

Is the dark really making me sad?

March 14 2017, by Linda Geddes

The inhabitants of Rjukan in southern Norway have a complex relationship with the sun. "More than other places I've lived, they like to talk about the sun: when it's coming back, if it's a long time since they've seen the sun," says artist Martin Andersen. "They're a little obsessed with it." Possibly, he speculates, it's because for approximately half the year, you can see the sunlight shining high up on the north wall of the valley: "It is very close, but you can't touch it," he says. As autumn wears on, the light moves higher up the wall each day, like a calendar marking off the dates to the winter solstice. And then as January, February and March progress, the sunlight slowly starts to inch its way back down again.

Rjukan was built between 1905 and 1916, after an entrepreneur called Sam Eyde bought the local waterfall (known as the smoking waterfall) and constructed a hydroelectric power plant there. Factories producing artificial fertiliser followed. But the managers of these worried that their staff weren't getting enough sun – and eventually they [constructed a cable car](#) in order to give them access to it.

When Martin moved to Rjukan in August 2002, he was simply looking for a temporary place to settle with his young family that was close to his parents' house and where he could earn some money. He was drawn to the three-dimensionality of the place: a town of 3,000, in the cleft between two towering mountains – the first seriously high ground you reach as you travel west of Oslo.

But the departing sun left Martin feeling gloomy and lethargic. It still rose and set each day, and provided some daylight – unlike in the far

north of Norway, where it is dark for months at a [time](#) – but the sun never climbed high enough for the people of Rjukan to actually see it or feel its warming rays directly on their skin.

As summer turned to autumn, Martin found himself pushing his two-year-old daughter's buggy further and further down the valley each day, chasing the vanishing sunlight. "I felt it very physically; I didn't want to be in the shade," says Martin, who runs a vintage shop in Rjukan town centre. If only someone could find a way of reflecting some sunlight down into the town, he thought. Most people living at temperate latitudes will be familiar with Martin's sense of dismay at autumn's dwindling light. Few would have been driven to build giant mirrors above their town to fix it.

What is it about the flat, gloomy greyness of winter that seems to penetrate our skin and dampen our spirits, at least at higher latitudes? The idea that our physical and mental health varies with the seasons and sunlight goes back a long way. The Yellow Emperor's Classic of Medicine, a treatise on health and disease that's estimated to have been written around 300 BCE, describes how the seasons affect all living things and suggests that during winter – a time of conservation and storage – one should "retire early and get up with the sunrise... Desires and mental activity should be kept quiet and subdued, as if keeping a happy secret." And in his Treatise on Insanity, published in 1806, the French physician Philippe Pinel noted a mental deterioration in some of his psychiatric patients "when the cold weather of December and January set in".

Today, this mild form of malaise is often called the [winter blues](#). And for a minority of people who suffer from seasonal affective disorder (SAD), winter is quite literally depressing. First described in the 1980s, the syndrome is characterised by recurrent depressions that occur annually at the same time each year. Most psychiatrists regard SAD as

being a subclass of generalised depression or, in a smaller proportion of cases, bipolar disorder.

Seasonality is reported by approximately 10 to 20 per cent of people with depression and 15 to 22 per cent of those with bipolar disorder. "People often don't realise that there is a continuum between the winter blues – which is a milder form of feeling down, [sleepier and less energetic] – and when this is combined with a major depression," says Anna Wirz-Justice, an emeritus professor of psychiatric neurobiology at the Centre for Chronobiology in Basel, Switzerland. Even healthy people who have no seasonal problems seem to experience this low-amplitude change over the year, with worse mood and energy during autumn and winter and an improvement in spring and summer, she says.

Why should darker months trigger this tiredness and low mood in so many people? There are several theories, none of them definitive, but most relate to the [circadian clock](#) – the roughly 24-hour oscillation in our behaviour and biology that influences when we feel hungry, sleepy or active. This is no surprise given that the symptoms of the winter blues seem to be associated with shortening days and longer nights, and that [bright light](#) seems to have an antidepressive effect. One idea is that some people's eyes are less sensitive to light, so once light levels fall below a certain threshold, they struggle to synchronise their circadian clock with the outside world. Another is that some people produce more of a hormone called melatonin during winter than in summer – just like certain other mammals that show strong seasonal patterns in their behaviour.

However, the leading theory is the 'phase-shift hypothesis': the idea that shortened days cause the timing of our circadian rhythms to fall out of sync with the actual time of day, because of a delay in the release of melatonin. Levels of this hormone usually rise at night in response to darkness, helping us to feel sleepy, and are suppressed by the bright light

of morning. "If someone's biological clock is running slow and that melatonin rhythm hasn't fallen, then their clock is telling them to keep on sleeping even though their alarm may be going off and life is demanding that they wake up," says Kelly Rohan, a professor of psychology at the University of Vermont. Precisely why this should trigger feelings of depression is still unclear. One idea is that this tiredness could then have unhealthy knock-on effects. If you're having negative thoughts about how tired you are, this could trigger a sad mood, loss of interest in food, and other symptoms that could cascade on top of that.

However, recent insights into how birds and small mammals respond to changes in day length have prompted an alternative explanation.

According to Daniel Kripke, an emeritus professor of psychiatry at the University of California, San Diego, when melatonin strikes a region of the brain called the hypothalamus, this alters the synthesis of another hormone – active thyroid hormone – that regulates all sorts of behaviours and bodily processes.

When dawn comes later in the winter, the end of melatonin secretion drifts later, says Kripke. From animal studies, it appears that high melatonin levels just after the time an animal wakes up strongly suppress the making of active thyroid hormone – and lowering thyroid levels in the brain can cause changes in mood, appetite and energy. For instance, thyroid hormone is known to influence serotonin, a neurotransmitter that regulates mood. Several studies have shown that levels of brain serotonin in humans are at their lowest in the winter and highest in the summer. In 2016, [scientists in Canada](#) discovered that people with severe SAD show greater seasonal changes in a protein that terminates the action of serotonin than others with no or less severe symptoms, suggesting that the condition and the neurotransmitter are linked.

It's possible that many of these mechanisms are at work, even if the

precise relationships haven't been fully teased apart yet. But regardless of what causes winter depression, bright light – particularly when delivered in the early morning – seems to reverse the symptoms.

Instead of bringing the sun to the people, the people would be brought to the sunshine

It was a bookkeeper called Oscar Kittilsen who first came up with the idea of erecting large rotatable mirrors on the northern side of the valley, where they would be able to "first collect the sunlight and then spread it like a headlamp beam over the town of Rjukan and its merry inhabitants".

A month later, on 28 November 1913, a newspaper story described Sam Eyde pushing the same idea, although it was another hundred years before it was realised. Instead, in 1928 Norsk Hydro erected a cable car as a gift to the townspeople, so that they could get high enough to soak up some sunlight in winter. Instead of bringing the sun to the people, the people would be brought to the sunshine.

Martin Andersen didn't know all of this. But after receiving a small grant from the local council to develop the idea, he learned about this history and started to develop some concrete plans. These involved a heliostat: a mirror mounted in such a way that it turns to keep track of the sun while continually reflecting its light down towards a set target – in this case, Rjukan town square.

The three mirrors, each measuring 17 m², stand proud upon the mountainside above the town. In January, the sun is only high enough to bring light to the square for two hours per day, from midday until 2pm, but the beam produced by the mirrors is golden and welcoming. Stepping into the sunlight after hours in permanent shade, I become aware of just how much it shapes our perception of the world. Suddenly,

things seem more three-dimensional; I feel transformed into one of those 'merry inhabitants' that Kittilsen imagined. When I leave the sunlight, Rjukan feels a flatter, greyer place.

As far back as the sixth century, historians were describing seasonal peaks of joy and sorrow among Scandinavians, brought about by the continuous daylight of summer and its almost complete absence in winter.

Three hundred and fifty miles south of Rjukan, and at roughly the same latitude as Edinburgh, Moscow and Vancouver, lies Malmö in southern Sweden. In Sweden, an estimated 8 per cent of the population suffer from SAD, with a further 11 per cent said to suffer the winter blues.

In early January, the sun rises at around 8.30am and sets just before 4pm. For Anna Odder Milstam, an English and Swedish teacher, this means getting up and arriving at work before dawn for several months of the year. "During the winter, we just feel so tired," she says. "The children struggle with it as well. They are less alert and less active at this time of year."

Anna picks me up from my city-centre hotel at 7.45am. It's early January and still dark, but as dawn begins to break it reveals a leaden sky and the threat of snow. I ask if she's a winter person and she visibly shudders. "No, I am not," she replies stiffly. "I like the sun."

Lindeborg School, where Anna teaches, caters for approximately 700 pupils, ranging from preschool age through to 16. Since there's little the school can do about its high latitude and brooding climate, the local authority is instead trying recreate the psychological effects of sunshine on its pupils artificially.

When I walk into Anna's classroom at 8.50am, my eyes instinctively

crinkle, and I feel myself recoiling. It's as if someone has thrown open the curtains on a darkened bedroom. Yet as my eyes adjust to the bright light, I see the curtains in this classroom are firmly closed. In front of me sit a class of 14-year-olds at evenly spaced desks, watching my reaction with mild amusement. They're part of an experiment investigating whether artificial lighting can improve their alertness and sleep, and ultimately result in improved grades.

"We can all feel that if we're not very alert at school or work, we don't perform at our top level," says Olle Strandberg, a developer at Malmö's Department of Internal Services, which is leading the project. "So if there is any possibility of waking the students up during the wintertime, we're keen to take it."

Since October 2015, Anna's classroom has been fitted with ceiling lights that change in colour and intensity to simulate being outside on a bright day in springtime. Developed by a company called BrainLit, the ultimate goal is to create a system that is tailored to the individual, monitoring the type of light they've been exposed to through the course of a day and then adjusting the lights to optimise their health and productivity.

When Anna's pupils enter the classroom at 8.10am, the lights are a bright bluish-white to wake them up. They then grow gradually more intense as the morning progresses, dimming slightly in the run up to lunch to ease the transition to the gloomier light outside. Immediately after lunch the classroom is intense whitish-blue again – "to combat the post-lunch coma," jokes Strandberg – but then the lights gradually dim and become more yellow as the afternoon progresses.

Bright light in the morning suppresses any residual melatonin that could be making us sleepy, and provides a signal to the brain's master clock that keeps it synchronised with the 24-hour cycle of light and dark. The idea is it therefore strengthens our internal rhythms, so that when night

comes around again, we start to feel sleepy at the correct time.

Already, there's some preliminary evidence that it's having an effect on the pupils' sleep. In a small pilot study, 14 pupils from Anna's class and 14 from a neighbouring class that doesn't have the lighting system were given Jawbone activity trackers and asked to keep sleep diaries for two weeks. During the second week, significant differences started to emerge between the two groups in terms of their sleep, with Anna's pupils waking up fewer times during the night and spending a greater proportion of their time in bed asleep.

No one knows whether the lighting system is affecting the students' exam scores, or even how to measure that. But it might. Besides suppressing melatonin and warding off any residual sleepiness, recent studies suggest that bright light acts as a stimulant to the brain. Gilles Vandewalle and colleagues at the University of Liège in Belgium asked volunteers to perform various tasks in a brain scanner while exposing them to pulses of bright white light or no light. After exposure to white light, the brain was in a more active state in those areas that were involved in the task. Although they didn't measure the volunteers' test performances directly, if you are able to recruit a greater brain response, then your performance is likely to be better: you will be faster or more accurate, Vandewalle says.

Anna agrees. Anecdotally, she reports that her students are more alert. "They've expressed that they feel more able to concentrate and they are more focused," she says. "I also look forward to going into my classroom in the morning, because I've noticed that I feel better when I go in there – more awake."

Of course, the idea of using light to counter the winter blues is nothing new. SAD lamps are a mainstay of treatment for winter depression, and in Sweden, which was a vigorous early adopter of [light therapy](#), clinics

often went one step further: dressing patients in all-white clothes and sending them into white rooms filled with bright light.

Baba Pendse, a Malmö-based psychiatrist, recalls visiting one of these early light rooms in Stockholm in the late 1980s: "I remember that after being in there for some time, we all started to get very lively," he says. In 1992, he opened a light therapy clinic in Lund, and another in neighbouring Malmö a few years later, which still exist today.

Sitting in the Malmö light room with Pendse brings back memories of sunny cafés at the top of ski slopes: the brightness elicits the same sense of elation. The room contains 12 white chairs and footstalls, each draped in a white towel and clustered around a white coffee table stacked with white cups, napkins and sugar cubes. The only non-white object in the room is a jar of instant coffee granules. It's warm, and the lights emit a very faint hum. Around 100 people diagnosed with SAD use the light room each winter, initially booking in for 10 two-hour sessions in the early morning over the course of two weeks. Pendse offers his patients the choice of group light therapy or taking antidepressants to combat their depression. "But unlike antidepressants, with light therapy you get an almost immediate effect," he says.

In recent years, light therapy has experienced something of a backlash in Sweden, and Malmö's clinic is one of only a handful that remain. In part, this was a response to a 2007 study by the Swedish Council on Technology Assessment in Health Care, which reviewed the available evidence and concluded that "although treatment in light therapy rooms is well established in Sweden, no satisfactory, controlled studies have been published on the subject". They said the value of therapy with a light box for SAD "can be neither confirmed nor dismissed", which, while inconclusive, was interpreted by some as 'light therapy has no effect'.

Pendse shakes his head telling me this. Conducting gold-standard, randomised placebo-controlled studies of light therapy is difficult, he says, because "what do you use as a placebo?"

Even so, there's some evidence that light therapy may have a similar effect on the brain to many antidepressants. In a study published in 2016, 11 patients with SAD treated with two weeks of light therapy saw plunging levels of serotonin transporter binding – a measure of how quickly serotonin's activity is curtailed. Their levels became similar to those seen during summertime.

There is other evidence, besides. At the back of our eyes, an unusual type of photoreceptor has been found that seems to help synchronise our circadian rhythms to the 24-hour cycle of light and dark. These cells, called ipRGCs, are particularly sensitive to blue light, connect to a number of different brain areas, and seem to feed into our circadian clock, our sleep centres and even some mood-regulating areas.

Through these cells, bright light seems to affect our mood and alertness in several ways – suppression of melatonin and synchronisation of the circadian clock, for instance – but [researchers believe](#) they have another, more direct impact on mood. Mouse studies have found that bright light at inappropriate times of day leads to depression-like behaviours (the mice became less interested in sugar and quickly gave up when challenged with a forced swimming test – a common measure of despair in mice). But this doesn't happen in mice genetically engineered to lack ipRGCs.

Vandewalle's lab meanwhile has discovered that the brain areas responsible for processing emotion light up more strongly in response to blue light, and has found an abnormal response to blue light in the hypothalamus of SAD sufferers during the winter months. "People with winter depression tend to sleep more, eat more and to be demotivated.

The hypothalamus is implicated in all these areas, so it may be an important region for the impact of light on the brain," he says.

Not everyone in Rjukan has welcomed the sun mirrors with open arms. Many of the locals I spoke to dismissed them as a tourist gimmick – though all admitted they were good for business. On the day I visited, the town was blessed with clear blue skies and a golden shaft of light descending from the mirrors, yet few people lingered in the town square. In fact, of the people I spoke to, it was recent immigrants to Rjukan who seemed most appreciative of the mirrors.

Martin Andersen admits to having got used to the lack of sunlight over time. "I don't find it so bad anymore," he says. It's as though the people who've been brought up in this uniquely shady place, or who have chosen to stay, have grown immune to the normal thirst for sunlight.

This is certainly the case in another Norwegian settlement: Tromsø. One of the world's most northerly cities, it is some 400 km north of the Arctic Circle. Winter in Tromsø is dark – the sun doesn't even rise above the horizon between 21 November and 21 January. Yet strangely, despite its high latitude, studies have found no difference between rates of mental distress in winter and summer.

One suggestion is that this apparent resistance to winter depression is genetic. Iceland similarly seems to buck the trend for SAD: it has a reported prevalence of 3.8 per cent, which is lower than that of many countries farther south. And among Canadians of Icelandic descent living in a region of Canada called Manitoba, the prevalence of SAD is approximately half that of non-Icelandic Canadians living in the same place.

However, an alternative explanation for this apparent resilience in the face of darkness is culture. "To put it brutally and brief: it seems like

there are two sorts of people who come up here," says Joar Vittersø, a happiness researcher at the University of Tromsø. "One group tries to get another kind of work back down south as soon as possible; the other group remains."

Ane-Marie Hektoen grew up in Lillehammer in southern Norway, but moved to Tromsø 33 years ago with her husband, who grew up in the north. "At first I found the darkness very depressing; I was unprepared for it, and after a few years I needed to get a light box in order to overcome some of the difficulties," she says. "But over time, I have changed my attitude to the dark period. People living here see it as a cosy time. In the south the winter is something that you have to plough through, but up here people appreciate the very different kind of light you get at this time of year."

Stepping into Ane-Marie's house is like being transported into a fairy-tale version of winter. There are few overhead lights, and those that do exist drip with crystals, which bounce the light around. The breakfast table is set with candles, and the interior is furnished in pastel pinks, blues and white, echoing the soft colours of the snow and the winter sky outside. It is the epitome of *kos* or *koselig* – the Norwegian version of *hygge*, the Danish feeling of warmth and cosiness.

The period between 21 November and 21 January in Tromsø is known as the polar night, or dark period, but for at least several hours a day it isn't strictly speaking dark, but more of a soft twilight. Even when true darkness does descend, people stay active. One afternoon I hire a pair of cross-country skis and set off down one of the street-lit tracks that criss-cross the edge of the city. Despite the darkness, I encounter people taking dogs for walks on skis, a man running with a head torch, and countless children having fun on sledges. I stop at a park and marvel at a children's playground lit up by floodlights. "Do children climb here in winter?" I ask a young woman, who is struggling to pull on a pair of ice

skates. "Of course," she answers, in perfect English. "It's why we have floodlights. If we didn't, we'd never get anything done."

During 2014–15, a psychologist from Stanford University called Kari Leibowitz spent ten months in Tromsø trying to figure out how people cope during the cold, dark winters. Together with Vittersø, she devised a 'winter mindset questionnaire' to assess people's attitudes to winter in Tromsø, Svalbard and the Oslo area. The farther north they went, the more positive people's mindsets towards winter were, she tells me. "In the south, [people](#) didn't like winter nearly as much. But across the board, liking winter was associated with greater life satisfaction and being willing to undertake challenges that lead to greater personal growth."

It sounds dismissively simple, but adopting a more positive attitude really might help to ward off the winter blues. Kelly Rohan recently published a clinical trial comparing cognitive behavioural therapy (CBT) to light therapy in the treatment of SAD, and found them comparable during the first year of treatment. CBT involves learning to identify patterns and errors in one's way of thinking and challenging them. In the case of SAD, that could be rephrasing thoughts such as 'I hate winter' to 'I prefer summer to winter', or 'I can't do anything in winter' to 'It's harder for me to do things in winter, but if I plan and put in effort I can'.

It also involves finding activities that a person is willing to do in [winter](#), to pull them out of hibernation mode. "I don't argue that there isn't a strong physiological component to seasonal depression, which is tied to the light–dark cycle," says Rohan. "But I do argue that the person has some control over how they respond to and cope with that. You can change your thinking and behaviour to feel a bit better at this time of year."

This [article](#) first appeared on [Mosaic](#) and is republished here under a Creative Commons licence.

Provided by Mosaic

Citation: Is the dark really making me sad? (2017, March 14) retrieved 20 April 2024 from <https://medicalxpress.com/news/2017-03-dark-sad.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.