Dreams of a geographer: A long dream and waking life series of geographic locations

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Summary. Several studies have shown that daytime geographic locations are more frequently incorporated into the dreams of the next two nights, but also after a 7 days delay. We analyzed the dream locations in 680 dream reports longer than 20 words recorded over a calendar year in a single geographer subject, and compared them with the exhaustive, concomitant daytime log of the 122 cities he visited during the same year. Among the dream reports, 24.4% (from 38% of the nights) named the geographic location in dreams. There were 107 cities visited in dreams and 122 visited during daytime: only 30 locations were common to dream and daytime life. Dream reports were longer when they indicated a location (90 ± 92 vs. 70 ± 67 words/dream, p = 0.008). In contrast, 72% (77/107) of locations visited in dreams had not been visited during the same year and 20 (18.7%) dreamt locations had never been visited during the entire life. In the 139 nights including a dreamt location, there was a timely (same night) concordance of 32.5% between the location visited the day before and the location in dream. Another 13.5% dreamt locations corresponded to locations visited within 10 days prior to target nights (without any peak at the 7th day), whereas 11.5% dreamt locations were locations to be visited the next day(s) (anticipation effect). This within-subject, large single longitudinal dream series, concomitant with an exhaustive log of visited geographic locations, confirms the continuity hypothesis for incorporation of recently visited locations in dreams, does not confirm the 7th day delay in incorporating location sources, and shows a small but interesting anticipation effect in dreams of future visited locations.

Keywords: Geography, location, dreaming, lag

1. Introduction

Whether our daily life is featured in our dreams has now been demonstrated for half a century, and referred to as the "continuity hypothesis" (Schredl & Hofmann, 2003). A large (>80%) amount of our dreams contains memories of characters and locations from our daily environment. However, the timing of incorporation of day events into dreams is imperfectly determined. Most dreams incorporate immediate events of the preceding days (day-residue effect) with consistent relative proportions of dreams referring to events from the first and second days prior to target dreams of two thirds and one third, respectively (Epstein, 1985; Jouvet, 1979; Nielsen & Powell, 1992). However, some dreams incorporate events dating from 4 to 9 days ago (dream-lag effect), suggesting a delayed treatment of daytime geographical information (Jouvet, 1979; Marquardt, Bonato, & Hoffmann, 1996; Nielsen & Powell, 1989, 1992; Powell, Nielsen, Cheung, & Cervenka, 1995; Roffwarg, Herman, Bowe-Anders, & Tauber, 1978; Verdone, 1965). In several within-subjects studies using a cross rating of dreams and daytime source memo-

ries, sinusoidal U-shaped curves were observed, with peak scores occurring for dreams following the source by 1 day and 4–9 days. Michel Jouvet observed this dream-lag effect in his personal, longitudinal collection of dream reports and concomitant daytime memory sources (1979). In 130 dreams, he found a sinusoidal U-shaped curve with peak references occurring 1 day (34.6%) and 9 days (10%) prior to the dreams. Incorporation of new spatial memories is of special interest. Indeed, in rats, ensembles of location cells in CA1 of the hippocampus, activated when learning a labyrinth, are reactivated in similar temporal sequences during subsequent NREM and REM sleep (Louie & Wilson, 2001; Wilson & McNaughton, 1994). Whether and how this replay is represented in the settings of the dreaming scenario in human is unknown. In an analysis of 270 dreams recorded during and after travel abroad, Michel Jouvet found that geographic elements of the new environment were mostly apparent in his dreams on average 7.8 days after leaving on the trip, whereas his home environment was mostly apparent on average 6.5 days after returning from travel. Michel Jouvet suggested that the delayed references reflected a mechanism responsible for delayed (circaseptan) processing of spatial memory of environment (Jouvet, 1979). This U-shape curve was replicated in 470 young students (mostly women), using a between-group design (TA Nielsen, Kuiken, Alain, Stenstrom, & Powell, 2004). Of interest, delayed incorporations had the highest likelihood of referring to geographical locations, whereas no delayed incorporation was found for self-actions. Most of these studies were however limited to 5-7 days of experiment, which may mask longer incorporation process. Plus, they were by definition limited

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by the ability to remember dreams (and their exact content) as well as to precisely log daytime events and locations.

We took the opportunity to study the personal dream collection of a regular, high dream recaller. This subject was a professional geographer who simultaneously kept a precise log of his daytime geographical locations for more than one year. Thanks to his personal, strong interest towards his daytime and dreaming space locations, we expected to establish more accurate correspondences between target dreams and daytime location prior to and after the night dream, in order to check for day-residue effect, dream lag effect, and also anticipation effect (whether one would dream of a location in the days prior to visiting it).

2. Method

2.1. Participant

The male subject was a healthy professional university geographer, aged 54 years old at time of the study. He took no drug or substance treatment. He was raised in Provence (Avignon), in the South East of France, from 0.5 to 16 years old, then lived in Paris from 17 to 23 years old, in various places from 24 to 31 years old and moved with his family in the West coast of France, where he lives for 23 years. He was also travelling for working purposes in France and in Portuguese Archipelago (close to the North Atlantic Basin). He was travelling for visiting family in Versailles (Yvelines department, close to Paris). During Year 2015, the subject visited 6 new (never visited before) locations for a very brief period. He had the habit for more than 20 years to write down the various geographical locations he visited during the day on a personal log, named "geographical location database". This location was precise at the level of a village. As a subject with high dreaming recall abilities since childhood, he regularly kept a concomitant dream diary since teenage years. He was not aware of Michel Jouvet's books and of any dream theories about day-residue effects and dream-lag effects when he completed the dream diary. Note that his schedule across the year included periods of faculty teaching lasting 7 months per year (during which he has regular commuting between his house and the university, 60 km apart), 4 months when he had research activities (either working at the university office, writing analyzes and reports or field activities, collecting geographic data in Portuguese Archipelago) and 1 month of vacation.

2.2. Daily space location database

A geographic location is a portion of terrestrial space, most of the time designated by a proper name, which is characterized by its limited size and its location on a terrestrial map. Each day of Year 2015, the subject indicated on a database the locations visited (at the level of the village), the purpose of the visit (work, leisure, family), the modes of transportation (walking, bicycle, car, bus, train, plane) and whether he was alone or not. Only the final destinations were registered, as well as the ones where the subject stopped for a specific reason. Consequently, the locations crossed without stopping (in a train or a car) did not appear. Travels were defined as any displacement from a city to another city, e.g., daytime commuting represented 2 travels/day. The database did not indicate the amount of time spent at each city and included the cities where he stopped and changed of transportation mean (e.g., change from a train to another train, or change from a car to a train).

2.3. Dream diary

Dream memories were written in French language during the night or early morning on paper sheets. They were then typed into a computer database. The dream diary content was analyzed for number of dream reports per night. The computerized count of words contained in the transcript was measured per dream report, as the exact number of words after elimination of personal comments on the dream. Each day, the subject indicated on the dream database the actual location where he slept as well as the cities visited during the day (if different). The dream report was searched for two types of locations: i) the locations where the dream took place (as exactly named in the report), or dreamt locations; and ii) the locations suggested by the dream, referred to in the dream report as: "it looks like …" or "it makes me think of…" as suggested dreamt locations. An example of a dream containing a location indication was: "Just an image of Louisa at a corner of Bellecour square in Lyon. It's at night. She was enshrouded in an orange urban light, a little hazy. We had to walk up the Rhône river bank", whereas an

Table 1. Most frequently visited cities in 2015 and their social and geographical references

City	Department code	Visits, n/y	Link with the subject
La Revêtizon	79	275	Home (from 39 to 55 y old)
Beauvoir-sur-Niort	79	223	Home neighboring city
La Foye-Montjault	79	94	Home neighboring city
Granzay-Gript	79	91	Home neighboring city
Niort	79	83	Home reference urban center
La Rochelle	17	78	French working location
Mauzé-sur-le-Mignon	79	60	Train station (towards La Rochelle)
Marigny	79	59	Home neighboring city
Fazenda das Lajes	Azores	56	Portuguese/Atlantic working location
Paris	75	43	Capital of the country, transport hub
Versailles	78	31	Parents home

Table 2. Number of dreams (N = 801) in function of the total word count, and of the month (Year 2015)

Month \ Total word count	< 20	20-50	51-100	101-200	201-300	301-500	> 500	Total
January	11	19	12	9	2	0	0	53
February	3	23	9	10	0	0	0	45
March	3	41	15	7	1	4	0	71
April	4	45	22	8	1	0	0	80
May	7	23	16	6	2	1	0	55
June	6	26	10	6	0	1	0	49
July	22	31	17	1	0	1	1	73
August	12	41	16	15	6	0	1	91
September	11	30	11	7	0	1	0	60
October	14	26	22	13	4	1	0	80
November	10	28	17	9	1	0	0	65
December	17	32	17	11	1	1	0	79
2015 Total	120	365	184	102	18	10	2	801

example of a suggested dreamt location was: "I saw a man appearing on a beach (which looked like the La Couarde beach, but contained sand instead of pebbles and was wider). He appeared at a high speed, seemingly lugged on his back. He was dressed in red, he was pulled by a paragliding sail and moved forward at very high speed." An example of dream which contained both named and suggested locations is the following "This dream occurs in Marseille. The first part of the dream takes place outside, between two locations, one close to the Panier district (in its part close to the sea and the old harbor), and one within downtown. I wait in the wharf, dawdling in the sunset. I shuttle between these two places, going through vaguely shopping back streets, waiting to find a place to stay for the night, (which was delayed, even if I know that I'll find it). In one of the intermediary streets, there are taverns on the right side, in the Bairro Alto style of Lisbon."

2.4. Statistical analysis and correspondence between dreamt and lived locations

We restricted the analysis to dream reports longer than 20 words, to avoid including dream reports with reduced information. Between groups comparisons were performed using Student t test (continuous measures) and chi-square test (categories).

3. Results

3.1. Characteristics of the daytime space location database

The database for location was exhaustive, indicating all locations visited during 365 days, and the 1936 journeys from city to city. There were 5.3 travels/day on average, the lowest being in August (4/d, due to resting time on vacation), April (4.1/d) and October (4.1/d, due to professional missions abroad with strong self-investment on site) and the highest being in March (7.4/d), November (6.9/d), September (6.8/d) and December (6.7/d). The subject visited a total of 122 different cities over the year; 58 (47.5%) cities were visited only once, 21 (17%) cities were visited twice, 23 (19%) cities were visited 3 to 9 times/year, and 20 (16.5%) cities were

visited 10 times or more in the same year. A total of 11 cities were the most visited (more than 30 visits/y, Table 1). They corresponded to the familial and professional attachment spots of the subject, as well as hubs for commuting.

As indicated in Figure 1, most visited cities were located in four specific territories: Deux-Sèvres - French department (on the West part of France) where the subject lived (25 different cities); Charente-Maritime - French neighboring department where the subject worked (20 different cities); Azores -Portuguese archipelago where the subject also worked (18 different cities); and Isère – South-East French department where some of his family members lived and where he spent some holidays (16 cities). The sedentariness of the subject was medium, as he spent 75% of the year in his living city and its neighbors. The number of locations (n = 16) where the subject slept at night represented only 13.1% of the total number of locations (n = 122) visited during the same period. The subject slept 70% of the nights at home, 15% of the nights in the Azores, and 15% of the last nights in 14 various cities, both French and Portuguese.

3.2. Characteristics of the dream diary

The dream collection of Year 2015 contained a total of 801 dream reports, and at least one dream report from 350/365 (96%) nights, yielding a mean 2.2 ± 1.38 (mean ± SD) dreams per night. The 365 nights contained 0 dream (n = 15 nights, mostly spent in a hotel), 1 dream (n = 129 nights), 2 dreams (n = 103 nights), 3 dreams (n = 64 nights), 4 dreams (n = 27 nights), 5 dreams (n = 12 nights), 6 dreams (n = 6 nights), 7 dreams (n = 3 nights), 8 dreams (n = 2 nights), 9 dreams (n = 1 night) and 10 or more dreams (n = 3 nights). The computerized number of words per dream report varied from 20 (those shorter than 20 were discarded) to 713 words (Table 1). The dream report frequency varied across the months (Table 2). The lowest amount of dreams was in February and the highest in August (time of vacation of the dreamer). The rate of dream report per night (at least one dream/night) varied from 57.1% when sleeping in Montferrat (Isere department) to 100% when sleeping in Azores, Portugal (Atlantic) and Versailles (Yvelines department) depending on the night location. As many as 97.5% of the nights spent at home were associated with at least a dream.

Table 3. Locations in dreams depending on locations where the subject had been located during the previous day

Locations of actual sleep	South of Niort (home)	Azores
Geographic dreams, n	123	34
Locations named in dreams		
South of Niort (home)	16.2%	0%
Azores	17%	35.3%
La Rochelle	15%	5.9%
Paris	8%	17.5%
Travelling	6%	0.2%
Others	38%	41%

3.3. Geographical location in dreams

Out of the 680 dream reports longer than 20 words, 280 (41%) dreams contained a named or suggested location. Among them, 166 (24.4%), coming from 139 (38%) nights indicated exact locations in the dream (dreamt locations, reported in Figure 2). In addition, 114 (16.8%) dream reports contained suggested dreamt locations (e.g., "it looked like this location"; "it makes me thinking about") and 24 adjectives were related to locations (like "American", "African", not used in this analysis as they cannot be reported on a map). There were 14/280 (5%) dreams containing both named and suggested locations within the same dream. The dream reports were longer when they indicated a geographical location than when they did not (90 ± 92 vs. 70 ± 67 words/dream, p= 0.008). The proportion of dreams with geographical locations was the highest in May (42%) and July (31%), and the lowest in February (12%) and November (15%), independently of periods with high or low mobility. The rate of dreams containing a geographical location was similar when sleeping at home (n = 98/250 [39%] nights) and when sleeping in Azores (the second most common
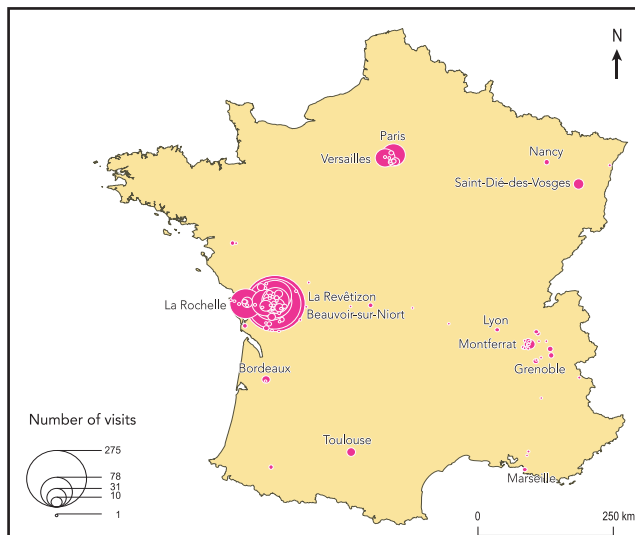
sleeping location, n = 25/54 [46.3%] nights, p = 0.33). The rate increased to 71.4% (n = 5/7 nights) in Montferrat (Isère) and 100% (n = 2/2) at La Ferrière d'Allevard (Isère), locations where the subject was raised as a child, which were rarely visited in the year (the numbers of nights were too small to be included in the analysis).

Figure 2 indicates the named (in purple) and suggested (in green) locations dreamt by the subject during Year 2015, with circles proportional to their frequency in dream reports. The dreams' map contained a main area, composed of the home (South of Niort) and working locations (La Rochelle) of the subject, as well as three well delimited other areas, including the Azores (Flores Island, Portugal), Ile de France region, and the Rhône-Alpes-Auvergne region.

3.4. Comparison between visited and dreamt locations

There were 122 cities visited during daytime and 107 visited in dreams, among which only 30 were common. Thus, dream reports incorporated only 24% (30/122) of the locations visited during the same year. In contrast, 72% (77/107) of locations visited in dreams had not been visited during the same year and 20 (18.7%) dreamt locations had never been visited during his entire life (e.g., the dreamer visited the Chicago train station, Ukraine, and the border of Land of Fire). Conversely, 92/122 (75.4%) locations were visited during daytime but did not appear in dream reports. Of interest, three dreamt locations did not exist in reality (to the best of our knowledge, and after having checked on Google): the "Lachiev Islands", a location named "Beggiard Madouri" and the "place des Arganiers"(square of the Arganiers), without any idea about the source of these names. The maps from Figure 1 (visited locations) and Figure 2 (dreamt locations) were highly similar.

An analysis restricted to the main living locations of home in France and work in Azores indicated that the maximal concordance between the slept and the dreamt location

Figure 1. Map of France indicating in red circles the locations visited during real life by the geographer during Year 2015. The circles' size is proportional to the number of visits. N = North

Figure 2.Map of France indicating in purple circles the locations named in the dreams of by the geographer during Year 2015, and in green circles the locations suggested in dreams (e.g., it looked like…). The size of the circles is proportional to the number of dreams displaying these locations. N = North
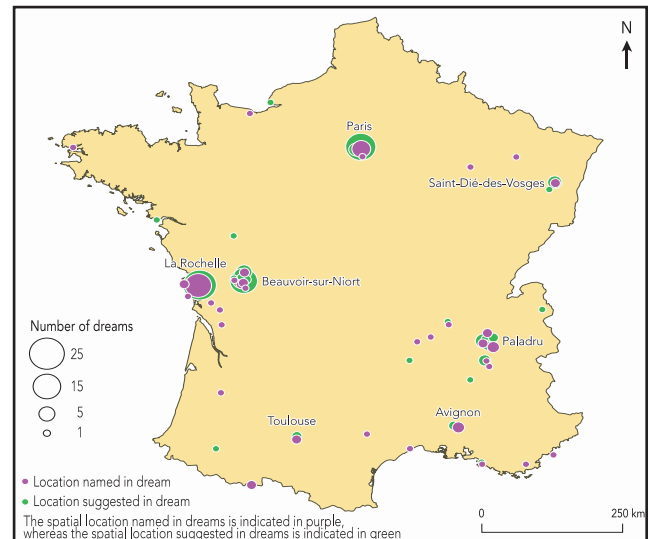
occurred when sleeping in Azores (35.3%) (Table 3). Consequently, the subject dreamt more about Azores when sleeping in Azores than about home when sleeping at home (16%, P = 0.002). The locations containing this high concordance effect were Fazenda das Lajes (9 concordances in 56 days there, i.e., 16%), La Rochelle (10 concordances in 78 days, i.e., 12.8%), together with Châbon en Isère (1 dream followed the first visit of this location in the French Pre-Alps).

3.5. Time lag effect in dream location

If one wants to establish temporal links between visited (122 different cities) and dreamt locations (107 different locations) during one year, there are more than 13,000 possible combinations in the back (memory) and forth (anticipation) directions. To reduce the possible combinations, we grouped locations together depending on their geographical location. The neighboring cities of the two main living locations of the subject -in France and in the Azores- were put together, creating two new surroundings groups. We selected the 139 nights with dreamt locations. With this grouped analysis, 45/139 (32.5%) same nights contained dreamt locations concordant with the location visited during the previous day. When extending the analysis to the 9 days preceding the target night (excluding the day before), only 19/139 (13.5 %) nights contained dreams with a location having been visited during these last 10 days, without any evidence for a peak at any of these days, and especially no peak at the 7th day prior to the target night (Figure 3). Six of the 19 dreams featured locations visited 3 days ago, and 4/19 dreams featured locations visited the day before.

In addition, we looked for an anticipation effect: did the subject dream about a new location during the 10 nights before traveling there? This was the case in 16/139 (11.5%) nights. Most (11/16, 68.8%) dreams featured a city scheduled (and actually visited) the next day. When looking at the 3 anticipation dreams before going to Azores (Figure 3), we could not identify any threatening events: in the first dream, the subject culled fruits in Azores; in the second dream, the subject had to intervene in a meeting about Azores to re-establish the truth, as a man with a costume was telling lies; In the third dream, the hostess of the dreamer in Azores suggested a discovery trip to make the dreamer discover unknown places. Eventually, there was no temporal link for any location (including 10 days before and after the target night) in 59/139 (42%) nights.

We also examined the effect of travels to test for the dream-lag effect. We selected places where the subject had stayed for more than one week, with a return for more than

Figure 3. Absence of dream lag effect. Among the 139 nights with a dreamt location, 64 dreamt locations had been visited within the 10 days before the index dream, including 70% the day before the dream. The other 30% were scattered around the 9 other previous days, without any peak at the 7th day.
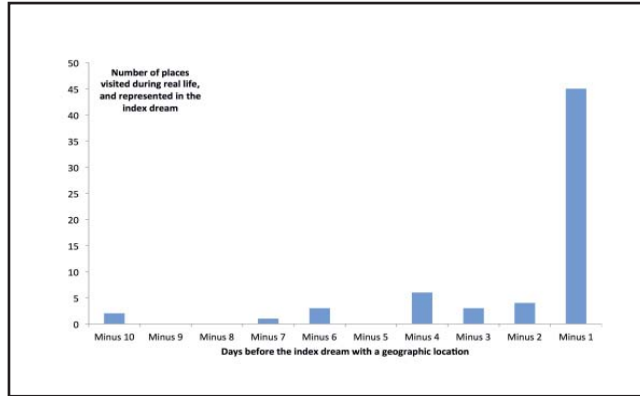

one week home. The geographer had been travelling three times across the year from France to Azores Archipelago (Atlantic, a place that he already visited several times during the years before 2015) for working purposes (Figure 4), had stayed there for 3 consecutive weeks each time and had travelled back and stayed home for more than 2 weeks each time. We examined the frequency of dreams about the Azores prior, during and after having travelled there. There were more dream reports incorporating the Azores when working there than when being back in France, with a small, inconsistent anticipation effect and a more regular lag effect (no statistical analysis due to small numbers).

4. Discussion

4.1. Main results

In this dream series concomitant with an exhaustive location database collected during the same year, 122 cities were visited during daytime and 107 were visited when dreaming. Having visited 122 different cities in a single year places the subject's mobility within the high part of the normative in the general population, which is around 60 cities per year (Armoogum, Madre, Gascon, François, 2010). Among 680 long (> 20 words) dream reports, 24.4% (from 39% of the nights) named the geographical location in dreams. Dreams with locations were longer than dreams without locations. In the 139 nights with a dreamt location, 32.5% corresponded to a timely concordance (same night) between the location visit-

Figure 4. Temporal link between Azores Archipelago settings in dream reports (green points: one dream containing this location) and real travels to Azores Archipelago (orange rectangles) across year 2015. The nights at home are indicated in blue rectangles.
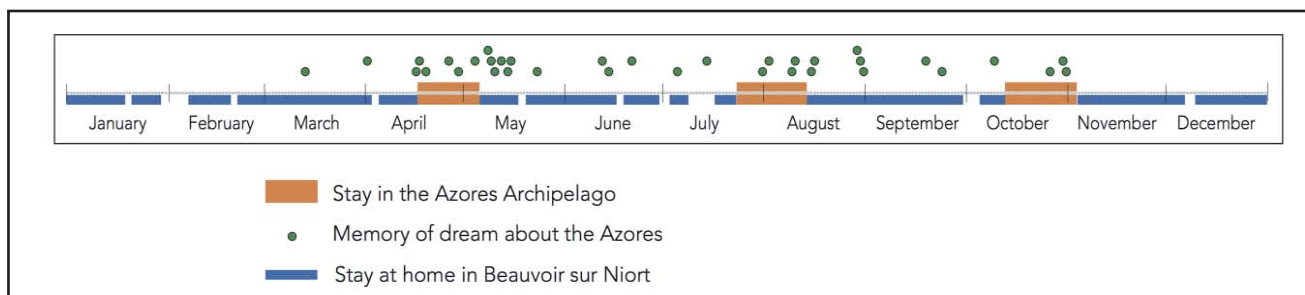
ed during the day and the location visited in dream. Another 13.5% dreamt locations corresponded to locations visited within 10 days preceding target nights (without any peak at the 7th day), whereas 11.5% dreamt locations represented the locations to be visited the next 10 days (anticipation effect). In this series, 59.3% of the 280 locations in dreams were named, whereas 40.7% had suggested names, because they were presented as: "it makes me think about", "it looked like". This kind of uncertainty is classical within dream reports. In a recent study on incorporation of remote vs. recent memories into dream content, nearly half of the dreamed places were unknown to the participant and the remaining places were either existing (26%) or with mixed attributes (27%) (Vallat, Chatard, Blagrove, & Ruby, 2017).

4.2. Day residue effect

This study partially supports the continuity hypothesis (which states that dreams reflect waking-life experiences) especially for geographic location in dreams. Notably, 30 cities visited in dreams had been really visited during the same year. However, most (72%) dreamt geographic locations had not been visited during the same year. As 32.5% of dreamt locations corresponded to the location where the subject was actually sleeping (or had visited during the day prior to the dream), the day residue effect was important. This time concordance is close to the concordance (34.6%) for incorporating any event from the previous day in a long personal, longitudinal series (Jouvet, 1979). The day residue effect may extend to the days preceding the target night/dream, as shown here by an additional 13.5 % of dreams containing locations visited during the previous 10 days, yielding to 46% of dreamt locations linked to recent spatial memory sources.

4.3. Absence of dream lag effect

Surprisingly, we found no clear dream lag effect, i.e., no peak of incorporation of spatial memory sources dating from approximately 7 days before the target dreams, even when restricted the observation to traveling periods. Differences with previous within-subject studies may pertain to a longer time of observation here, as previous studies examined spatial memory sources in dreams over a 7-10 days single period, but not over a full year. Each of the 107 geographical locations visited in dreams provided the opportunity to test the dream lag hypothesis, thanks to the large prospective mobility database of the subject. The dream series of Michel Jouvet (1979) was extended to 8 years and 2,525 dream reports, corresponding to 0.9 dreams/night. The author however ruled out the dream reports containing events having occurred more than 14 days before the target dream at home. He found that the frequency of incorporated events decreased rapidly from the day before (34.6%) to the 7 days before, with however a small (10%) peak of incorporation of the events of the 8th previous day. In addition, he studied 270 dream reports obtained during and after 20 travels abroad. He found that the new setting was mostly (99%) absent in the dreams of the 6 first days abroad, and appeared with an increasing frequency from the 7th night, and a similarly decreasing frequency when returning back home. In 29 subjects collecting their dreams and waking events during 14 days, 65% of a total of 299 dream reports were self-judged to reflect aspects of recent waking life experiences (Fosse, Fosse, Hobson, & Stickgold, 2003). The epi-

sodic replay of location was found in 29% of reports (with confidences in the similarity between the locations in dream and in reality varying from strong to faint), a frequency lower than other wake events such as themes, emotions, characters and action. The dream lag effect, previously replicated by Tore Nielsen et al (2004), may however not apply to any condition. Indeed, no dream lag effect has been observed within dreams collected upon awakenings from N2 and N3 sleep (Blagrove et al., 2011; van Rijn et al., 2015). The dream lag effect disappears when external judges study the dream reports, suggesting that the original experience may be more transformed or abstracted in dreams 5–7 days after an event (Blagrove, Henley-Einion, Barnett, Edwards, & Seage, 2011; Nielsen & Powell, 1992). In 44 subjects having reported their dreams and daily activities and concerns over a 10 days period, the dream-lag effect was found only for the incorporation of personally significant events into REM dreams collected at home, but not for major daily activities or major concerns, nor for REM sleep dreams collected in the lab (van Rijn et al., 2015). One may imagine that the geographical locations may not correspond to personally significant events in our subject.

Plus, the absence of dream-lag effect in our subject may relate to his schedule: As a faculty teacher, he taught every weekday during 7 months, with no between-days difference. This may have structured his memory differently from workers who have specific and repetitive topics or schedules on Monday, different from Tuesday and from other days. An activity repeated every given day of the week may act as a cue to structure and reactivate a memory source linked to that specific day. Another potential confound may be his high and daily interest toward locations, which may have increased the day-residue effect and decreased the dream-lag effect. Indeed, Nielsen and Powell (1992) raised a similar concern after having assessed incorporations of subjects' self-reported events across a 14-day period. While a strong day-residue effect was found, there was only slight evidence of a dream-lag effect, specifically, at Nights 6 and 12 following the events. However, the subjects in this experiment had been asked to record their most significant event of the day just prior to retiring each evening, a procedure which may have biased them toward emphasizing that same event in their dream reports the following morning.

4.4. Anticipation effect

Here we explored whether future travels would be featured in dreams. We found that 11.5% of dreams with locations represented travels (change of location) scheduled within the next 10 days, the most frequent taking place the day after the dream. Anticipation in dreams has been poorly studied yet, except from two studies having analyzed examination dreams before the actual examination (Arnulf et al., 2014; Halliday, 1993). In the medicine students (Arnulf et al., 2014), the negative anticipation of the exam in dreams was common on the night before the examination: 60.4% of students dreamt of the exam, and problems with the exam appeared in 78% of dreams (primarily being late and forgetting answers). When examining the anticipation dreams prior to travelling to Azores, they did not feature any threatening or negative aspects about the future trip. We may also imagine that anticipation dreams do not feature the daytime experience but the concerns of the dreamer when planning an important event. In the 10 days preceding a travel, any subject has to prepare the event, to take the tickets, orga-

nize the future stay, and prepare one's luggage. These real events and related thoughts may be featured into the dream as so, or may trigger some memories that randomly nourish the dream content. In this direction, the view of dreams as embodied simulations that dramatizes personal conceptions and concerns has been developed by many researchers (Domhoff, 2011).

4.5. Strengths and limitations of the study

This study contains several limitations. It is a dream and locations series collected in a single individual; these results should be compared in the future to collection obtained in larger samples. Plus, this subject was a professional geographer, which means that he paid a higher attention to places than non-geographer subjects. This is a classical bias of interest. However, this interest both applies to his daytime location log and to the locations in the dream diary, which gives more robustness to timely compare these two sources of information. Although the dream and mobility databases were one year long, we did not examine the very remote memory sources for geographic locations. Indeed, 10 to 18% of memory sources of the dreams date from more than one year before the dream (Vallat et al., 2017). The present series however carries several strong points: the prospective wake mobility database is exhaustive (thanks to the habit, expertise and accuracy of the geographer in this domain) which prevented to miss several cities visited over one year. Furthermore, this subject is a high dream recaller. With at least a dream during 96% of the nights, and a mean 2.2 dreams per night (i.e., more than 15 dreams per week and more than 64 dreams/months), he had a dream recall frequency ten times greater than the average frequency in the general population (Nielsen, 2012), greater than usual high recallers, who recall more than 3 dreams/week (Eichenlaub, Bertrand, Morlet, & Ruby, 2014) and similar to the dream report frequency of "great dreamers" such as Michel Jouvet's (Jouvet, 1979) and Michael Schredl's subject (Schredl, 2011a; Schredl, 2011b). Consequently, he provided a rich material in his dream diary. The dream reports lower than 20 words were removed from the final analysis, to increase the probability of catching settings in dream. In addition, his personal and professional interest into geographical aspects made him particularly receptive and trained to identify geographic locations in his dreams. Plus, the study period of this longitudinal series is prolonged (365 days) which reduces the bias (of interest, of lack of entrainment) due to the constraint of 7-14 days applied in most previous studies about places in dreams. This combination of a complete location log, an extensive dream diary and a long study duration provides a robust data set with which to examine correlations between wake and dream events.

5.   Conclusion

To summarize, this empirical longitudinal series analyzing locations in dreams vs. reality supports the continuity hypothesis, including a day residue effect accounting for a 32% concordance between dreamt locations and those visited the preceding day, but no dream lag effect featuring locations visited the 7th-8th day before. A modest anticipatory effect was found here, the location to be visited in the next 10 days (and mostly the next day) being found in 11% of the dreams. The geographical aspects of dreams have been to date restrained to settings in the dream scenario. They could however cover the concepts and methods attributed to the geographical science: territory, landscape, space, distance, society, representation, or maps. We deliberately chose to focus on geographical locations in this research. Future researches may focus on landscape, distance and inner maps in dreams.

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