

Abstract

Approximately half the population have experienced a lucid dream. Yet, it is not well understood how an individual realises they are dreaming (i.e. lucid insight). A few studies suggest it can be triggered by a nightmare, or by the identification of inconsistencies/dream-like qualities/peculiarities. The present study aimed to produce a detailed typology of lucidity triggers to inform consideration of the nature of associated thought processes. 91 lucid dreamers were identified in an undergraduate sample of 148. Lucid dreamers were asked to describe what it was, if anything, that had made them realise they were dreaming. Thematic analysis of responses extracted evidence of four overarching triggers consistent with previous research: identification of an abnormality, identification of a dream-like quality, an emotionally-arousing dream event, and miscellaneous. It was uniquely identified that 'abnormalities' within the dream were those inconsistent with waking knowledge rather than with the accompanying dream content. Novel triggers were identified that were classifiable as subthemes under the previously-identified triggers, and triggers co-occurred in a third of cases. Novel triggers included 'déjà rêvé', the feeling that one has dreamt the experience before, as well as 'self-comfort/denial' involving an emotionally-driven denial of the reality of a distressing dream. Nightmare-induced lucidity appeared to arise via qualitatively diverse paths: via self-comfort/denial and/or via the identification of abnormalities/dream-like qualities. The nature of the triggers indicates that higher-order cognition can precede, and promote, lucid insight. This sheds light on a key theoretical issue of whether lucid insight is a pre-requisite for the re-emergence of higher-order cognition.

Keywords: lucid dreaming, lucidity, nightmares, higher-order cognition, phenomenology.

Examining the Triggers of Lucid Insight

Lucid dreaming is a well-established phenomenon characterised by the dreamer's awareness that they are in fact dreaming whilst remaining in dream state (i.e. not upon awakening; Doll et al., 2009; Voss et al., 2013). Approximately half of the general population will have experienced a lucid dream at least once in their lifetime, and around 20% will experience them at a rate of once a month or more (Schredl & Erlacher, 2011; Snyder & Gackenbach, 1988). Despite the high prevalence of lucid dreaming, and despite it being thought that lucid dreams typically emerge when a non-lucid dream transforms into a lucid dream (e.g. LaBerge et al., 1981, 1986), it is not fully understood how an individual comes to realise they are dreaming and whether the nature of the dream content triggers this realisation (i.e. the in-dream lucidity triggers).

The possibility that lucidity is triggered by unrealistic dream content has been examined by Voss et al. (2013). This was found not to be the case since the realism of dream content was not related to the likelihood of the dreamer becoming aware they were dreaming. Gackenbach (1982) asked undergraduates to write about their experiences of lucid dreams and their situational determinants over a 16-week period. The most common feature that initiated the 313 reported lucid dreams was categorised as the "dreamlike quality", with 48% of lucid dreams found to arise from this identification (Gackenbach, 1982). 19.2% of lucid dreams arose from the identification of an incongruent element; 15% were nightmare-induced, and the remainder were triggered by factors not falling under these categories (Gackenbach, 1982). In a later study of 136 lucid dream reports, Gackenbach (1988) found broadly similar proportions of triggers, with the majority of lucid dreams initiated by the identification of a "dream-like sense" of the dream (67%), and similar proportions

triggered by the identification of an incongruent element (11%) and by a nightmare (18%). Stumbrys et al. (2014) asked participants an open-ended question about the circumstances under which a lucid dream had first arisen. Similar to Gackenbach (1982, 1988) it was found that lucid insight sometimes occurred spontaneously but more often arose from particular dream experiences. Of the 571 participants, 18.2% reported the emergence of lucidity to be spontaneous, 17.2% reported it to be nightmare-induced, 8.41% through recurring dreams, and 5.08% via the identification of peculiarities within the dream. These triggers bear much similarity to Gackenbach's (1982, 1988) triggers that included nightmares and the identification of a 'dream-like' quality or of inconsistencies, which could fall under the category of 'peculiarities'. Additionally, there is further evidence for lucid dreams emerging from nightmares (Schädlich & Erlacher, 2012; Voss, Frenzel, Koppehele-Gossel, & Hobson, 2012; Wolpin, Marston, Randolph, & Clothier, 1992).

For a dreamer to be able to identify inconsistencies, dream-like qualities, and peculiarities that led to the conclusion they must be dreaming, would seem to require contemplating, evaluating, reasoning about, and/or reflecting upon, the ongoing dream experience. Yet, higher-order cognition (HOC), which encompasses such analytical thought processes, tends to be impoverished in the non-lucid dream state (Dresler et al., 2012; Filevich, Dresler, Brick, & Kühn, 2015; Foulkes, 1990; LaBerge & DeGracia, 2000; Voss et al., 2013). Nonetheless, HOC occasionally features in non-lucid dreams unaccompanied by lucid insight (see reviews by Kahan, 2001; Kahan and LaBerge, 2011; Kozmova, 2012), individuals can deliberately use lucidity induction methods involving HOC such as critical reflection and reality checking (e.g. Stumbrys et al. 2014), and the onset of dream lucidity itself is characterised by the return of HOC capacities (Voss et al., 2013). While it is well-established that HOC

capacities re-emerge when a non-lucid dream transforms into a lucid dream, the point at which they re-emerge and how this re-emergence relates to lucid insight, remains an unresolved empirical question (Kahan & LaBerge, 2011; Voss et al., 2013).

It has been theorised that the re-emergence of the HOC capacity of access to waking knowledge/expectations, typically diminished in non-lucid dreams (Barrett, 1992; LaBerge & DeGracia, 2000; Voss et al., 2013), triggers lucid insight by permitting a comparison between the presently-experienced dream and waking knowledge/expectations (LaBerge & DeGracia, 2000). While there is evidence that HOC can emerge independently of lucid insight (Kahan, 2001; Kahan & LaBerge, 2011; Kozmova, 2012), the proposition that its presence may promote the onset of lucid insight has limited support. Only three studies thus-far have studied dream reports that describe the experience of reaching lucid insight. The reported lucidity triggers of identifying inconsistencies, dream-like qualities, and peculiarities may involve HOC but not necessarily in the form of access to waking knowledge/expectations. HOC is perhaps less likely to underlie the nightmare trigger. To better speculate about the cognition underlying these triggers, and the point at which HOC typically emerges during the onset of lucidity, more research is needed regarding the nature of thought processes and realizations that are associated with the experience of transitioning from a non-lucid to a lucid dream state. For example, it is unclear whether the recognition of dream-like qualities and lucid insight are synonymous.

For these reasons, the present study aims to (1) produce a typology of the triggers that dreamers report lead-to lucidity and to quantify these, and (2) to use this to inform consideration of the nature of the thought processes that are associated

with the transition from a non-lucid to a lucid dream state. To fulfil these aims, participants were asked to write about their most memorable lucid dream and identify what it was, if anything, that made them realise they were dreaming. Based on the responses acquired, the following research questions will be addressed: (a) What do lucid dreamers report led them to realise they were dreaming? (b) Can we use lucid dreamers' reports to discern the nature of thought processes that are associated with the transition from a non-lucid to a lucid dream state?

Method

Participants

An opportunity sample comprised of one hundred and forty-eight undergraduates from the University of Lincoln were recruited via online social networking platforms and the university's online subject pool. The exclusion criterion was not having suffered from any neurological or psychological illnesses. All participants completed the online questionnaire which was generated using Qualtrics online survey software. Participants accessed the questionnaire remotely via a link.

A total of 107 participants reported having experienced at least one lucid dream. Data from 16 of these participants were excluded from analysis due to their lucid dream reports being incompatible with, or indicating a misunderstanding of, the definition of dream lucidity. For example, some participants described a pre-lucid dream, false awakening, sleep paralysis or realising they had been dreaming upon awakening.

Questionnaire Items

Participants were asked the following question first to decipher whether they were a lucid dreamer. "Have you ever had a dream during which you became aware of being in a dream, while the dream was ongoing? This does not include realising you had just been dreaming upon awakening". This definition, obtained from Doll et

al. (2009), was used to reduce the chances of participants misinterpreting what a lucid dream is. Participants could select “yes”, “maybe”, or “no”. If participants selected “yes” or “maybe”, they were then asked to “...describe specifically a memorable incident in which this happened and what it was (if anything) that made you realise that you were in a dream”. Participants entered their response in the text entry box provided.

Data Analysis

Following data collection, responses to the item asking lucid dreamers to describe what it was, if anything, that made them realise they were in a dream were screened to exclude incomplete responses or those incompatible with the definition of lucidity. The remaining 93 responses (two participants provided two responses each) were thematically analysed using both an inductive and deductive approach. The approach was deductive in that the coding frame was initially based on Gackenbach's (1982, 1988) and Stumbrys et al.'s (2014) typologies, but this was moulded, refined, and supplemented by patterns identified in data. The analysis procedure, following Braun and Clarke's (2006) guidelines, yielded a coding frame where codes were organised in to sets that resembled aforementioned typologies. The reliability of the coding frame was assessed by a second coder. This entailed random selection of 10% of the responses using a random number generator, and these were blindly coded by the second coder who had been trained by the first. This yielded an inter-rater agreement of 83.3%, which was deemed satisfactory for analysis of the full dataset to commence.

Ethical Approval

The research project was approved by the Ethics Committee of the Faculty of Psychology at the University of Lincoln.

Results

72.3% (n = 107) of the sample of 148 undergraduates reported having experienced at least one lucid dream, but upon excluding responses that were incongruent with the definition of lucidity it was determined that 61.5% (n = 91) of the sample had likely experienced a lucid dream. Because two participants provided two responses (i.e. two examples of lucid dreams) each, results are reported as percentages of responses as opposed to percentages of participants, though these approximately equate. The thematic analysis (Braun & Clarke, 2006) conducted on the 93 responses from these verified lucid dreamers yielded several themes and subthemes. Because responses contained descriptions of what (if anything) led to the realisation of dream state, the themes categorise the triggers of lucidity. The thematic framework, that can be seen in Figure 1, thus organizes the triggers. It can be seen that the triggers varied in nature, with the subthemes providing an idea of the scope and diversity of each overarching trigger (i.e. theme). There were four overarching lucidity triggers; identification of abnormalities, emotional arousal, identification of dream-like quality, and miscellaneous. Subsequent content within this section provides a detailed account of these triggers. The percentage of responses featuring each overarching lucidity trigger is provided in Figure 2. It must be mentioned here that because multiple (i.e. 2-4) triggers co-occurred in some (34.4%) responses, the triggers are not mutually exclusive in nature, which is why the total proportion in Figure 2 does not sum to 100%. Relatedly, these co-occurring triggers sometimes fell under different themes. It must be noted that because multiple classifiable triggers featured in some reports, the proportion of responses per trigger is displayed for when the trigger occurred alone, co-occurred with another within a dream (i.e. as a co-trigger) and in total (i.e. the total proportion of responses

that featured the trigger) in Table 1. Finally, it can be seen from Table 1 that reports commonly featured non-miscellaneous triggers as co-triggers.

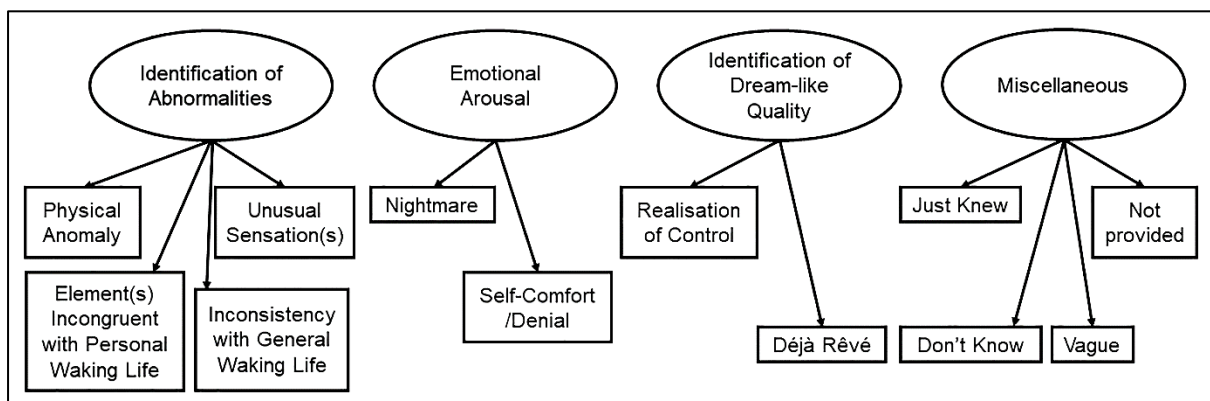


Figure 1. A developed thematic map showing the four overarching lucidity triggers (i.e. themes) and corresponding subtheme triggers.

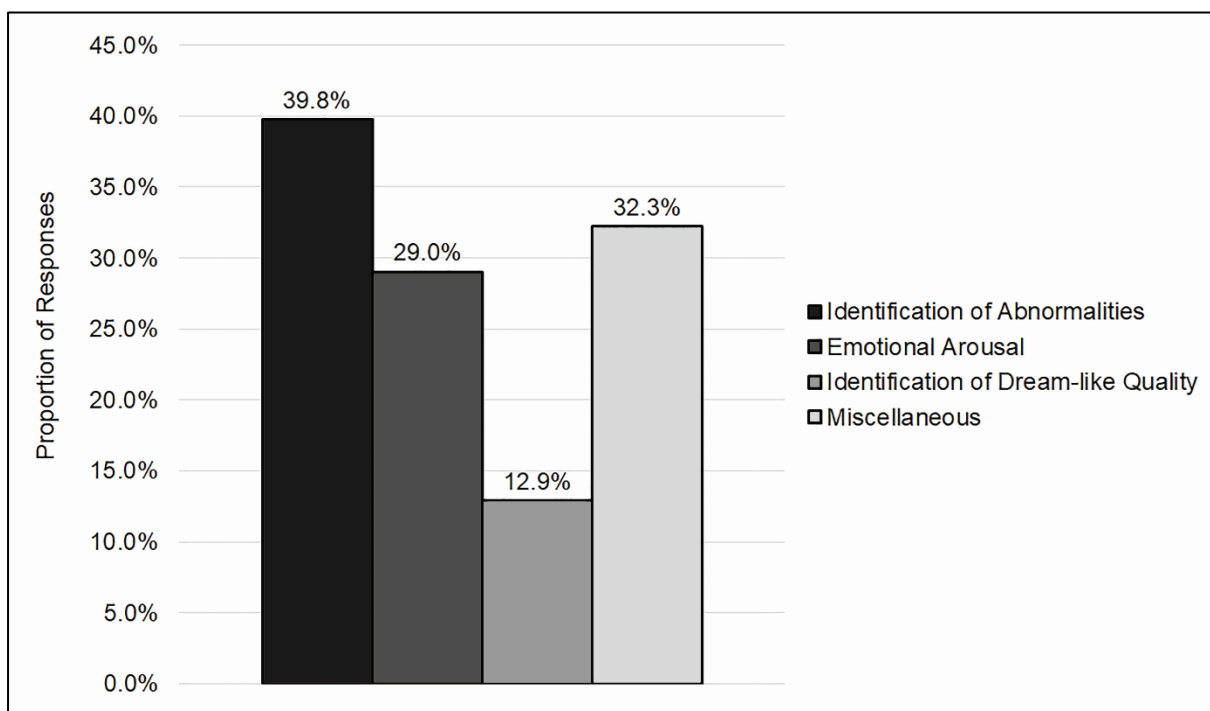


Figure 2. Percentage of responses that reported lucidity triggers falling under each theme (i.e. overarching triggers). Note. Some responses contained intra- and/or inter-theme lucidity trigger co-occurrences.

Table 1

Proportion of Responses for which each Trigger Featured Alone, as a Co-Trigger, and in Total

Triggers (Overarching and Subtheme)	Proportion of Responses Featuring This Trigger Only	Proportion of Responses Featuring This as a Co-Trigger	Total Proportion of Responses Featuring This Trigger
<u>Identification of Abnormalities</u>	19.4%	20.4%	39.8%
Physical Anomaly	6.5%	14.0%	20.4%
Element(s) Incongruent with Personal Waking Life	6.5%	12.9%	19.4%
Inconsistency with General Waking Life	5.4%	4.3%	9.7%
Unusual Sensation(s)	1.1%	3.2%	4.3%
<u>Emotional Arousal</u>	6.5%	22.6%	29.0%
Nightmare	4.3%	22.6%	26.9%
Self-comfort/Denial	2.2%	10.8%	12.9%
<u>Identification of a Dream-Like Quality</u>	5.4%	7.5%	12.9%
Realisation of Control	4.3%	4.3%	8.6%
Déjà Rêvé	1.1%	4.3%	5.4%
<u>Miscellaneous</u>	31.2%	1.1%	32.3%
Not provided	11.8%	0.0%	11.8%
Don't know	9.7%	0.0%	9.7%
Vague	8.6%	0.0%	8.6%
Just knew	1.1%	1.1%	2.2%

Note. The proportion of responses that featured the corresponding trigger only and those that featured it as a co-trigger sum to equal the total proportion of lucid dreams featuring the corresponding trigger. Trigger combinations are presented subsequently.

For the two participants that reported two dreams each, there was a singular trigger for each dream. Both participants' reports featured the recognition of personal life inconsistency, one featured the miscellaneous trigger "just knew" and the other the nightmare trigger.

Theme 1: Identification of Abnormalities

The reports categorised under this theme involved the dreamer identifying an aspect, or aspects, of the dream as abnormal because they were judged as incongruent with what typically, or invariably, occurs in waking life. This identification reportedly triggered lucidity in 39.8% of responses rendering it the most prevalent overarching lucidity trigger (see Figure 2). Further analysis yielded several subthemes that reveal the varying natures of abnormalities that were reported to trigger the onset of lucidity. These are outlined below.

Subtheme 1a: Physical Anomaly. The most commonly identified abnormality that reportedly triggered lucidity was a physical anomaly. As aforementioned, these were identified as anomalous in that they deviated from waking expectations, and not because they were abnormal within the dream context. Occasionally these physical anomalies were abnormal properties of dream objects, or of the dream scenery. On other occasions they were "physical" entities interacting in implausible ways so that they may have for instance violated the commonly-known laws of physics or at least one's implicit knowledge of the typical nature of physical interactions:

One time I awoke in a dream, thinking I was awake I got up to go into my kitchen. Upon entering all of my flat mates were ironing. Gravity must have been off because they were standing on the ceiling and walls. The furniture was also in impossible positions. I almost sighed to myself as I realised I was still dreaming, before putting everything as it should be before sitting down on the sofa and subsequently waking myself up.

The physical anomalies identified by dreamers also encompassed those that were transient in nature such as alteration of appearance. This identification was often followed by the reported realisation that this would normally be physically impossible in the real world. It seems that despite the array of bizarre elements present, sometimes the dreamer fixated upon one particular dream element and was then able to identify it as 'implausible', or as 'unrealistic'. It was this identification that appeared enough to facilitate lucid insight in some cases:

"In the last dream I had, the shoes I was wearing were burgundy velvet stilettos, which changed when I next looked down to granny slippers with the heel still, which wasn't plausible."

"Realised that the colours and proportions of landscape were unrealistic."

Subtheme 1b: Element(s) Incongruent with Personal Waking Life. The second most commonly identified abnormality that reportedly triggered lucidity was element(s) incongruent with personal waking life. Sometimes these dream elements were perceived as incongruous with the individual's conceptualisations of how they, or their acquaintances/family/friends, may behave. In other instances, dreamers realised that the situation they were in wouldn't happen in wakefulness. For example, three participants reported having realised they were dreaming upon noticing that someone featuring in the dream is deceased in the waking world. In other cases, there appeared to be an array of un-realistic elements present, and yet it was not always the most extreme inconsistency present that triggered lucidity. For example, one dreamer noticed that they were in a dream because their house looked different, but they could accept that they and their friends were appearing in a TV series:

"I was dreaming about myself and friends in a particular TV series and I realised because my house looked different."

I just dream about ordinary things but with slight changes that are the things I usually pick up on. Such as I dreamt I was going to dye my hair red or that someone spoke to me when they wouldn't. Things like that are usually points where I realise I'm dreaming...

Subtheme 1c: Inconsistency with General Life. The lucidity triggers classified under this subtheme pertained to those involving the judgement that certain dream elements were incongruent with that which the dreamer would expect to be the case in life in general, not just in their personal life and not constrained to physicality. The following are prototypical examples of the trigger 'inconsistency with general life' with the latter co-occurring with the nightmare trigger:

...Another thing that happens a lot is that video game mechanics start appearing in dreams where I seem to be doing something perfectly normal. An example of this was when I had a dream a few days ago where I was taking my clean washing up the stairs to put away when before I went up the stairs I felt the need to 'check my inventory' for some bizarre reason and I saw a grey box appear but then I realised I didn't need to open it but as I was walking up the stairs I realised that that wouldn't happen in real life...

"Very unrealistic dream was about to be eaten by some monsters and knew it wasn't real"

Subtheme 1d: Unusual Sensations. The last type of abnormality that participants reported they had identified and reached lucid insight as a result, was an unusual sensation. For instance, some dreamers reported not feeling pain despite being injured:

"...being chased in a dream and getting hurt however experienced no pain that made it clear it was a dream"

"Once I dreamt I was fighting in a war on an island, and a Chinese soldier shot me and nothing happened. So, I realised I was dreaming."

Theme 2: Emotional Arousal

In 29.0% of responses, participants reported they had become lucid following an emotionally arousing experience. These involved feelings of distress, discomfort, or survival fears which appeared to facilitate lucid insight. There were two types of

emotional lucidity triggers identified, that often co-occurred: nightmares and the act of self-comforting/denial.

Subtheme 2a: Nightmares. In 26.9% of responses participants reported that lucid insight followed a nightmare, rendering it the most prevalent subtheme trigger. Many nightmares that triggered lucidity involved the dreamer attempting to escape or confront the threat, which appeared to promote lucid insight:

“...Usually, during a nightmare it will dawn on me that it is, in fact, a dream, and that I can escape it if I simply open my eyes...”

Sometimes, attempts to escape or confront dream threats seemed to promote the identification of abnormalities or dream-like qualities in the surrounding environment which reportedly led to lucid insight:

I was running away from an attacker that I could see in a place I had never been before, upon me stopping and upturning round to face my attacker I realised that the area I was in was completely distorted as was the attacker. This is what led me to realise that I was in a dream and alter my surroundings to a less dangerous situation.

Subtheme 2b: Self-comfort/Denial. The other form of emotionally-induced trigger was labelled ‘act of self-comforting’. This refers to the way in which some dreamers reached lucid insight after re-assuring themselves that the distressing or confusing experience was just a dream. Often, nightmares induced this act of self-comforting/denial that in turn led to lucid insight:

Usually during a nightmare. I tell myself that it isn't real and that it can't hurt me, I just need to hold on until I wake up and I will be ok. I try to wake myself up but mostly can't do this.

Had a dream I was being spoken to by a creepy old man who I used to see walking his dog and it made me uncomfortable and scared even though I was telling myself in the dream that it was only a dream and I needed to wake up quickly.

Theme 3: Identification of Dream-Like Qualities

This trigger involved the judgement that the experience was dream-like which led the dreamer to realise they were dreaming. The dream-like quality was not always clearly articulated by participants, and sometimes it merely involved a general sense of the experience being dream-like in nature. This trigger featured in 12.9% of responses.

Subtheme 3a: Realisation of Control. Some participants reported they had reached lucid insight upon realising that they could manipulate dream content or by experiencing a sense of agency which was typically heightened compared to that experienced in wakefulness:

“I felt that I could control my own body and manipulate what happened in the dream; and I made myself fly.”

This is considered a dream-like quality because it is only in dreams, and not in wakefulness, that it is possible to have the level of control participants were typically referring to (e.g. manipulating dream content).

Subtheme 3b: Déjà Rêvé. The term *déjà rêvé* was independently coined by Funkhouser (1981) and Neppe (1983) to refer to the sense that the current experience has been dreamt before. This appeared to trigger lucid insight in some cases. This sense usually arose from a recurrent dream or nightmare:

I had these magical powers and was fighting in a battle. My abilities had been working fine throughout the majority of the dream, but it came to a point where they just stopped working and I couldn't do anything. I have had similar dreams to this before and so I realised it was a dream and made my powers start again.

I knew I was dreaming whilst I was still in the dream because it is a horrible dream I have had before, in which my mouth is full of caramel which I can't swallow or spit out, and it tastes salty and sickly at the same time and makes me feel sick and like I am choking on it. As I have had this before I think I learned to realise, whilst still dreaming, that it wasn't real.

I used to have a recurring nightmare as a child about a giant red scorpion being after my family and I knew I was dreaming and would pinch myself in my dream to try and wake up but couldn't.

Theme 4: Miscellaneous

Approximately one third of the sample either did not report a trigger, reported a trigger that was too vague to fall under the aforementioned themes, could not identify or recall what it was that had made them realise they were dreaming, or claimed just to have simply known they were dreaming:

In the most memorable instance, I 'woke up' in my bed but just knew that it wasn't real and that I was still dreaming so knowing that I got myself to float in the air before hitting the ground and actually waking up.

"I don't know what made me realise that I was in a dream, I just did."

Co-occurring triggers

34.4% of responses contained multiple (i.e. 2 to 4) triggers that appeared to co-occur within a dream. While co-occurrences were not involved in the majority of responses, reports commonly featured non-miscellaneous triggers as co-triggers than as singular triggers (34.4% versus 31.2% respectively). As briefly outlined previously, subtheme triggers co-occurred across themes (i.e. inter-theme) and/or within themes (i.e. intra-theme). For example, some participants reported realising they were dreaming after identifying an abnormality (e.g. a physical anomaly) during an emotionally-arousing event (e.g. a nightmare), which is an inter-theme trigger co-occurrence. Intra-theme trigger co-occurrences refer to those involving multiple subtheme triggers falling under the same theme, for example realising one is dreaming because of identifying a physical anomaly as well as an unusual sensation, with both of these subtheme triggers falling under the theme identification of abnormalities. Not all possible trigger co-occurrences featured, but those that did are reported in this section. It must be noted that some responses featured both intra- and inter-theme co-occurrences.

Inter-Theme Trigger Co-Occurrences. The total proportion of responses that contained inter-theme trigger co-occurrences was 14.0%. Of these co-occurrences, the identification of abnormalities and emotional arousal was the most common pairing (6.5% of responses) followed by the identification of dream-like qualities and emotional arousal (5.4% of responses). The identification of abnormalities and dream-like qualities were co-triggers in 2 responses, with one of these responses also containing an emotional arousal trigger.

Only one response contained an inter-theme trigger co-occurrence that didn't feature emotional arousal. This response featured two subtheme triggers falling under the identification of abnormalities, specifically identification of a physical anomaly and an incongruity with personal waking life, as well as a subtheme trigger falling under the identification of dream-like qualities, specifically realization of control:

In the dream I was back at my old primary school but at the age I was at that moment (being around 15/16 years of age at the time). As soon as I recognised the specific differences (i.e. the space felt smaller in comparison to my memory, I was taller, etc.) I felt that I could control my own body and manipulate what happened in the dream; and I made myself fly.

The remaining inter-theme trigger co-occurrences all featured emotional arousal, specifically the subtheme trigger nightmare. The subtheme triggers that featured in the inter-theme co-occurrences of emotional arousal and identification of abnormalities were as follows. Nightmare co-occurred solely with incongruity with personal waking life in 1 response, with inconsistency with general life in 1 response, and with unusual sensation in 1 response. Nightmare featured alongside both the recognition of physical anomaly and of an unusual sensation in 1 response, and alongside self-comfort/denial and identification of inconsistency with general waking life in another.

The subtheme triggers that featured in the inter-theme co-occurrences of emotional arousal and identification of dream-like qualities were as follows. Nightmare co-occurred solely with realization of control in 2 responses and with déjà rêvé solely in 2 responses. In one response nightmare co-occurred with self-comfort/denial, realisation of control and déjà rêvé.

Lastly, the subtheme triggers featuring in the inter-theme co-occurrence of emotional arousal, identification of abnormalities and of a dream-like quality (1.1%) were nightmare, identification of an incongruency with personal waking life, and déjà rêvé.

An example of nightmare with the identification of abnormalities, specifically the subtheme trigger physical anomaly:

“I have had nightmares of trying to run away from something but not actually getting anywhere and I have realised that it is a dream.”

Déjà rêvé, a subtheme trigger falling under identification of dream-like qualities, triggered lucidity in some nightmares, which in the following example was promoted by a recurring nightmare:

“I used to have a recurring nightmare as a child about a giant red scorpion being after my family and I knew I was dreaming and would pinch myself in my dream to try and wake up but couldn't.”

Intra-theme Trigger Co-Occurrences. Nightmare and self-comfort/denial featured as an intra-theme co-occurrence either as sole co-triggers (i.e. a lone pair) or accompanied by triggers of different themes (2.2%). The total proportion of responses featuring this intra-theme trigger co-occurrence was 10.8%. Examples are:

“Usually in tense dreams or maybe trying to get away from something I realise it's only a dream and it's not real even though it seems like it is actually happening, kind of reassuring myself unintentionally in a dream.”

“Usually during a nightmare. I tell myself that it isn't real and that it can't hurt me, I just need to hold on until I wake up and I will be ok. I try to wake myself up but mostly can't do this.”

Only one participant reported an intra-theme trigger co-occurrence that fell under the theme identification of dream-like qualities (i.e. subtheme triggers realization of control and déjà rêvé), and this pairing occurred alongside the emotionally-arousing triggers of nightmare and self-comfort/denial. The subtheme triggers that featured in the intra-theme co-occurrences under the theme of identification of abnormalities (14.0% of responses), in two responses alongside triggers of a different theme, were as follows. Physical anomaly and element(s) incongruent with personal waking life in 10.8% of responses. Physical anomaly and unusual sensations in 1.1% of responses. Element(s) incongruent with personal waking life and inconsistency with general waking life in 2.2% of responses.

Discussion

In-Dream Triggers of Lucid Insight

In the present research, most lucid dreamers could specify a memorable incident in which they had become lucid and could describe how they had realised they were dreaming. From these descriptions of lucidity triggers, it was possible to classify responses under four themes (i.e. overarching triggers). Most commonly, lucid dreamers reported that they had realised they were dreaming upon discovering abnormalities, upon identifying a 'dream-like quality' of the experience, and/or from an emotionally-arousing dream experience. A third of lucid dreamer reports contained miscellaneous triggers because they could not be classified in this way, the trigger could not be identified, or the participant stated that they couldn't recall how they came to the realisation that they were dreaming.

Overall, the present typology bears much similarity to Gackenbach's (1982, 1988) which included identification of inconsistencies, identification of the 'dream-like quality' of the dream, and nightmares, as frequent triggers of lucidity. However, it is not known whether the trigger of 'identification of inconsistencies' identified by Gackenbach (1982, 1988) referred to inconsistencies within the dream, or inconsistencies between the dream content versus that which typically or invariably occurs in waking life. In the present study it was only the latter identification that reportedly triggered lucid insight. This appears to align with Stumbrys et al.'s (2014) findings, whereby identification of 'peculiarities', such as the 'bizarreness of the dream' and 'flying', appeared to trigger lucidity in a number of cases. This trigger was termed "identification of abnormalities" in the present study to encapsulate all newly identified triggers that fall under this category; identification of physical anomalies, of element(s) incongruent with personal waking life, of an inconsistency with general

waking life, and of unusual sensations. Identification of anomalies is also an established lucid dreaming induction technique (LaBerge & DeGracia, 2000; Zadra et al., 1992). Incidentally, Zadra et al. (1992) found that 44% of trained lucid dreamers were able to notice anomalies including flying, dream characters that in real life are deceased, and being in the wrong city or an unknown place; all of these identifications were found to trigger lucid insight in the current sample of lucid dreamers.

Findings also align with Stumbrys et al.'s (2014) since it was found that recurring dreams can trigger lucid insight. More precisely, in the present study it appeared that recurrent dreams promoted *déjà rêvé*, which enabled the dreamer to conceptualise the experience as a dream. It is interesting to note that *déjà rêvé* has previously been identified as a method of inducing lucidity that can be learnt, alongside anomaly recognition (LaBerge & DeGracia, 2000). Stumbrys et al. (2014) also found, much like the present study and Gackenbach's (1982, 1988) studies, that nightmares and disturbing dreams appeared to trigger lucidity. The finding that lucid dreams can spontaneously emerge from nightmares is broadly supported (Schädlich & Erlacher, 2012; Voss et al., 2012; Wolpin et al., 1992).

In summary, the major triggers of lucidity identified in the present study closely aligned with Gackenbach's (1982, 1988) and Stumbrys et al.'s (2014). However, present findings were unique in three key aspects. Firstly, over a third of lucid dreams (34.4%) were seemingly induced by the co-occurrence of triggers, as opposed to a singular trigger. Triggers co-occurred across themes (i.e. inter-theme) and/or within themes (i.e. intra-theme). Notably, all but one inter-theme co-occurrence featured an emotionally-arousing experience as a co-trigger, specifically a nightmare. It is also notable that reports more commonly featured non-

miscellaneous triggers as co-triggers than as singular triggers. These key findings not only indicate that multiple triggers may often underlie lucid insight, which include the identification of multiple abnormalities and/or dream-like qualities, but also that nightmares may promote such identifications. This is discussed in detail later.

However, it is important to note that in most cases a singular trigger, when including those classed as miscellaneous, appeared sufficient for initiating lucidity. The second unique aspect was the identification of novel triggers of lucidity that could be classified under an extension of Gackenbach's (1982, 1988) triggers (i.e. as subtheme triggers). The third unique aspect was that the present study demonstrated that the 'recognition of dream-like qualities' is not synonymous with lucid insight itself. This is because some participants reported 'just knowing' they were dreaming or not knowing how they had realised, whereas in other cases the recognition of dream-like qualities led to lucid insight. In the latter cases, this was accompanied by varying degrees of reasoning.

This more nuanced account of lucidity triggers allows us to generate tentative hypotheses concerning the nature of cognitive processes involved in reaching lucid insight. Overall, results indicate higher-order cognition (HOC) may sometimes facilitate lucid insight. The reasoning underpinning this contention is elaborated below with respect to all triggers (i.e. overarching and subtheme). The use of retrospective reports and phenomenological descriptions is widely considered a valid method of measuring underlying cognitive processes in dreams (Kahan et al., 1997; Ormerod & Ball, 2017; Pantani et al., 2018; Solomonova et al., 2014; Windt et al., 2016).

The Nature of Cognition Preceding Lucid Insight

Since it has been shown that the realism of a dream does not correspond with the likelihood of the dreamer reaching lucidity (Voss et al., 2013), this raises the question of how dreamers were able to identify abnormalities and dream-like qualities that triggered lucidity in the majority of present cases. Overall, the abnormalities were not judged as abnormal in the context of the dream, but rather because they were considered incongruent with what typically, or invariably, occurs in waking life. Therefore, to deem a dream element as abnormal in this way would necessitate the HOC ability of access to waking knowledge. Similarly, the way in which the identification of abnormalities involves reflecting on the plausibility of dream events indicates the presence of reflective self-consciousness - a form of HOC (Dresler et al., 2012; Filevich et al., 2015; Foulkes, 1990; Voss et al., 2013).

For these reasons, results indicate that the presence of HOC may be involved in identifying a dream element as abnormal. Since such an identification was reportedly responsible for triggering lucid insight in numerous cases, this indicates that lucid insight is not a pre-requisite for the re-emergence of HOC which directly opposes that originally theorised (see Kahan & LaBerge, 2011). That is, while it was originally assumed that HOC only features in dreams following the onset of lucidity, results instead suggest that the presence of HOC can actually promote the onset of lucidity and thus precede it. This suggestion is congruent with prior evidence showing that HOC can feature in non-lucid dreams even though it tends to be more characteristic of lucid dreams (see reviews by Kahan, 2001; Kahan & LaBerge, 2011; Kozmova, 2012).

In summary, results indicate that the re-emergence of HOC during a non-lucid dream facilitates the identification of dream elements as 'abnormal' and can thus promote lucid insight. It is suggested that the re-emergence of HOC promotes, as

opposed to invariably induces, lucid insight. This is indicated by two sets of findings. Firstly, it has been shown that HOC can feature in non-lucid dreams without inducing lucidity (see reviews by Kahan, 2001; Kahan & LaBerge, 2011; Kozmova, 2012). Secondly, it has been shown that dreamers can identify dream elements as abnormal without realising they are dreaming (Barrett, 1992; Moffitt et al., 2012). In these studies participants reported identifying dream events as implausible/bizarre, dream characters/objects as unreal, and/or can access memories of the waking world, without realising they are dreaming.

LaBerge and DeGracia (2000) have provided a similar suggestion regarding the process by which dreamers reach lucid insight, contending that the metacognitive recognition of being within a dream state is sub-served by access to knowledge of waking life. Access to waking knowledge is a HOC ability associated with lucidity (Barrett, 1992; LaBerge & DeGracia, 2000; Voss et al., 2013). According to LaBerge and DeGracia (2000), this access to memories allows for a contrast to be made between the current dream experience and knowledge of waking life, which is essential for recognising that the current dream experience cannot be classed as a waking experience. In reports involving the recognition of abnormalities and/or dream-like qualities, this process was sometimes described explicitly but sometimes a line of reasoning wasn't reported. Additionally, while this process could underlie the identification of abnormalities, identifying some abnormalities such as physical anomalies and unusual sensations may only involve access to implicit waking memories (e.g. schemas). This may be equally true for recognising some dream-like qualities. Alternatively, identifying an experience as dream-like may only involve access to memories of previous dreams which is inherent to *déjà rêvé*.

While not all reports appeared to involve comparing the dream experience to waking knowledge, it seems that the return of other forms of HOC may underlie the triggers identified. For a non-lucid dreamer to realise the degree of control they can exert upon the ongoing dream events requires a sense of agency. This trigger of “realisation of control” was deemed an identification of a “dream-like” quality because it is only in dreams and not in wakefulness where it is possible to have the level of control participants typically referred to (i.e. manipulating dream content in implausible ways such as restoring their superpowers.). Similarly, for the trigger *déjà rêvé*, the “dream-like quality” is recognised because of the dreamer recalling, or feeling a sense of, having experienced the set of events within a dream previously. In this way, the identification of a “dream-like” quality involves engaging in thoughts that exceed the boundaries of the presently experienced scene, which is a form of HOC (LaBerge & DeGracia, 2000). Similarly, the lucidity trigger “act of self-comfort/denial”, which fell under emotional-arousal triggers, also requires this HOC capacity. This is because while it involves emotionally-driven denial in the reality of the distressing dream, the self-reassurance that the experience is “only a dream” is a form of thinking that exceeds the boundaries of the presently experienced scene.

Overall, across the two thirds of reports, participants recalled having both thought about and commented on dream content in order to identify abnormalities, dream-like qualities, or to re-assure themselves that the distressing experience is not real. For example, one participant reported “Most of our dreams are quite unrealistic or improbable, but I remember thinking: this can't be real, I must be in a dream”. These accounts thus provide evidence of HOC in the form of reflective consciousness before the onset of lucidity. Similarly, the way in which participants could recall what it was that made them realise they were dreaming in a memorable

instance indicates the presence of reflective awareness before lucidity onset, which refers to an awareness of ongoing thoughts, feelings or behaviour (Kahan & LaBerge, 1994). Further to this, it could be argued that to identify abnormalities and dream-like qualities would require having contemplated, evaluated, and/or reflected on, the ongoing dream experience to a degree which thus indicates the presence of analytical thought processes. Therefore, while present suggestions are consistent with LaBerge and DeGracia's (2000) hypothesis in that the lucidity trigger of identification of abnormalities requires access to waking memories/knowledge, it appears that alternative HOC capacities may underlie lucid insight in cases involving other triggers.

In summary, a major suggestion from our findings is that the presence of HOC promotes the identification of abnormalities and dream-like qualities as well as self-comforting, thereby triggering lucid insight. This suggestion is congruent with previous research in that all the HOC abilities presently proposed to underlie the lucidity triggers, despite being uncharacteristic of non-lucid dreams, have been shown to occasionally feature in them (Barrett, 1992; Bradley, Hollifield, & Foulkes, 1992; Kahan, 2001; Kahan & LaBerge, 1994, 2011; Kozmova, 2012; LaBerge & DeGracia, 2000; McCarley & Hoffman, 1981; Moore, Middleton, Haggard, & Fletcher, 2012; Skrzypińska & Szmigielska, 2013; Tholey, 1985; Voss et al., 2013).

Limitations

Overall, the evidence discussed thus-far indicates that HOC abilities may precede, and facilitate, lucid insight. As aforementioned, evidence therefore sheds some light on the theoretical issue, highlighted by Kahan and LaBerge (2011), because it indicates that lucid insight is not a pre-requisite for the re-emergence of

HOC capacities. However, a limitation of the present study was that participants were asked to describe a memorable incident in which they had realised they were dreaming and what it was (if anything) that made them realise that they were in a dream. Therefore, it might be that in the majority of lucid dreams there are no readily identifiable lucidity triggers. In other words, it is perhaps only those lucidity triggers that are most memorable that involved a clear line of reasoning (e.g. identification of an abnormality).

In light of this limitation, future studies could ask participants to report their most recent lucid dream, or to complete dream diaries as used by Gackenbach (1982, 1988), to provide a more accurate depiction of the in-dream triggers of lucidity. Although, results did bear much similarity to Gackenbach's (1982, 1988) findings. Still, even with daily dream diaries there is an unavoidable delay between the dream and the corresponding report. This inevitably reduces the accuracy of reports since memories of dreams often decay rapidly (Eysenck, 2014). To reduce this delay further, sleep laboratory studies could be conducted using the long-established technique of indicating the onset of lucidity using volitional eye-movements upon which the participant can be woken-up to provide an immediate dream report. This technique was founded by LaBerge et al. (1981) to validate the very existence of lucid dreaming. However, due to lucid dreams being sporadic and infrequent in the general population, frequent lucid dreamers need to be recruited for such studies which could reduce the generalisability of findings. Nonetheless, notwithstanding the methods used, the retrospective nature of dream reports, coupled with their introspective nature, means they can be error-prone, confabulatory, as well as temporally and factually inexact (Kahan & LaBerge, 1996; Solomonova & Sha, 2016). It also means they may reveal more about individuals'

preconceptions concerning the nature of the experience (i.e. reaching dream lucidity) than the actual nature of the experience itself (Hurlburt & Heavey, 2015).

The accuracy of dream reports is also compromised because they are necessarily written in the wake state, which differs markedly from the sleep state dreams are experienced in, and memory itself is state dependent (Eysenck, 2014). Dream recall ability is also known to vary night-to-night and between individuals (Lewis, Goodenough, Shapiro, & Sleser, 1966; Schredl & Fulda, 2005; Watson, 2003) as does the ability to determine if one's internal commentary (e.g. that preceding lucid insight) occurred during the dream or when thinking about the dream in wakefulness (i.e. source monitoring ability; Johnson et al., 1984; Kahan & Claudatos, 2016; Mitchell & Johnson, 2000). Therefore, in some cases the internal commentary participants reported had accompanied lucid insight may have merely accompanied the act of recollection (cf. Foulkes, 1990; Kahan & LaBerge, 1996) and so might not indicate the presence of HOC before the onset of dream lucidity.

Implications

For now, these limitations notwithstanding, current findings indicate that further in-depth study of the in-dream triggers of lucidity may prove fruitful and help to enhance our understanding of the cognitive mechanisms underpinning lucid insight. The study also contributes to our understanding of the emergence of lucidity because it has uniquely found that nightmare-induced lucidity can arise via diverse paths. Some participants reported having reached lucid insight by denying the reality of the nightmare and telling themselves it was only a dream (i.e. through the act of self-comforting/denial), whilst other reports showed lucidity to be triggered because of the dreamer attempting to escape or confront a threat. Such attempts seemed to

promote logical thinking that then allowed for the identification of abnormalities or dream-like qualities in the surrounding dream environment. On the surface-level the outcome is identical and yet the underlying processes are distinct from one another. That is, present results indicate that lucid insight can be reached in nightmares through an emotionally driven denial, versus through a quest for escape that appears to involve problem solving. This latter process is similar to that hypothesised by Kozmová and Wolman (2006); that intense emotion can trigger reflective awareness and HOC in dreaming. It has similarly been hypothesised by Nielsen, McGregor, Zadra, Ilnicki and Ouellet (1993) that intense dream sensations (e.g. pain), that feature in nightmares, may induce problem solving cognition. This is the first study to provide direct evidence for such hypotheses. Relatedly, Bourke and Shaw (2014) found evidence suggesting that shared cognitive abilities may underpin lucid insight in dreams and problem-solving insight in waking life. They found that frequent lucid dreamers showed strong performance on problem-solving tasks designed to measure insight.

The present study has thus shed light on the well-established link between nightmares and lucidity. It is also the first study to show that lucidity can be induced by co-occurring triggers, with the nightmare trigger featuring in almost all inter-theme co-occurrences. This nuanced account of the in-dream triggers of lucidity highlights that there may be differential individual differences associated with each qualitatively diverse trigger and trigger co-occurrences. It may be found that the trigger co-occurrence of nightmare and self-comforting/denial is uniquely associated with psychopathology, while the trigger 'identification of abnormalities' and the trigger 'identification of dream-like qualities' may be uniquely associated with problem-solving ability in wakefulness. This would fit with a recent study that has found

psychopathology to be associated with lucid dreams rated low in sense of control and high in negative affect (Aviram & Soffer-Dudek, 2018). Relatedly, Gackenbach (1982) found that nightmare-initiated lucid dreams, compared to those initiated by the identification of a dream-like quality, tended to be associated with a sense of lesser dream control and heightened negative affect. It was further found that in the days preceding and following a nightmare-initiated lucid dream, participants reported more anxiety, hostility, depression and insecurity, relative to the days surrounding lucid dreams initiated by the identification of dream-like qualities. Future studies may therefore find that daily mood, alongside individual differences in problem-solving abilities and mental health, affects the lucidity trigger experienced.

Present findings, if supported by further phenomenological investigations, could also unite the seemingly paradoxical conceptualisations of lucid insight. This is because they could explain why lucid dreaming has been likened to a dissociative state on the one hand (Voss & Hobson, 2015; Voss et al., 2013), and a state underpinned by the activation of neural systems involved in executive functions on the other (Dresler et al., 2012, 2015; Mota-Rolim & Araujo, 2013; Spoormaker, Czisch, & Dresler, 2010). Executive functions encompass a range of HOC processes, including memory, attention and problem-solving, that are regulated predominately by the prefrontal cortex (Arnsten & Li, 2005; Miller & Cohen, 2001). The dissociative nature of lucid dreaming and its association with executive functioning, may correspond to the trigger of self-comforting/denial and the triggers of identification of an abnormality/dream-like quality respectively. The trigger of self-comforting/denial could be likened to a dissociative state because the dreamer realises they are dreaming upon detaching themselves from the distressing dream reality. Conversely, triggers involving the identification of abnormalities/dream-like

qualities appear to involve mental processes that connect with one's thoughts, memories of wakefulness, and sense of identity, and so are less dissociative in nature. These triggers also appear to involve higher-order executive functions, such as reasoning and analytical thinking as has been discussed.

However, results were not conceptually clear-cut since it was additionally found that in some cases lucidity was triggered by self-comfort/denial coupled with the identification of abnormalities and/or dream-like qualities. Therefore, despite these routes to lucidity being opposing in nature, in that the former involves disengaging from the dream content and the latter engaging with the dream content in order to identify abnormalities/dream-like qualities, they are not mutually exclusive. Although, it could instead be that the dreamer self-comforting/in denial wishes to solely disengage with the dream reality, as opposed to the dream content per sé, and this may motivate them to identify unrealistic dream elements that provide evidence for it being a dream. This would explain why these triggers co-occurred and provide a mechanism by which intense emotion can trigger reflective awareness and HOC in dreaming as hypothesised by Kozmová and Wolman (2006). For now, the evidence of trigger co-occurrences reveals that the path to lucidity may be more complex than originally thought and may vary from dream-to-dream and inter-individually.

Conclusion

In conclusion, present research found that lucid dreamers could often specify what it was that had made them realise they were dreaming. Most commonly, lucid insight was reported to have followed the identification of an abnormality, an emotionally-arousing experience (e.g. a nightmare), and/or the identification of a “dream-like” quality. For a small proportion of lucid dreamers, the trigger was un-identifiable in that either they could not remember what had made them realise they were dreaming, or they reported that they ‘just knew’ they were dreaming. Overall, this is consistent with earlier typologies. The present study also extended these typologies by identifying a number of novel lucidity triggers, including the identification of physical anomalies, act of self-comforting/denial, and déjà rêvé. It also uniquely identified that in a substantial proportion of cases lucid insight followed co-occurring triggers. This more detailed typology permitted the examination of the nature of thought processes associated with the transition from a non-lucid to a lucid dream state. This examination indicates that HOC abilities can precede, and promote, lucid insight.

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<https://doi.org/10.1037/h0094350>

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