these two views.

So far, Threat Simulation Theory is much older and has been empirically tested, not only by me but also by other researchers. But the Social Simulation Theory has not been directly tested. The ideas were proposed at the same time as the Threat Simulation Theory, as a kind of as a critique to the Threat Simulation Theory, but the ideas were not very well defined. We also know a lot about social interactions in dreams, but there's still plenty to do to test the SST. We recently tried to put together a theory that would make explicit hypotheses for empirical studies to be devised and now we have to wait for the empirical evidence to accumulate before that we can say whether or not dreams actually portray social interactions that would support the SST. Do we get practise in social relations in our dreams, and is this practise cost-effective?

We are conducting the first studies and it will take a while to get the data public, so let's see how the Social Simulation Theory holds out.

RB: And you say that the Social Simulation Theory is about fifteen years old?

KV: Yes, because the Threat Simulation Theory was published in the year 2000 and in the many commentaries it was mentioned that this idea of threat simulation was too narrow. There were several researchers who said that dreams could be useful for practising theory of mind, or bonding and attachment, forming relationships and coalitions, make allies and friends, tell enemies apart from friends, but that was it. These were ideas that were thrown in the air and then no theory was developed. But the ideas were good.

We wrote a theoretical article, published this year, where we tried to actually outline what a Social Simulation Theory might be like. What would it predict what we need to find in dreams?

RB: Are there more recent theories that have not been tested yet?

KV: We published our version of the Social Simulation Theory earlier this year and, of course, we have a lot of data of dream content that is relevant. For example, we know that dreams involve a lot of other individuals, 3 or 4 people on average. It's been looked at how much the interaction between individuals is positive or negative. It seems that it's more aggressive than friendly, but actually there is very little information on neutral interactions. I think the majority of interactions in dreams are neutral, but what types of things are actually rehearsed in neutral interactions?. Of course, the question is "Do these have any function, do they train us for anything?" I think that what we need to look at in much more detail is how much of the individuals in our dreams are only perceived, so that there is no interaction whatsoever between the dream self and the other dream characters, and how much there really is interaction, practising this mutual interaction. Then, what types of interactions there are, and how the familiarity of the character affects the interaction. How much is there prosocial or altruistic behaviour, which the Social Simulation Theory predicts there should be a

lot of. Also, how much there is conflict and aggression, which would then fall more into the scope of Threat Simulation Theory.

RB: I remember reading about the various characters in dreams. There is the dream self, of course, and all the other characters in a dream, but that they are all part of one's own psyche. You're not looking at 'another' character, they are all part of you.

KV: It's your own brain that is creating the other characters in your dream, but the funny thing is, you don't know what the other characters are thinking, you don't know what they're going to do next, so even if your own brain creates these characters you cannot control them. You can't predict what they are doing and that, I think, is fair ground to suspect that it's possible that there is a rehearsal function. In fact, dream characters often behave in a bizarre manner, so that they are highly unpredictable, they are not doing anything that they would typically do in a waking world. So, making us train to figure out what other people are going to do, dreams put us on the edge, in a sense. Also, if we think about over half of the characters in dreams are familiar characters, people whom we know, and about half are total strangers, so it is possible that we get a lot of practise in different types of social interactions in dreams. But, as I said, the jury is still out, we have to wait for the empirical evidence to build before we can say whether or not the theory gets supported or not. Then we should consider which one of the theories gains more support, and is there a way to reconciliate between these two theories? Maybe they actually address the same rehearsal issue but from slightly different angles? There is also the possibility that dreams are not a rehearsal at all, and serve no function at all.

RB: What implications do these theories have about the function of consciousness?

KV: We have difficulties defining what a normal state of consciousness is, so what is it that we actually do day-in day-out? Simulation theories could be applied to wakefulness, as well. The funny thing is that we think we are very focussed on the environment and that we see everything that is going on and we easily react to anything that needs our attention, but at least 30%, maybe even 50%, of the time awake our minds are wandering. It seems that the content of 'mind wandering' is very often future oriented, it's simulation based on past experiences but its future oriented. What our waking consciousness seems to be doing most of the time is simulating the future, preparing us for what is to come, predicting how things are going to go based on previous events. Maybe what waking consciousness is for is to enable us to process sensory stimuli, to react adequately to what is going on, and when there are no immediate task demands, simulate what is likely to happen in the near future? It may be that dreaming is an extension of this simulation function. Our brains are equipped to simulate the future and we do that also during sleep in our dreams, but in our dreams we completely lose the ability to realise that this is not real. During mind wandering we are still attached to the physical world. We may not pay attention to what is going on in the environment, but we know that we are awake and we can be easily brought back to the task. But dreams are, in a sense, an ultimate simulation in that we do not know that we are simulating something. We think that we are actually going through whatever we are going through.

This comes back to what we discussed to an earlier question you asked about 'what is the function of dreaming?' We then need to ask 'what is the function of waking consciousness?' To answer that question we need to know what waking consciousness is doing. One thing that it's definitely doing is it's not making us constantly focus on the present moment. When there are no task demands the mind starts to wander. Again, the question is, 'is there a function for this?' Many have suggested that this type of mind wandering or day-dreaming has the preparatory function of making us

prepare for the future. This is called episodic future simulation. If waking consciousness has this function then maybe our dreams either reflect that function or add something to it.

RB: And this very much ties in with the importance of the imagination.

KV: Yes.

RB: Dreaming has been traditionally defined as an unconscious state, in opposition to waking consciousness. However, recent theories have argued that unconscious and conscious states might be working cooperatively to the extent that REM sleep dreaming is an altered state of consciousness, and that REM sleep dreaming is a proto-conscious state, which serves as a blueprint for waking consciousness. What are your views on this?

KV: I think that problems result if we define dreaming as an unconscious state. Being unconscious means that you have no experiences going on whatsoever. If you're having a dream you are having conscious experiences. As to the proto-consciousness theory, that is exactly where I have a difficulty in grasping the whole idea. I understand the idea that REM sleep-like state is very prominent in a developing foetus, so when a foetus first starts to form experiences it is possible that these emerge during REM sleep. I'm relatively certain that by the time the baby is born it has already had many different types of experiences, for example, hearing sounds. The hearing system develops very early on, as well as touch, pain and even smell and taste experiences, so foetuses do have experiences. Whether or not these appear during REM sleep, or when the foetus is awake, we have no way of knowing. The biggest problem I have with the proto-consciousness theory is that it somehow states that all this starts as an unconscious state that we are having experiences but we are not aware of them. There is a conceptual conflict, saying that we are having experiences but we have no idea what those experiences are. If we have conscious experiences we are conscious of them, at least on some level, but maybe we cannot remember them afterwards, like babies might not be able to. So, my biggest problem with the proto-consciousness idea is that it says that we have experiences but we are not aware of them, as foetuses, and only during early childhood do we start to become aware of our experiences and start to remember them. When, then, does the development of waking consciousness take place? Also, if we have experiences, when we are having the experiences, we are *having* it. What types of experiences do foetuses have? I have no idea. How to investigate what types of experiences foetuses have? I have no idea.

Another problem is that, why shouldn't this proto-conscious only be during REM sleep? Again, why do we separate between wakefulness and sleep? Isn't it important that a baby, during its onto genetic development in the womb, builds the machinery that enables it to have experiences, and then modifies everything after it has been born? Does it matter whether this occurs during sleep or wakefulness, and how could we even tell? We know newborns can remember things. They can react differently to sounds that they have been exposed to during pregnancy, they pay most attention to the mother's voice and they can learn tunes, so they can recognise musical pieces that have been played to them during pregnancy. Why would all this have to happen when the foetus is in REM sleep? When it comes to brain activity REM sleep and wakefulness look very similar, so maybe it is that this proto-consciousness emerges during the foetal period, but we have no idea how we can test whether it appears during REM sleep or not.

RB: Lucid dreaming is a dissociated state, which involves an unusual combination of hallucinatory dream activity and wake-like reflective awareness. Some researchers have suggested it involves a specific alteration in brain physiology. What are your thoughts on this?

KV: First of all, I think it is very logical to assume that if we can regain self-awareness during a dream that there is something different going on in the brain than when in typical REM sleep dreams you are not aware of dreaming. Lucid dreaming is well proven, that it is possible to have dreams where you realise that you are dreaming. Let's take that for granted. The first studies that showed, when they measured EEG, is that there is this increase in high frequency activity in frontal areas when a person is having a lucid dream as compared to a normal dream. That was the first evidence that there might be something different going on in the brain. Of course, the problem with EEG is that it's not spacially very accurate, and only measures what is happening in large neuronal populations in the cortex. It tells us very little what is going on in deeper brain structures. We think that the brain areas that relate to the ability to reflect on what is real and what is not, and handle this kind of self-awareness, is the dorsolateral prefrontal cortex and the precuneus. A few years back there was the fMRI study, where one participant managed to achieve two lucid episodes in a fMRI scanner. They would show that the dorsolateral prefrontal cortex and the precuneus, were more active during the lucid dream than during a normal REM sleep episode. I think that even though there is still very little data, for example the fMRI study comes from a single subject, it points to certain brain areas being activated during lucid dreaming compared to non-lucid dreaming.

RB: What are the neural correlates of dream experiences?

KV: The only correlate that we have is REM sleep because, typically people remember dreams better from REM sleep than from normal sleep. The correlation is not even near perfect because we have REM sleep awakenings without dream remembering, especially early in the night, and we have NREM sleep with high dream recall. So, we don't know what the neural correlates of dreaming are. Studies have been conducted and many of them pose several methodological problems and the results typically have not been very replicable. I think what we need is more PET and fMRI studies because sleep stages in themselves have both been studied with both PET scans and fMRI but in those experiments, except just few, nobody has asked whether or not the participants had been dreaming. I think these technologies should be utilised more and, in fact, there is a big project that we are currently doing, where are using high-resolution positron emission tomography to image the sleeping brain in different sleep stages, trying to compare those awakenings that lead to dream report to those that do not, within the same sleep stage.

We don't know the neural correlates of waking consciousness either so we don't know the neural correlates of dream conscious are, but one thing that we can do with dreaming, which we can't do with waking consciousness, is that when we are awake we have experiences all of the time. It's impossible to be unconscious during wakefulness, by definition. But during dreaming it might be possible that we have sleep but do not have any experiences as compared to periods of sleep when we are dreaming. Contrasting these two states, neuro-physiologically, could mean that what we are contrasting is the presence of experiences versus absence of experiences, the presence of consciousness versus the absence of consciousness. Of course, the big problem is that, because we don't know the neural correlates, all we have to rely on is the subjective report and the recall of the experience. So when we wake the person up in the scanner do they remember a dream or not? Of course it might be that there is a dream experience but no recall of it later, and that would bias our findings. What we would be studying is the presence or absence of dream recall.

RB: Why are nightmares important?

KV: We know that nightmares correlate with health risks, frequent nightmares especially. People who have nightmares on a weekly basis have a higher risk of also being depressed or having insomnia than for people who don't have nightmares or have them less frequently.

Nightmares, not in all but some people, cause distress and it's this psychological distress that can ruin your life and, in fact, it seems that this distress factor of nightmares is more related to psychological problems than how frequently you have nightmares. There are people who have a lot of nightmares who couldn't care less about them, they just go back to sleep. Then there are people who have nightmares and are very distressed by them, so that they keep thinking about the nightmare when they are awake.

Of course, nightmares can also occur when we have traumatic experiences, it's typical to have post-traumatic nightmares. However, there is no evidence that nightmares are in any way good for our psychological wellbeing, like post-traumatic nightmares would help us to recover from the trauma, quite to the contrary, they seem to just keep the trauma memory vivid and live. When nightmares are linked to mental health problems, such as depression, and insomnia, it seems like nightmares are not very good for us. But, if we think of dreams and nightmares as extreme forms of threat simulation dreams I think that these are these evolutionary remnants that this was what the system was designed to do, to trigger very negative dreams whenever we have been exposed to something that threatens our survival or reproductive success. If we would understand that these dreams might have had a fitness enhancing function it might help us to understand why we have nightmares in the first place. So, why is it that nightmares exist? And people who were prone to nightmares in our ancestral environment might have been better off than those that did not, because they practised more, their sleep was lighter, they kept waking up and checking the environment.

So, nightmares don't make us happy, they don't increase our psychological wellbeing, but they may have been important for our ancestors, to keep them alive.