Abstract

To what extent do I have a sense of agency over my thoughts while I dream? The sense of agency in dreams can alter in a variety of interesting ways distinct from normal, waking experience. In fact, dreams show many similarities to the experiences of individuals with schizophrenia. In this paper I analyze these alterations with a focus on distinguishing between reduced sense of agency and other cognitive features such as metacognition, confabulation and attention. I argue that some dream reports demonstrate two interesting commonalities with schizophrenia: thought insertion (TI) and auditory hallucination (AH). This line of research has the potential to further our understanding of TI and AH in schizophrenia through the analysis of similar experience in a different conscious state. Through the analysis of dream reports, I found that although TI and AH both occur in dreams, TI is very rare. This is an interesting result since TI is common in patients with schizophrenia. I propose two speculative lines of explanation for the rarity of TI in dreams: first, the cognitive differences between the symptoms of schizophrenia and dreams, and second, the problem of dream reporting conditions. Dream reporting conditions are particularly important, as without controls, reports can be vague. Analysis of dream reports reveals that it is often unclear whether 'hearing voices' indicates sound phenomenology or thought phenomenology. I propose that dream reports could be disambiguated given the right experimental conditions and I suggest how this could be achieved in future experimental research.

Keywords: Sense of agency, dreams, thought insertion, auditory hallucination, schizophrenia.

Introduction

Altered sense of agency (SoA) in dreams plays a profound role in the way we think during sleep, yet this topic has received little in-depth discussion in the dream literature. Reduced SoA in dreams is often linked to other aspects of cognition, such as attention, metacognition, executive control, and logical failings. Nevertheless, the link between these features is complex. I emphasize that SoA is a distinct feature of cognition which deserves an independent analysis. Focusing on dream thoughts, I first distinguish between SoA and other cognitive features and analyze two ways in which SoA can be disrupted: thought insertion (TI) and auditory hallucination (AH). I then describe the similarities between altered SoA in dreams and schizophrenia in order to argue that cognitive features similar to TI and AH in schizophrenia also occur in dreams. I support this contention with examples derived from dream reports. My findings suggest that although dreams share many commonalities with schizophrenia, and both AH and TI do co-occur, TI is very rare in dreams whereas AH is relatively common. I discuss several speculative explanations for this discrepancy, including (a) cognitive differences across waking and dream experiences and (b) conditions that affect dream reports. Finally, I suggest future empirical research to control for a number of the problems that arise from the ambiguity of dream reports.

Sense of agency in the dream literature

Sense of agency (SoA), or *agentive experience* is "the experience of a particular movement or mental event as realizing one's own agency" (Bayne 2011). SOA is manifested in multiple forms, such as the experience of having autonomy, efficacy, and mental causation. SoA is essential to human cognition as it is a primary aspect of *the self* (Morsella, 2011), meaning that SoA is important for what makes me

me. The feeling of control and ownership over my actions and thoughts is essential to my personal identity. Disruption to the SoA integral to thought and action characterizes some symptoms of mental illness (Moore & Fletcher, 2012). Alterations to our SoA over movements occur when offline monitoring systems and attenuation, the unconscious process of reducing and simplifying sensory feedback, are disrupted (Frith 2002; Frith 2012; Hohwy & Frith 2004). Such disruptions are experienced by patients with schizophrenia who suffer from passivity symptoms or delusions of control, in which movements of the limbs feel as if they are controlled by an external source (Marchetti & Della Salla, 1998; Della Sala et al, 1991; Goldberg & Bloom, 1990). Alterations to the SoA over thoughts, in contrast, can produce the feeling that a thought arises from a source external to the self. One example of this loss of SoA is the delusion of thought insertion (TI; Billion, 2013, Fernandez, 2010, Martin & Pacherie, 2013), in which thoughts are experienced as if they had been *inserted* into the individual's mind ("head") from an external source. In contrast, alterations to the SoA over thought accompanied by an auditory hallucination component (AH), is associated with hearing sounds or voices "in your head" (AH; Carruthers 2012, Sommer et al. 2010). In this case, self-generated thoughts are interpreted as externally generated sounds or voices but "heard" as if from inside the head.

Dream experts have reported a wide range of alterations to the dream-self's SoA (Kahan & LaBerge, 1994; McNamara et al., 2007; Noreika et al., 2010; Occhionero, 2005; Windt et al., 2014). Dream SoA can equal or even exceed what is experienced during waking life, as evidenced in lucid-control dreams. When lucid-control occurs in a dream, the dreamer both realizes they are dreaming and can control elements of the dream, leading to a strong SoA with respect to a variety of dream elements, including characters and scenery (Kahan & LaBerge, 1994). Windt et

al. (2014), in a preliminary study on SoA in lucid dreams, focused on the ability to self-tickle and found that, like in waking, it is not possible to self-tickle in lucid dreams, although one can be tickled by other dream characters. In waking, self-tickling is usually prevented due to the sensory attenuation of self-tickling actions. When I try to tickle myself, sensory feedback from the tickling hand causes the sensory information from the ticked site to be dampened (attenuated), thus it doesn't feel ticklish. This is an indication of normally functioning SoA because in normal cases we distinguish between self-touch and the touch of another. In contrast, patients with schizophrenia are often able to tickle themselves. This has been hypothesized as symptomatic of failed self-movement attenuation, which means that the sensation is not dampened and also causes reduced SoA over the tickling movement (Blakemore et al 2000, Weiskrantz et al. 1971). Self-tickling in lucid dreams, like in waking, is not possible, which indicates SoA in lucid dreams may be similar to what occurs during normal waking, and is stronger or more compelling than what people with schizophrenia experience. However, the SoA in non-lucid dreams can also be greatly diminished.

According to McNamara and colleagues (2007), SoA can be altered in a variety of interesting ways – "many people report a sense of helplessness when being chased in dreams for example. On the other hand, the dream Self typically has some thing or object toward which he or she is striving, thus indicating some sense of agency or purpose" (p7). This observation indicates that a variety of alterations of the SoA, rather than a consistent absence of the SoA, may occur during dreaming. Such heterogeneity is particularly apparent in comparisons between adult and child dreams. In an analysis of dreams collected from two dream databases (one publicly accessible at www.dreambank.net, the other a private database, described in Stickgold, et al.,

2001), McNamara and colleagues (2007) found that adult dreams generally are more frequently marked by agency compared with children's dreams. Whereas children's dreams are predominantly passive and the child is often on the receiving end of aggression, adult dreams, though at times passive, often display active involvement, decision-making, and carrying out of intentions. Occhionero (2005) notes that adults experience numerous variations in agentive dream – "the dreamer can be a simple passive observer of the oneiric scene, an active participant, as well he/she can have a double role, an altered presence, or he/she can be embodied in other people or objects of the dream, and so on" (p 76). Adult dream reports also indicate a wider variety of alterations in SoA than in children, such as the feeling that a goal has been achieved or thwarted. Adults reflect on and are aware of agency in dreams more often than children, as adults, unlike children, often think about goals and strive to achieve them, which "suggests something more than just a prereflective form of Self experience in spontaneously recalled adult dreams. Specifically the sense of agency is enhanced in adult relative to children's dreams" (p 120). An analysis of unusual sense of agency over thought in children's dreams would be illuminating; however, because of the heterogeneity, variety and availability of adult dreams, they are more likely to display interesting and noteworthy alterations in SoA. This is why adult dreams are the focus of the subsequent analysis.

Often, discussion of SoA in the dream literature is mentioned only briefly. Noreika, Windt and Lenggenhager (2010) describe dreams as characterized by reduced cognitive capacity, associated with disorientation, poor reasoning, confabulation, and a reduced SoA.

> The characteristic disorientation, confabulatory and erratic reasoning style and spontaneous, uncontrolled behaviour of stereotypical nonlucid dreamers is

> symptomatic of a reduced sense of agency: the stereotypical, cognitively impaired nonlucid dreamer does not deliberately control the direction of attention, her thoughts or even her behaviour in the dream state. While she may nonetheless experience herself as the author of her thoughts and actions, she lacks […] the experience of engaging in such deliberate control […] (p 42).

Although dream theorists often note a link between reduced SoA and other cognitive features, the specific attributes of reduced SoA remain unclear. For my purposes, it is important to distinguish between SoA and metacognition, attention, and actual agency (or control). In the following section, I will argue that the links among these features can be counter-intuitive.

The distinction between SoA and other cognitive features

Prima facie, one would expect that reduced SoA would be correlated with, or at least indicated by, reduced metacognition, attention, and control. Still, the relations among these cognitive features can be complex.

Changes in metacognition[1] – the ability to reflect and pay attention to our own cognitive states – do not necessarily parallel changes in reports of SoA. First, people do not necessarily reflect on agency – that is the SoA can be "pre-reflective" (Frith, 2005; Gallagher, 2013): In fact we typically feel in control of our actions and thoughts in the absence of conscious reflection. When asked to reflect on their sense of agency, the individual may attribute the SoA to previous actions, even if he or she was not paying attention to a SoA at that particular time.

[1] Generally, metacognition is defined as our cognition about cognition, for example, thinking about my thoughts. Reflective awareness and attention to one's cognitive states are types of metacognition.

Second, when we feel in control of a movement, we generally are *not* aware of all sensory feedback from the movement, the online adjustments we make, or all causal factors that precede the movement. Reflecting on intentions and paying close attention to these factors (e.g., sensory feedback) may reveal a *discrepancy* between intention and action or blocked goal directed action, which evokes a sense of *lack* of agency (Blakemore, et al., 2000; Frith, 2005; 2012; Hohwy and Frith 2004). Frith (2005) gives an every-day example of the feeling of thwarted agency, referred to as the "whoops" effect (p 755). This occurs when we realize that we are about do something we should not, such as pressing a button that will wipe our hard drive, but it is too late to stop. *Increased* monitoring of action (metacognition) along with the realization that intention and action do not match is what brings about this sense of compromised agency (Frith, 2005). Attention to minutiae of feedback might reveal small discrepancies between intention and action that are usually unimportant since they are undisruptive and go unnoticed. Attention to such discrepancies can reduce SoA, thus increased attention is not always associated with increased SoA.

The sense of *failed* agency should be distinguished from *absence* of a SoA, in which we feel neither agency nor lack thereof. Lacking or absent SoA is merely an absence of feeling, whereas sense of lacking is a feeling that one has lost agency.

A further distinction should be made between absence of SoA and pre-reflective SoA, as discussed above. The difference can be determined by later reflection – pre-reflective SoA can be later reported despite lack of reflection at time T, whereas absent SoA at time T will later be reported as absent. These distinctions are important for the discussion of SoA in dreams. Pre-reflective SoA in dreams would be akin to our common experience during waking. In contrast, absent SoA may correlate with utter passivity which, as mention earlier, is a feature of many dream

experiences.

A complicating factor is poor memory and dream report confabulation, which is common when report dreams (Rosen, 2013). Poor memory may cause inaccurate reports, especially regarding such subtle distinctions as absent SoA and pre-reflective SoA. In contrast, sense of *lacking* agency, when one's intentions are thwarted, is less subtle and usually highly salient. For these reasons, I would expect reports of sense of lacking agency to be less ambiguous, making them a better focus for SoA research.

Actual agency and SoA can also be dissociated, in that one might have no agency, but still feel a normal SoA and vice versa. Some theorists (Wegner 2003; Harris, 2012), argue that SoA is in fact entirely illusory – that although we may have a *sense* of agency, we in fact have *no* free will. However, the nature of agency is not the topic here, and I sidestep the issue, instead focusing on the SoA itself. If SoA is indeed an illusion, it is still an interesting aspect of the human experience worthy of study. One motivation for focusing on reports of sense of lacking agency similar to schizophrenia is to avoid ambiguity between agency, SoA and absence of reports agency.

My intent here is to underscore the importance of understanding the relations among these related cognitive features such as metacognition, SoA and attention, without conflating one with another. For example, walking through a bizarre dream scenario unreflectively may not indicate reduced SoA; similarly, paying attention to one's movements might not indicate a strong SoA. So how do we determine whether sense of agency is lacking in a dream if dreams, like waking, frequently do not involve reflection regarding agency? My approach is to narrow the focus of analysis to a specific set of phenomena which indicate a sense of lack of agency in waking consciousness and compare reports of such experiences with dream reports of similar

experiences. The two main cases I discuss are thought insertion (TI), in which self-generated thoughts are ascribed to an external source, and auditory hallucination (AH), in which patients hear sounds or voices in their head. I then discuss the relevant causal mechanisms of SoA in order to later argue that similar alterations occur to the SoA in dreams.

Disrupted sense of agency over thought

Sense of agency over thought involves features distinct from SoA over movement. Frith (2005) hypothesizes that an inability to attenuate proprioceptive sensation, as well as hyper-awareness of movements and feedback, might partially cause delusions of control – the belief that an external force is controlling movements. This is because such hyper-attention brings focus to small discrepancies between intention and action, similar to the "whoops effect" discussed above. However, this isn't relevant to SoA over thought, as thoughts don't involve proprioception and movement sensation, and "unbidden thoughts" (UT) can "pop" into our heads without being disturbing. In contrast, feeling lack of control of movement is usually very disturbing. Here it is important to account for the difference between common UTs two unusual SoA aberrations: thought insertion (TI) and auditory hallucination (AH).

Thought insertion

Thought insertion (TI), in contrast with UT as alluded to above, occurs when ''the subject experiences thoughts which are not his own intruding into his mind. The symptom is not that he has been caused to have unusual thoughts, but that the thoughts themselves are not his'' (Wing, Cooper, & Sartorius, 1983). For example, "thoughts are put into my mind, like 'Kill God'. It is just like my mind working, but it

is not. They are not my thoughts. They belong to this guy, Chris. They are his thoughts" (Frith, 1992, p. 66). TI is common in schizophrenia – in a large study of patients with psychosis, Peralta and Cuesta (1999) found that TI was elicited in 19% of patients with schizophrenia[2].

Theorists disagree on whether TI is primarily a failure of the i) SoA (Stephens, 2000; Stephens & Graham**,** 2000), ii) a failure of the sense of *ownership* of thought (SoO) (Martin and Pacherie, 2013) or iii) a misattribution of subjectivity the belief that the thought occurs in someone else's mind (Gibbs, 2000). Here I will briefly justify my focus on (i) and (ii) as it is unlikely that (iii) is a relevant factor.

Sufferers of TI report that externally generated thoughts are *in their own heads,* which makes (iii), a misattribution of subjectivity, implausible. Stephens (2000) supports this view, arguing that to determine subjectivity for any thought, M, we must ask: "Who is the subject in whose mind or psychological history *M* occurs?" (p 203). If TI is a case of mistaken subjectivity, sufferers of TI would claim to have introspective awareness over a thought that occurs in someone *else's* head. However, patient reports do not indicate this. Mistaken subjectivity is not a likely attribute of the experience of TI, so will not factor into the discussion of dreams.

Although (iii) is not correlated with TI, both (i) and (ii) are relevant. If a disruption of SoA is the only relevant factor, it is not clear what distinguishes TI from UT because UTs also lack a SoA – we don't feel agency over thoughts that pop into our heads. According to Martin and Pacherie (2013), the lack of SoA in TI is a *consequence* of an initial disruption of the SoO. Ownership refers to the feeling that the thought *belongs* to us, whereas agency refers to the feeling of control over a

[2] However, this number varies from study to study. Sartorius and colleagues (1977) report TI occurring in 52% of patients. This higher estimate may be due to a broader definition of TI that includes thought broadcast (Mullins & Spence, 2003)

thought. This distinction provides a plausible means of differentiating UTs from TI. Feeling lack of SoA alone does not lead an individual to ascribe a thought to an external source; thus an UT can feel like it is 'mine'. Similarly in dreams we can have unusual UTs that we don't feel SoA over but still feel like *our own* thoughts. Here, dream SoA and SoO are both analyzed due to their importance for TI.

What causes this failed SoA and SoO in schizophrenia? Martin and Pacherie (2013) note that sufferers of schizophrenia experience an information integration deficit:

> both clinical and experimental data confirm that the perceptual world of patients is subjectively fragmented and present basic deficits in the perceptual organization processes that normally bind elements into a context-appropriate coherent whole (p 114).

We feel SoO over UTs because they have the appropriate *causal-contextual binding* that is lacking in TI. A UT might be unanticipated and out of context with the *content* of other thoughts (lacking *semantic coherence),* but integrated with other *causal* sources (or having *causal coherence*). Thoughts can be evoked either from internal promptings (e.g., other thoughts, emotions or sensations), or external promptings (perceptual stimuli), and are moderated by a variety of perceptual, situational, doxastic and memory constraints. For example, seeing the television out of the corner of one's eye (external factor), or thinking about a favorite TV program (internal factor), along with beliefs and knowledge that the program is currently screening could engender distracting UTs while trying to work (i.e. 'it's time to watch T.V.'). Sufficient binding of these internal and external factors, which gives the thinker access to their causal history, enables SoO over thoughts, despite their being unbidden. What distinguishes UT from TI is the explicit or implicit causal coherence

of UTs which occurs because the thought is integrated with its causal source "so that the presence of this thought within our stream of consciousness will feel ''natural'' and normal, independently of its semantic content" (p 126). The causal integration of TI, conversely, is disrupted. .

Martin and Pacherie (2013) propose that the cause of severe causal-contextual disruption in schizophrenia could be working memory (WM) deficits. WM, in contrast with long-term memory, is the ability to maintain, manipulate, and coordinate information online for a short period of time. WM is required to allow causal-contextual information to be appropriately integrated, imbuing thoughts, including unbidden thoughts, with the appropriate implicit or explicit context, and thus a SoO over them. This working memory theory is supported by data confirming that patients with schizophrenia suffer from working memory deficits (Lee & Park, 2005). Nevertheless, this feeling of disturbed SoO requires a second factor for TI delusion to occur: falsely attributing the thought to an external source. Martin and Pacherie (2013) suggest that misattribution occurs because patients with schizophrenia are less able to distinguish between plausible and implausible explanations for phenomena because of a "loss of general coherence" (p 21). Accordingly, when the person with schizophrenia searches for an explanation for their unusual experience, he or she accepts as plausible the bizarre explanation of thought insertion from an external source.

Auditory hallucination

Sommer et al. (2010) argue that AHs are distinct from TI because the former involve an auditory component. AHs are "heard" by the patient, with a similar phenomenology to listening to voices through headphones. In contrast, TI lacks the

auditory component and is experienced as thinking or inner speech rather than hearing. Nevertheless, AH and TI both involve "alienation;" that is, the thought or voice is not experienced as one's own, but as originating from an external source. According to Sommer and colleagues (2010), the auditory component of AHs is caused by an inability to suppress the activation of auditory perception areas during inner speech. In healthy subjects, EEG studies find evidence for the suppression of auditory perception areas during self-generated speech, whereas this suppression is reduced in patients with schizophrenia (Ford et al, 2002; Heinks-Maldonado, 2007). Sommer et al. (2013) note that auditory suppression during inner speech in schizophrenia has yet to be studied, but since such suppression is reduced during self-generated speech, this should be further investigated as a potential explanation for AH.

In rare situations, patients suffer from audible thoughts with no sense of alienation. One patient "heard" his own thoughts, but did not ascribe these "voices" to external causes. Instead, he surmised that he was suffering from a brain dysfunction. This example suggests a two-factor explanation of AH that involves first alienation caused by lack of auditory suppression, then misattribution of the source of the voice. According to Sommer et al. (2013), if the thoughts were not experienced as audible, then the experience would be TI.

Patients suffering from TI and AH also experience a diminished capacity to inhibit thought (Carruthers, 2012). Martin and Pacherie (2013) note that patients, "tend to over-process irrelevant information at the expense of relevant information, and as a result their mind is systematically assailed by a non-structured flow of information" (2013 p 118). In the following section, I show that cognitive deficits

similar to those occurring in schizophrenia, such as diminished inhibition capacity, misattribution of thought, and loss of general coherence also occur in dreams.

Dream cognition akin to schizophrenia

Other researchers (Fischman, 1983; Schredl, 2011; Skrzypinska, 2013; Wilkinson, 2013) have noted similarities between dream and phenomena that occur in schizophrenia. These similarities include cognitive impairments in executive function and memory deficits as well as neurobiological changes or deficits, such as reduced central inhibition, distorted cortical function, and suppression of gamma rhythm synchronization between visual areas, the frontal cortex, and the prefrontal cortex (Skrypinska 2013 p 32). McCreery (2008) argues that the loss of autonomy regarding mental content in dreams displays similarities to schizophrenia: "the dreamer experiences the dream-world as largely autonomous and beyond his control. The psychotic may experience thought insertion and other forms of subjective loss of control of his or her mental content." (p 4). However, McCreery does not elaborate on this point, or provide direct evidence that TI or AH occurs in dreams.

The following report, logged in the *Dreambank* database[3] and the *Sleep and Dreams* database[4], illustrates some of the interesting alterations in cognition that occur during sleep:

I'm in a strange house. It's a mix of the upstairs of my old house on one street and the distinct living room and kitchen of my old house on another street. […]. I begin reading [a] book and soon realize that it's full of curses and black magic. This isn't fantasy, it's present day and I know this book is dangerous, but I keep going. Inside

[3] http://www.dreambank.net/search.html

[4] http://www.sleepanddreamdatabase.org

there are instructions and ingredients I've never heard of. As I read it, in my mind a voice from the book or somewhere chants it with me. Then I stop reading, but the voice continues. It surrounds me and penetrates my head and I wake up. (Toby: A friendly party animal: #001, 12/02/03, dreambank.net)Bizarre elements and thoughts, metacognitive failure, irrational thinking and altered sense of agency are apparent in this report. First, the dreamer fails to realize the bizarreness of the situation, insisting that it is not fantasy but "present day," which exemplifies a metacognitive failure. The dreamer "realizes" the book is dangerous without reflecting on that particular thought, or exactly how he knew this information, indicating irrationality. The house is a mixture of different houses the dreamer has lived in, indicating 'binding' failure, as explained below. However, the most interesting element with regards to SoA over thought is the voice chanting in the dreamer's head, in which the dreamer misinterprets his own thought as either a sound or a thought from an external source.

Binding is the subconscious integration of multiple sensory elements into a coherent experience. Binding may involve either in one sense modality, such as color, texture and shape, or multiple modalities, such as emotion, sound and visual stimulus (Revonsuo & Tarkko, 2002). Binding failure – which appears to be a crucial aspect of this reported dream experience and one of the probable causes of TI – is an organizational disturbance and information integration deficit that engenders dissociation of these elements or modalities as manifested, for example, in a failure to integrate shape texture and color, or the experience of emotion inappropriate to a particular context (Revonsuo 1995; Revonsuo & Tarkko, 2002). Here I will argue that dreaming and schizophrenia share two commonalities regarding binding, both "feature binding", or the binding of sensory modalities, and "context binding", "the ability to organise [feature] representations into a coherent metacognitive structure

such as a narrative or theoretical explanation" (Gerrans, 2012, p 217). This second type accounts for the binding of thought with context, a subcategory of which is the previously discussed "causal-contextual" binding.

Firstly, patients with schizophrenia experience feature binding. Martin and Pacherie (2013) refer to this as "perceptual organization disturbances" and argue that for patients with schizophrenia, "the perceptual world […] is subjectively fragmented and present basic deficits in the perceptual organization processes that normally bind elements into a context-appropriate coherent whole" (p 122). For example, some patients see the world as fragmented (Chapman, 1966) or have difficulty counting coherently organized visual stimulus (Place & Gilmore, 1980).

Similarly, dreams often lack coherent feature binding. For example, *incongruous elements* are properties of a dream object that do not correspond with the properties of the same waking object.

> Thus, seeing a blue banana, encountering a person with a distorted face, finding a normal banana growing in an apple tree, or bumping into the President of the United States in one's home, would all be examples of incongruous elements in dreams (Revonsuo & Tarkko, 2002, p 4).

The causal-contextual binding failure which Martin and Pacherie (2013) propose as a cause of TI also occurs in dreams.

When people dream, they frequently experience unusual associations, strange leaps of logic and metacognitive failures, including failing to realize that the dream is bizarre or unusual (Gerrans, 2012; Revonsuo & Tarkko, 2002). The relation between these disturbances and TI is that binding failures lead to an inability to buttress unbidden thoughts with the appropriate casual-contextual information required for a SoO over thought. Incongruous binding of thought with affective response, such as

feeling fear or surprise at a thought, might lead to decreased SoO in dreams. In waking delusions, incongruous binding of emotion when seeing the face of a loved one can contribute to Capgras delusion (i.e., the belief that your loved one has been replaced by an imposter), or Fregoli syndrome (i.e., the misidentification of a stranger as a friend or loved one; Coltheart, 2005). Misidentifications similar to Capgras and Fregoli delusions occur in dreams (Gerrans, 2012; Skrzypińska & Szmigielska, 2013), as illustrated in the following reports.

> I'm still marvelling at how I could swear I'm with Arnold, except his face just looks different for the moment - or maybe this is how he "really" looks. (Alta:a detailed dreamer: #379 5/20/92, dreambank.net)

Out in mead with my mom. See a body floating in the bathtub. Call for her and she comes and lifts him up to see him dead. His face looked like my dad, but knew it wasn't him. (dreamboarda:dreamboarda #401, date:unknown, sleepanddreamdatabase.org)Both dreams and delusions, such as Fregoli, Capgras, and TI, also involve misattribution of the cause of the unusual experience.

Another similarity between dreams and TI is the relaxing of constraints on unbidden thoughts, such as beliefs, memories and context (Martin and Pacherie 2013). Beliefs and memories can similarly be disrupted in a dream. Dreamers might hold different beliefs than they do when awake, misremember events, or recall altered situations and contexts. The dreamer might believe that Sydney is the capital of Australia, or remember going ballooning – something she has never actually done. Dreamers also misinterpret internally derived elements as external; for example, not realizing that the dream scene is internally generated.

As Martin and Pacherie (2013) note, "the loss of general coherence that affects schizophrenia patients would not make them very good judges of the weirdness of the

explanation they are giving for their inserted thoughts" (p 121). Similarly, diminished cognitive abilities, such as logic and metacognition, can mean that dreamers are also poor judges of whether their thoughts and other aspects of the dream are plausible or weird. Misattributed explanations cannot be accurately judged for coherence. Lucid dreaming, in which the dreamer realizes they are dreaming, is an exception to this in that lucid dreamers can display good memory and increased metacognitive and rational capacity (LaBerge, S & Rheingold, H. 1990; LaBerge, S. 1980; LaBerge, S. 1981).

Researchers have discussed memory failure in dreams at length **(**Domhoff, 2003, 2011, Baylor & Cavallero, 2001; Fosse, Hobson, & Stickgold, 2003, Hobson, 1988, 2005, Montangero et al. 1996). Working memory (WM) is highly degraded in most dreams, similar to what often occurs in schizophrenia.

> […] both the common deficiency of short- and long-term memory within the dream state and frequent dream amnesia after awakening also mean that most nonlucid dreams are only weakly integrated with autobiographical and narrative layers of self-related processing (Noreika, Windt and Lenggenhager, 2010, p 42).

Dreamers often suffer from complete amnesia for dream content, which frequently occurs when waking up. Usually, recall of dream content rapidly diminishes, leaving only vague recollections or no memory of having dreamt. Around 32% of individuals rarely or never remember dreaming (Stepansky et al., 1998), despite the fact that nearly everyone dreams not only once but multiple times per night (Domhoff, 2003). Due to dream related working memory deficits, the dreamer often forgets previous dreamed events, resulting in disorientation and altered memory "for the dream and within the dream" (Nir & Tononi 2010).

Little is known about the association between causal-contextual failure and memory; thus, further research in this area is required. An in-depth analysis of the types of memory deficits that occur in dreams, as well as the regularity of these deficits and how often they are correlated with TI, would deepen our understanding of the causes of TI, both in sleep and awake states. Such research could also help determine whether there is a causal relation between TI and WM deficit.

Dreams display generally reduced cognitive abilities such as logical thought and metacognition, which represents information inhibition similar to schizophrenia (Skrzypinska, 2013). This diminished cognitive activity is apparent even in lucid dreams, in which the dreamer often enjoys increased cognitive abilities compared with nonlucid dreams. Improved cognitive abilities in lucid dreams are usually unstable, and the dreamer can fade in and out of awareness (LaBerge, S & Rheingold, H. 1990; LaBerge, S. 1980; LaBerge, S. 1981). Nevertheless, even when dreamers become aware that that the scenery of the dream is internally generated and should be susceptible to conscious control, they still have difficulty inhibiting certain experiences, such as scary elements.

> I began to put sense to everything and realize it was in fact a dream. I couldn't control every aspect of the dream but I was able to control things I would in real life such as *my thoughts*, actions and how I interacted with the environment. I remember trying to explain to my friend that this was just a dream but he didn't understand what I was talking about and as soon as this started happening I started loosing control over the dream despite my efforts to keep control (gackenbach:lucid #715, date: unknown, http://sleepanddreamdatabase.org).

The subject's ability to control elements fluctuates and any control gained is fleeting.

> In the last dream I had where I realized that I was dreaming, I recall that I could not control it in any manner. I was upset in the dream because I was trying to wake myself up, but nothing I did would allow me to leave the dream (gackenback:lucid #174, date:unknown http://sleepanddreamdatabase.org)

In this example, the dreamer is unable to inhibit experiences, despite the realization that he should be able to control them.

Dreams also exhibit cognitive features similar to AH. Auditory hallucinations, in the general sense, are a very common occurrence in dreams. Simply put, hallucinations are "sensory perceptions without environmental stimuli" (Brasic 1998). There is some contention regarding whether dream experiences are largely perceptual (Hobson et al. 2000, Hobson, 2002, Windt & Noreika, 2010) or imaginal (Ichikawa & Sosa, 2009, Ichikawa 2008, 2009, Sosa, 2005, McGinn, 2004); however, as I have argued elsewhere (Rosen 2013), a pluralistic theory of dreams according to which dream experience involves a variety of imagination and perceptual experiences is most plausible. According to this view, we do perceive internally generated sounds in dreams, most of which are in fact hallucinations, barring the occasional filtering in of external sounds (Hobson et al., 2000; Sallinen et al., 1996; Wehrle et al., 2007); for example, the sound of a car backfiring experienced in the dream as a gun going off (Dennett, 1976). These are in fact examples of *illusions* or misinterpretations of actual stimuli (Remvig, 1969) in dreams, accounted for, in part, by research findings that externally generated sounds are linked with increased activation of the auditory cortex during sleep (Atienza et al., 2001; Dang-Vu et al., 2011; Desseilles, 2011). Increased cortical activation can also occur with other sensations such as pain (Nielsen et al. 1993; Raymond et al. 2002) and visual stimuli (Keelin. 2007) during dreams. Although internally generated sounds during dreams are common and share

similarities with auditory hallucinations in general, here I take a narrower focus on dreams that are phenomenally similar to "hearing voices in the head." Note that *in the head* does not refer to *all* internally generated sounds, but more specifically, internally generated sounds that are also "heard" as if they are coming from *within* the head. Such hallucinations are similar to TI but are reported to be marked by a sensory element.

In dreams, areas associated with auditory experience such as the temporo-occipital areas, the limbic system and amygdala are hyper active (Maquet, 2000; Maquet et al., 1996; Muzur et al., 2002), which might account for the common reports of internally generated auditory stimuli. However, another cognitive similarity with AH is that hyper-activation inhibits the suppression of the auditory cortex, which fosters the perception of thoughts as sounds or voices. This reduced ability to specifically suppress the auditory cortex has received little empirical investigation; however, memory confabulation and reduced logical capacities could lead to confabulated explanations of such unusual stimulus. Dream reports akin to TI and AH provide further evidence of the similarities between dreaming and schizophrenia.

TI and AH dream reports

Given the similarities between schizophrenic cognition and dream cognition, we should expect to observe similar alterations of the SoA in dreams as we do in schizophrenia. The presence of AH and TI-like experiences in dream reports supports this prediction.

The following report, taken from the well-studied Barb Sanders dream series (Domhoff 2003; 2006), includes experience similar to thought insertion and other alterations of the SoA.

> I am in a room with 3 other women. […] We touched "cores." I felt slightly repelled but allowed it to happen. **Something in my mind was assuring me this is O.K. It's always been forbidden but now it is O.K. and nice to do**. **It is important to do.** She holds me in a caring way. *Another woman is in a closet, sort of narrating thoughts.* **(**Barb Sanders: #0308, 02/24/81, www.dreambank.net, bold and italic emphasis added**)**

In the sentences emphasized in bold, Sanders reports a thought, rather than a voice, which she ascribes as being caused by some external, unidentified source, although it is never made clear exactly who or what this "something" is. Although Sanders demonstrates some agency over action by "allowing" events to happen, the 'inserted' thoughts conflict with other feelings and beliefs, including her feeling of repulsion which indicates reduced SoA and SoO over thought. However, it is unclear whether the phenomenology of "narrating thoughts", emphasized in italics, refers to a woman sitting in the corner narrating out loud, or narrating *in* the dreamer's *head* as sound or thought.

The following dream involves the experience of having information inserted into one's head from an external source, but it is not clear what the phenomenology of this experience is, whether thought-like, visual, or auditory.

> "[…] I got an e-mail [from my former girlfriend] – I just read it. It felt like it was beamed into my head or onto a sheet of paper right in my hands that I was reading. She said she wanted my sperm" (Dream Text: Last Night's Dream, van series, 19/1/2008, sleepanddreamdatabase.org)

Dreamers often report experiences that are better described as auditory hallucinations, as illustrated in the following dream reports.

> […]I'm in a long hallway. On the walls are posters on naked chicks and I can

> hear people having sex. It's so loud that I'm sprinting down the hallway. I never reached the end, but I turn to the right, open a door and the noises in my head stop. (Toby: A friendly party animal: #014 (04/13/06), dreambank.net)
>
> […]As we flew over the city, resembling NYC, I saw huge C4's attached to all the buildings. I could hear my ex BF in my head laughing and saying I wasn't out of the woods yet. (gackenbach_nightmares #70, 2010, sleepanddreamdatabase.org)
>
> I remember saying to Connie something like, Do you hear that too? and she said Yes. It was a voice in my head, or a voice that only the two of us could hear that was telling us the future. (sersa #3143, last_nights_dream, date:unknown, sleepanddreamdatabase.org)

Such experiences may be explained by altered cognition and brain activity during sleep. In my research of dream databases, I found these reports are quite common, as discussed in further detail below. The common occurrence of AH in dreams might be due to hyper-activation in the auditory cortex and a misattribution of thoughts as sounds. However, one puzzle is that my search indicates that TI dreams are relatively rare.

Given that the TI delusion, as mentioned earlier, occurs in around one-fifth of patients with schizophrenia (Peralta and Cuesta 1999), TI-like reports in dreams are quite uncommon. I researched the publicly accessible dream databases dreambank.net (DB, over 20,000 reports total) and sleepanddreamdatabase.org (SDDB, 26,199 reports total). Finding the appropriate search terms required analysis of waking TI reports to determine common descriptions of TI, then using trial and error to find appropriately specific terms for a database search. Further analysis of individual reports was required to ascertain the context of the search term. For example, the term

"thought" resulted in 1124 matches on SDDB and included irrelevant reports such as "I looked around in what I *thought* was my house" whereas "thought control," "thought insertion" and "inserted thought" all resulted in zero hits. "Insert, "inserted," and "inserting" resulted in 10 hits, none of which was relevant. "My thoughts" resulted in 23 hits, four of which were relevant phenomena (mind reading, 'hearing' others thoughts) but none of which were similar to TI reports of people with schizophrenia. Across the two databases, "in my head" and "in my mind" resulted in over 200 hits, out of which 28 were reports of voices or sounds "in my head". "Into my mind" resulted in three hits, all unbidden thoughts rather than TI, whereas "into my head" resulted in six hits, 1 of which, although unclear, could be interpreted as TI. I found only four reports strongly suggesting an experience similar to TI, and of these only 1 was relatively unambiguous. Although choosing search terms specifically geared towards finding TI and not AH, reports of AH[5] far more frequently- between 30 and 40 reports. Although not intended as a thorough statistical analysis, but with a focus instead on content analysis, the difficulty finding TI and ease of finding AH indicates that AH occur much more frequently than TI in dreams. In the following sections I advance several hypotheses as to why TI dreams are rare and propose future research to test these hypotheses.

Why inserted thoughts are rare

Cognitive deficits, such as poor memory, metacognition and rational capacity may decrease the likelihood that dream-TI will be reported; however, I argue that the reporting conditions and the difficulty in accurately describing an experience of TI

[5] Specifically, the types of AH which have been my focus – in which a voice from an external source is hear from within the dreamers head. I have excluded other forms of internally generated sounds and voices, as technically, almost all sounds heard in a dream are internally generated.

may also account for the rarity of reported dream-TI. In the following section, I will discuss both cognitive deficits and reporting difficulties as potential causes for reduced reports of TI in dreams.

The cognitive deficit explanation

One possible explanation for the rarity of TI in dreams is that due to cognitive deficits such as reduced reflection, metacognition and attention to thought, dreamers fail to notice alienated thoughts, and they go un-reported. Dreamers are often unable to discriminate between unusual and common phenomena: dream bizarreness is typically passed off as not remarkable or noteworthy, or dreamers make up an illogical explanation for the presence of bizarre dream elements. Cognitive deficits therefore may simultaneously cause TI like experience in dreams *and* make such experience less likely to be noticed and reported. For example, upon feeling lack of ownership over a thought, the dreamer does not realize that the experience *is* unusual and thus feels no need to ascribe the thought to an external source. Binding failure in dreams often goes unnoticed; for example, feeling the wrong affective response when seeing a familiar face (Capgras-like experiences) without realizing that this is unusual. It is more common in dreams than in waking for any unusual experience to fly under the radar of reflection (Hobson et al. 2000, Hobson 2009). Decreased ability to reflect and pay attention to dream events may reduce our ability to notice causal-contextual binding failure in the same way that dreamers often fail to notice other incongruous dreams elements.

Decreased awareness of and access to the autobiographical self and memories (for a discussion of this see Rosen & Sutton, 2013) may also contribute to the lack of reflection on dream thoughts. Martin and Pacherie (2013) note that unbidden thoughts

that occur without SoA are not always experienced as inserted thoughts, because we can assess them as being consistent with the type of thought that we usually have. The **"**fallback mechanism of self-interpretation would ensure that their ownership is not challenged" (p 119), even if we lack causal-contextual binding. Because dreamers may lack access to their autobiographical self, they may fail to assess the thought as uncommon, or fail to reflect on dream content entirely. If the fallback mechanism of self-interpretation, as explained above, misinterprets an unusual thought as consistent with normal thought, then the dreamer might not consider the thought as unusual. For example, when awake, if the thought "kill God" popped into my head, I would consider this very unusual and out of character and wonder where the thought came from. However, in a dream, I might falsely assess that such thoughts are consistent with my character. Therefore the type of thought that might elicit a feeling of lack of ownership when awake might fail to do so when dreaming.

I argue that although cognitive factors likely play a role in our ability to notice unusual, TI-like experience in sleep, issues associated with *reporting* dreams are likely to also contribute to the rarity of TI reports.

Reporting dreams

There are many limitations to the ability to report dreams, including reduced memory in sleep and confabulation upon awakening (see Rosen 2013 for an in-depth discussion). An interesting contradiction exists in our reporting tendencies: supernatural or unusual elements in both waking and dreaming tend to go under-reported (Bartlett, 1932) while bizarre and unusual elements increased the probability of remembering a dream (Foulkes 1996). These factors and the inability to corroborate dream reports with real events make it difficult to ascertain the accuracy

of the reports. Limitations in the accuracy of dream reports may diminish the accuracy of any comparison between waking and dreaming.

TI experience may be under-reported due to the strangeness of the experience. The sense that someone else's thoughts are in a person's head might be very difficult to describe or even comprehend upon waking, and such experiences are more likely to be confabulated into a coherent narrative. In contrast, the feeling of hearing sounds in one's head, akin to listening to headphones, is a common experience for most adults. Accordingly, AH experiences might be easier to describe as they are more familiar. The inability to make sense of a dream experience also increases the likelihood that the dream or the relevant element will be forgotten (Foulkes, 1999). Similarly, reporters generally focus mainly on visual and sound stimuli rather than other sensations – thoughts, *especially,* are rarely reported (LaBerge 1996). Reduced ability to focus attention and reduced metacognition may increase this reporting bias. So although confabulation and memory deficits are problematic for all dream reports, reporting thoughts is particularly unreliable. To complicate matters, TI and AH phenomena face *further* specific limitations that are not problematic for other dream phenomena.

When comparing TI and AH dreams, ambiguity arises regarding the specifics of the report. It is often unclear from dreamers' reports alone whether they refer to AH or TI experience. In waking reports, we expect people to be able to make a clear distinction between *hearing* and *thinking*, which reflect disparate subjective experiences. The report 'I heard his voice as if he was talking in my head' is clearly a case of AH, whereas 'his thoughts pervaded my mind' is an equally clear example of TI. Nevertheless, other subjective reports may be less clear, and it is possible that participants are mixing up the phenomenology of "hearing" and thinking. For

example, 'I'm thinking about my friend and hearing his voice in my head' may not literally indicate sound stimulus, but rather *thinking* about what he sounds like. Stephens and Graham (2000) note that "clinicians do tend to interpret reports of thought insertion literally," and not as if "hearing" indicates "thinking". According to Sommer and colleagues (2010), an auditory component distinguishes AH from TI; however, whether this distinction is clear in all reports is debatable. Hurlburt (1990) and Langdon et al. (2009) investigated the phenomenology of inner speech in patients with schizophrenia and found that when awake, participants did not experience any difficulty distinguishing between hearing voices in their heads and inner speech. Nevertheless, other theorists describe AH as merely a misinterpretation of inner-speech, which indicates that there may be little phenomenological difference between AH and inner speech (Hoffman 1986). Irrespective of who is right in this matter, dream reports are often marked by greater ambiguities in interpretation.

The ambiguity of dream reports is generally more problematic compared with waking reports. More specifically, dreamers who report *hearing* a voice in their head may be either referring to the phenomenology of hearing sound or of thinking. Take the following example.

> Can't fully remember dream. Can remember visuals; vivid, clear shapes, in my dream. I wanted to do something but can't remember what, trying to accomplish a task. […] I was from the outside looking at myself (in my dream I could see myself, like an onlooker, but **could hear my thoughts**, etc.). (kahan_sleep_wake #8771, date:unknown sleepanddreamdatabase.org [bold emphasis added])

This report has several interesting features. Memory deficit is clearly indicated, and the dreamer experiences from an "observer" perspective instead of a

"field" perspective (Sutton 2010). Observer perspective is defined as viewing from an external viewpoint while simultaneously identifying with the body being observed. Observer perspective is a common occurrence in dreams (Rosen & Sutton 2013), but this dream report does not specify what "heard" refers to.

The dreamer in the report above refers to "hearing" his or her own thoughts (the thoughts of the observed body); however, it is not clear that hearing in this report refers to the phenomenology of sound stimuli, thinking or even "thought broadcast", which is hearing one's own thoughts as if they are spoken aloud, or feeling as if one's thoughts are escaping (Pwar & Spence, 2003). The term "hearing" might be the simplest way of describing an abnormal experience for which the dreamer lacked an accurate vocabulary. 'Hearing' may instead indicate that the dreamer is thinking thoughts that she believes belong to an individual that she identifies as herself, but does not embody. The body is hers, so she feels SoO over it, but she is not the center of perspective of that body. Similarly, she might feel ownership over the thoughts of that body, but at the same time, perceive these thoughts as coming from that body. If she feels a sense of ownership without agency over this external body, the same could be said for her thoughts. They are *her* thoughts, but 'her' refers to the person she is looking at. It is unclear whether the reporter means to indicate "I was thinking the same thoughts as my dream body" or "I literally heard my thoughts as if I were listening in on myself". Without further explanation from the reporter, the ambiguity remains unresolved.

This confusion between hearing and thinking might apply to other dream reports that appear to indicate AH phenomenon. Indeed, this confusion could apply to any of the dream reports I previously deemed as examples of AH. The dreamers report hearing sounds in their own head, but this could actually mean that they feel no

sense of agency over their own thoughts, and upon waking later, use imprecise terminology to try to explain the experience.

The study of free-form dream reports lacks the controls used in inner speech, AH and TI research. Langdon et al. (2009) and Hurlburt's (1990) experimental techniques could be adopted in dream SoA research. These experiments are very specific in determining the type of phenomena that are occurring. Participants are questioned in order to determine the specifics of the experience and through this they learn how to report their experience more accurately. For example "'Does it feel like each voice is talking directly to you? Or is it more like you're just hearing words that aren't necessarily meant directly for you?" (Langdon et al., 2009, p 659). These questions are far more likely to elicit an accurate account of phenomenology than free reports. Accordingly, the problem of thought/sound ambiguity could be controlled for by adopting the techniques used in inner speech research (Hurlburt, 1990, Langdon, 2009). I will suggest some applications in the following section.

Future research

Many of the limitations of dream reporting are very difficult if not impossible to overcome. For example, because we can't compare reports that occur after waking with direct dream experience, we can never ascertain the accuracy of the report. This state of affairs contrasts with waking, as the latter reports can be made *during* an ongoing experience. Alternatively, multiple reports of the same event can verify a waking report. One aspect of dream reporting that can be better controlled is the ambiguity of description in SoA reports. Guided, yes/no, or either/or questions following a free form report could disambiguate unclear elements of the dream and focus more specifically on thought components. This could be achieved by asking the

dreamer to distinguish between auditory and thought phenomena and to train reporters to distinguish between specific types of phenomenology and altered SoA. The guided questions would need to avoid biasing participants towards certain answers, because dreams can be prone to misattribution. A freeform report elicited before specific questions may help control for such bias. Researchers have successfully supplemented free dream reports with target questions to increase the frequency of reporting emotions in dreams (Merritt et al. 1994, Sikka et al. 2014) and have demonstrated that dream recall frequency increases when subjects are provided with dream checklists. This increase may partially be due to motivational factors (Zadra & Robert, 2012). Voss and colleagues (2013) constructed a lucidity and consciousness in dreams scale (LuCiD) for dreamers to rate their dreams with respect to insight, control, thought, realism, memory, self-image and emotion with items ranging on a scale from 0 (strongly disagree) to 5 (strongly agree). Dream reports usually focus on visual and narrative features, so this scale lead the dreamers to focus on elements that usually go unreported. An example of a question on the scale is "the thoughts I had during the dream were exactly the same as I would have had in a similar situation during wakefulness." Some questions require a scale between 0 and 5, others a yes/no response or an either/or response. For example, for the question "I felt in control of my thoughts", a scale between 0 and 5 is more appropriate, whereas the question "one or more of my thoughts felt like they belonged to someone else" and "I heard voices in my head as if listening to headphones" require a yes/no response.

Waking participants during REM sleep elicits more reliable reports than waiting until they wake naturally in the morning. Researchers have shown that two report of the same dream will differ if the first report is taken during an REM awakening and the second is taken after waking naturally in the morning. For

example, often bizarre features are rationalized or omitted from the second report (Foulkes, 1979, 1999), similar to Bartlett's (1932) findings discussed earlier. Controlled lab awakenings may reduce confabulation and memory deficits, but overcoming the problem of report ambiguity does not require REM awakenings in a sleep lab. Dreamers could clarify the types of unusual thought experiences they remember by responding to targeted questions, dream checklists, or dream scales, and specify whether TI or AH occurred.

Conclusion

Alterations to the sense of agency and ownership over thoughts in dreams display many similarities with mentation that occurs in patients with schizophrenia, including the experience of thought insertion and auditory hallucination. Dreaming cognition shows features similar to symptoms and impairments in schizophrenia, including confabulation, binding deficits and reduced working memory. Such similarities provide clues to explain the thought insertion-like and auditory hallucination-like experiences that are reported. Nevertheless, given the similarities between mentation in dreams and schizophrenia, the relative rarity of TI in dreams compared with AH in dreams and TI in schizophrenia requires an explanation. I have argued that poor attention, metacognition, and memory in dreams may in part provide such an explanation. I also suggest that the unreliability of dream reporting and the type of schema used to report dreams most likely contributes to a bias against reporting TI in a clear, unambiguous way. In reports about dream thought it is often unclear whether the reporter intended to indicate hearing or thinking. I have proposed that this limit to dream reporting, unlike other limits such as memory and misattribution issues, could be controlled for by implementing better dream research

methodologies, such as asking a series of targeted questions after subjects report their dreams. Sense of agency in dreams is a relatively untapped field of research and further focus on agency could both promote a greater understanding of the differences between waking and dreaming cognition and further our understanding of the sense of agency.

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