

Impact case study (REF3)

| | | |
|---|--|--|
| Institution: Bishop Grosseteste University (BGU) | | |
| Unit of Assessment: 4 – Psychology, Psychiatry and Neuroscience | | |
| Title of case study: DrEAMSLab: Sleep, dream science, health and wellbeing | | |
| Period when the underpinning research was undertaken: 2015-2019 | | |
| Details of staff conducting the underpinning research from the submitting unit: | | |
| Name(s): Dr Caroline Horton | Role(s) (e.g. job title): Reader in Psychology: Cognition and Consciousness | Period(s) employed by submitting HEI: 01/04/2015 to date |
| Period when the claimed impact occurred: 01/04/2015 – 31/12/2020 | | |
| Is this case study continued from a case study submitted in 2014? No | | |
| 1. Summary of the impact | | |
| <p>DrEAMSLab was developed to pioneer ‘dream science’ investigation, and its work has been showcased in various public fora and received widespread media attention. Public engagement has aimed to increase understanding and awareness of the importance of sleeping well and its benefits. Activities have also sought to shape public attitudes and values and to inform professional practice via the delivery of several public presentations, engagement events, and prestigious keynotes to large public and professional audiences. Furthermore, The Sleep Well intervention project set out to enhance health and wellbeing outcomes by improving sleep quality in healthy adults.</p> | | |
| 2. Underpinning research – References in section 3 are indicated by number (e.g., R1) | | |
| <p>DrEAMSLab explores what happens to our mental activity during sleep. Evidence abounds that sleep is essential for physical and mental health, yet modern lifestyles render it difficult to maintain a consistent sleep routine. Individuals often remain awake, or ‘switched on’, for longer than is optimal, compromising sleep and consequently health. Sleep is needed to dream, but mental function when asleep and dreaming is less well understood. Horton’s work involves sampling dreams to understand such mental activity. Foundation empirical work led to the formation of a specialist laboratory, in turn leading to the development of theoretical models concerning functions and organisation of sleep cognition and dreaming.</p> <p>DrEAMSLab (Dreaming, Emotion, Associations and Memories in Sleep Laboratory) was established at BGU in 2016, led by Horton. The aims of the Lab are to:</p> <ul style="list-style-type: none"> • Promote the dream science method for studying conscious experience during sleep; • Further our understanding of the activation and reorganisation of memories in the sleeping brain; and • Apply the academic understanding of cognition during sleep to practice, by devising interventions to improve sleep. <p>Members of DrEAMSLab have investigated the nature of thoughts and memories (cognition) arising during sleep and manifesting as dreams. Foundation work inspired the dream-science approach (e.g., R1), to understand memory organisation (R2) and brain activations during sleep compared to wake (R3). This approach has demonstrated that studying dreams can be robust and systematic, challenging some popular misconceptions about the topic, and thus rendering it appealing to scientific audiences as well as non-specialist ones.</p> <p>Research within DrEAMSLab has involved developing and promoting several novel</p> | | |

Impact case study (REF3)

methodologies, ranging from virtual reality for modelling episodic memory, to annotating dreams for identifying characteristics of underlying memory sources. The latter has led to the conceptualisation of *hyperassociativity*: the cognitive function typifying Rapid-Eye-Movement sleep, whereby memory sources are reactivated in forms distant from their original waking experience (**R3**, **R4**, **R5**). This led to Horton co-hosting an interdisciplinary [Research Topic](#) on hyperassociativity across three journals, subsequently validating hyperassociativity empirically (**R2**).

Such research involves systematically sampling and studying the appearance of memories in dreams (e.g., **R2**), showcasing the way memories are structured and organised during sleep, namely, in fragmented (**R2**, **R4**) and emotional (**R5**) ways. By using dreams as a lens to understand memory activation during sleep, valid measures of everyday memory can be studied over a single night, involving complex memory systems such as autobiographical memory (**R4**). Previously, this had only been possible with expensive neuroimaging techniques (**R3**).

Additional work has highlighted the emergence of emotional memories during sleep. The incorporation of these experiences into dreams links dreaming behaviours to theories of the emotion-regulation (**R5**) and consolidation functions of sleep (**R4**).

The Dream Science Foundation funded three research projects. Additionally, collaborators were brought together by the British Psychological Society, for a funded series of public and academic events (with Horton as PI): *What can dreaming offer our understanding of sleep-dependent memory consolidation?* This led to numerous collaborations, the formation of a specialist regional centre (Lincoln Sleep Research Centre), and research being showcased via various media across the UK and internationally.

3. References to the research

Five independently peer-reviewed journal articles – with Impact Factor [IF] indicated

1. **Horton, C.L.** (2020) Key concepts in dream research: Cognition and consciousness are inherently linked, but do not control “control”! *Frontiers in Human Neuroscience: Cognitive Neurosciences*, 14 (259), 1-4. [IF: 3.209]
2. Malinowski, J.E., & **Horton, C.L.** (2020 online first) Dreams reflect nocturnal cognitive processes: Early-night dreams are continuous with waking life, and late-night dreams are emotional and hyperassociative, *Consciousness and Cognition*, 88, 103071. [IF: 2.044]
3. **Horton, C.L.** (2017) Consciousness across sleep and wake – continuity and discontinuity of memory experiences. *Frontiers in Psychiatry*, 8, 159. [IF: 3.532]
4. **Horton, C.L.** & Malinowski, J.E. (2015) Autobiographical memory and hyperassociativity in the dreaming brain: Implications for memory consolidation in sleep. *Frontiers in Psychology: Psychopathology*, 6, 874. [IF: 2.067]
5. Malinowski, J.E. & **Horton, C.L.** (2015) Metaphor and hyperassociativity: The imagination mechanisms behind emotional memory assimilation in sleep and dreams. *Frontiers in Psychology: Psychopathology*, 6, 1132. [IF: 2.067]

4. Details of the impact – Sources in section 5 are indicated by number (e.g., **S1**)

Impact activity comprised:

- Increasing public understanding and awareness;
- Shaping attitudes and values;
- Informing professional practice;
- Enhancing health and well-being outcomes.

Beneficiaries include:

- Professional organisations and partners;
- Public event attendees;
- Media readerships and audiences;

- Schools;
- Intervention study participants.

The importance of sleep and dreams

DrEAMSLab and Horton have been influential in a series of engagement activities to increase public understanding and awareness of the importance of sleep. Outreach also set out to shape attitudes towards the value of sleep and dreaming, and influence current and future practice. Widespread public and professional interest has accompanied the development of DrEAMSLab, and also increased with the COVID19 pandemic, which disrupted daily routines.

DrEAMSLab was launched at BGU in February 2016, with a programme of events funded by the British Psychological Society (BPS) to promote an understanding of dreaming in relation to sleep-dependent memory consolidation. Public events were held at BGU and the University of East London (in March 2017) and at Swansea University (in October 2017). The London event was featured in British Science Week, attracting an audience of 150+. Work from DrEAMSLab has contributed to numerous far-reaching awareness-raising campaigns about the importance of sleep quality. Horton was the academic lead for Manchester Science Week's 2016 'Chronarium' exhibition, in which a busy central shopping centre was turned into a "public sleep lab" for 10 days. This received widespread media attention (e.g. ITV news), increased public awareness of the need to sleep well and how to facilitate that (*The Independent*, **S1**).

DrEAMSLab activities have been showcased across numerous national and international media (**S2**). This has enhanced the public health and societal understanding, with large public and professional audiences and readerships having access to information about how to improve their ability to benefit from sleeping and dreaming "well". Horton's work has also been credited internationally via the Continuing Education credit scheme in the USA (**S3**). Sleep and dream health webinars were commissioned of DrEAMSLab by BrindleyPlace as part of Wellbeing Week (June 2020) and by Lakeside Harbour for Work-Life Balance Week (October 2020), which were similarly well-received, with attendees indicating their enhanced understanding of their physical and mental sleep health (**S5**).

Additional external opportunities to present dreams science research have been received from a range of scientific, public-science-engagement, and other organisations, groups and channels, including schools (**S4**). Horton produced Vlog material on the benefit of sleep and dreaming in children, which was distributed to over 264 schools nationally, with a reach of more than 63,000 pupils, enhancing 'public understanding and learning' (**S4**).

Dream science work was showcased to medics at the Royal Society of Medicine (RSM, London, March 2016; audience approx. 200) and the British Society for Clinical and Academic Hypnosis (July 2016; approx. 50). Horton was then invited as a keynote to share her research to inspire approximately 700 Psychology A-level student attendees, at a BPS 'Psychology4students' event (London, November 2016). The event was positively reviewed as a 'fascinating insight into how we process thoughts, experiences, experiences and memories' (**S5**). Horton provided the keynote at the Royal Institution for the 'RI Midsummer Night of Science', open to the public and patrons. This event sold out and was warmly received (**S6**). Horton delivered a popular TEDx talk, '*Sleep well, dream well, be fearless (almost)*', which linked emotion regulation functions of sleep to dreaming. To date, this has 951 views on YouTube (**S7**).

Work exploring emotion regulation in sleep and dreaming received particular interest from mental health professionals and the public suffering from sleep disturbances and sub-clinical mood disorders. Similarly this application of sleep and dream health at a time when sleep routines have been disturbed, namely over the course of the COVID19 pandemic, led to Horton featuring on eleven different BBC radio shows in April-May 2020 (**S8**).

Sleep and health and well-being outcomes

Academics, mental health support professionals and medics supported Horton's "Sleep Well"

sleep hygiene intervention. Implemented nationally, 91% of participants (n=79/87) indicated that they knew more about sleep hygiene as a result of engaging with the intervention materials, and 91% intended to follow their bespoke Sleep Well plans. Evaluation data demonstrated significantly improved wellbeing, measured via the Warwick-Edinburgh Wellbeing Scale. In a sample of 69 participants over a two week period, 54% indicated that their sleep had changed for the better since starting the intervention, and 90% indicated their sleep quality was very or fairly good, an increase of 36% from the beginning of the study (S9). Participants shared additional benefits, including increased alertness, fewer headaches, improved mood, reduced stress, feeling more focused, and energetic (S9).

5. Sources to corroborate the impact

1. Illustrative public exhibition: In October 2016, Horton was invited as the scientific partner to be involved with a 10 day public exhibition of a 'public sleep lab' in central Manchester, giving people the opportunity to have a brief nap. We emphasised the role of quality sleep in health and wellbeing and received widespread media coverage and interest. I was interviewed and broadcast on ITV evening news, and also here: *The Independent* (average circulation per issue 215,932) <https://www.independent.co.uk/life-style/health-and-families/the-science-of-sleep-and-why-napping-is-good-for-you-a7388701.html>.
2. Radio coverage: Regular interviews on BBC Radio Lincolnshire (2014-2020) (see also <https://thelincolnite.co.uk/2016/02/156710/> ; <https://www.bbc.co.uk/news/live/uk-england-lincolnshire-51674757>); BBC Radio Leeds (2014, April 2020); plus BBC Radios Shropshire, Berkshire, Merseyside, Lancashire, Cornwall and Guernsey in April 2020; and Solent, York, Surrey and Sussex, and Stoke in May 2020.
3. Horton's theories on dreaming have been incorporated into Continuing Education credited courses on dreaming in the US, e.g. <https://my-ella.com/wp-content/uploads/2018/05/EL27-2.1-Theories-of-Dreaming-1.pdf> and reviewed a number of times internationally in *Psychology Today* (e.g. <https://www.psychologytoday.com/us/blog/dreaming-in-the-digital-age/201608/news-the-2016-annual-dreams-conference>).
4. Indicative commissioned webinars*
 - Two webinars for Lakeside Harbour were commissioned as part of National Work Life Week (October 2020), and two webinars were hosted and commissioned by BrindleyPlace as part of a programme of activities in Mental Health Awareness Week (June 2020). Wellbeing videos developed by researchers at BGU were shared with partner organisations (secondary schools in the Lincolnshire and Nottinghamshire regions).
 - Horton, C.L. (2020) Monitoring Wellbeing Around the Clock: The Science Behind Sleep and Dreaming. December 2020. Youtube resource promoted to secondary schools, partners of BGU: <https://youtu.be/zwELh3fG9PI> There were 77 views within two weeks of promotion, and positive evaluations, including an email from a Head of a large local secondary school encouraging all staff to watch the video, is available on request.
5. Indicative keynotes and invited public lectures*:

Horton, C.L. (2016). *The ψence of dreaming*, Invited keynote presentation, "Psychology4Students" event, British Psychological Society, London 29th November 2016. (https://www1.bps.org.uk/system/files/user-files/psychology%204%20students%202016/P4S%20London%202016_WEB.pdf; see also a review of the presentation here: <http://thepsychologist.bps.org.uk/volume-30/february-2017/tour-dreams-and-nightmares>
6. Horton, C.L. (2017). *Sleep, memory and dreaming*, Invited keynote presentation, "Midsummer Night of Science" event, Royal Institution, London 6th July 2017. (<http://www.rigb.org/whats-on/events-2017/july/public-experience-midsummer-night-of-science>)

7. TEDx talk: Horton. C.L. (2018) Sleep well, dream well, be fearless (almost). TEDx talk. Brayford Pool #Fearless event, 30th June 2018, Lincoln. The presentation can be found here: https://www.youtube.com/watch?v=J_Qmep5eZE0 (951 views as of December 2020; 522 views within first week of availability).

8. Indicative national and international media coverage, print and online*:
Stylist Magazine <https://www.stylist.co.uk/life/careers/sleep-researcher-dreams-meaning-science-psychology-memory/350653> Average circulation per issue 401,856.
The Guardian <https://www.theguardian.com/science/2016/aug/14/scientists-secrets-dark-night-time-research-sleep-circadian>; Average circulation per issue 126,879.

9. Sleep Well evaluation data and testimonials*
** Wellbeing was measured via the Warwick-Edinburgh Wellbeing Scale.

* Fuller information available on request from BGU on webinars, keynotes, media engagement and Sleep Well project, including full list of events and engagements, feedback from commissioners, participant feedback and Sleep Well data.