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Pine fresh: The cultural and medical context of pine scent in relation to health – from the forest to the home

Abstract

Pine is a familiar scent in domestic cleaning products, but how often do we relate it to its origins as an odour emanating from a tree? This article takes a sensory history approach to trace the late nineteenth century and early twentieth century use of the pine forest as a therapeutic space, via the tuberculosis sanatoria to the use of pine scent in domestic disinfectant. By focusing on pine as experienced in this period as a micro-historical subject, this methodology will in turn allow for a detailed consideration of how historical context, and in particular medical conceptions and health concerns, can influence the creation of cultural memory. By following the trajectory of pine from its place in the forest to a commercial product used in the home, this will allow for an investigation at the intersection of environmental and medical histories and provide a framework for the consideration of the relationship of place to senses associated with concepts of health and wellbeing. As interest grows in the development of more effective sensory settings, in particular within healthcare, it also highlights the importance of considering the roles both cultural and personal memory play in response to various sensory stimuli.

Signaling cleanliness and health

In 2013 the US company Clorox, who manufacture the cleaning product Pine-Sol, changed its formula due to a shortage of natural pine oil; an element that had been synonymous with the product since its development in the 1920s. The response to the replacement of natural pine oil with a synthetic version was immediate condemnation from many consumers. The website, Ragan's PR daily reporting on this outcry in October 2014, noted that 270 people had signed a petition asking for the original scent to be reinstated. Comments below the line of the article's main text included the following from Stephanie pleading that she: 'was raised on the original recipe Pine-Sol scent cleaner. In my opinion if it doesn't smell like it, it's just not clean! I have been looking for any other brand with a 'like' scent and it's been difficult' (Ragan's PR daily, 2014). This highlights the close relationship between a particular scent, in this case natural pine oil, and ideas of cleanliness today, something that manufacturers regularly use to their advantage in their advertising campaigns. Ajax Pine Forest All Purpose Cleaner for instance states that its 'pleasant pine fragrance signals cleanliness' and the naming of the product as 'Pine Forest' also links it firmly to that environmental typology and its earlier history as a place of healing (Colgate Palmolive Company, online accessed 2021). In Britain, the most common pine product today is probably in the toilet duck range which is advertised as being 'perfumed with a pine fragrance, eliminating odours without masking them, giving your bathroom a long-lasting fresh scent and leaving your toilet sanitary clean' (Wilkos, online accessed 2021). This combination of masking one set of odours with another, whilst also working as disinfectant, is intertwined with the

idea that the pine fragrance will result in a ‘fresh’ smelling bathroom – all of which has deep historical roots.

Before we examine the history of pine itself it is worth noting that it is far less ubiquitous in our homes than it once was. On 15 April 2021, the British supermarket Waitrose ran an advertising feature in its free store newspaper on cleaning stating that ‘once pine was king. But today’s cleaning products offer so many more scents to choose from’ (Waitrose and partners 2021, 7), so these connections are by no means stable. Similarly in an article printed in the Los Angeles Times in 1987 on the growth of lemon additives in cleaning products, they reported this response from a woman asked why lemon was overtaking pine as the scent that represented cleanliness:

“I guess it’s the idea that lemons cut grease and smell good,” mused Zussman, a 28- year-old administrative assistant at a Los Angeles accounting firm. “It’s not that I dislike pine, but when I smell a lemon I think of the natural and fresh outdoors” (Shiver 1987, online)

The idea that the smell of pine no longer represents the ‘natural and fresh outdoors’ whereas lemon does is an interesting shift, which is also highlighted by other consumers in the same article (Shiver 1987, online). The twentieth-century connection between fresh air and the forest had been transplanted in the mind of Zussman by the lemon grove, or at least its citrus scent. The multisensory nature of lemon as a food stuff, might also be one reason that it lemon fragranced cleaning products have become particularly popular for kitchens, whereas pine, in the UK at least, has mainly become relegated to the bathroom.

To continue this relationship between smell and taste it is worth considering the term 'aroma', which is an abbreviated form of 'aromatics'. These are 'employed across cultures for a variety of purposes, including seduction, healing, hunting and communication with the spirits' as well as used to add flavour to food (Classen, Howes and Synott 1997, 7). This highlights the multisensory complexities of aromas of substances like a lemon, which in its natural and synthetic form we are both used to smelling and tasting. All of which as Mark Smith has argued 'is far from historically or culturally constant and how [lemon] tastes, its meaning, its salivating sharpness or margarita, Jimmy Buffet-laden signature, is dependent on many factors, the not least of which is history' (Smith 2007, 848). This connection between taste, smell and history also raises questions about whether the move of middle-class women into the kitchen to cook and clean themselves, and therefore the changing nature of that space, also impacted on commercial shifts in the range of scents for cleaning products. As increasing numbers of women, and men, have performed multiple roles in these spaces, and they have become places to eat as well as cook, this may have led to more complex multisensory responses relating to the interrelationship of taste and smell, although little work seems to have been conducted on this area to date (Martens and Scott 2005, 381). These changes may also highlight the importance of considering where, as well as how, sensory stimuli are encountered, which will be explored more later.

To return to pine, in a study cited by Classen, Howes and Synott pine fragrance was applied to facial tissues as part of an undated consumer test (Classen, Howes and Synott 1997, 194). This was based on results from earlier research in which the descriptions 'clean' and 'fresh' were attached by customers

to the scent of pine. However, once the pine was encountered in the form of scented tissues the associations shifted and the tissues themselves became considered 'hard' and 'rough', and thereby deemed unsuitable in relation to their intended cosmetic function (Classen, Howes and Synott 1997, 194). Classen, Howes and Synott use this example to argue that this was due to the complexity of associated meanings and the way in which the same smell could be experienced in very different ways when it is encountered in relation to the other senses. Other recent studies have also noted these multisensory entanglements including the impact of sound on the experience of taste (i.e., Spence and Deroy 2013).

We can perhaps further complicate the narrative about multisensory relationships, if we consider that cosmetic tissues are themselves produced from cellulose, a by-product of forestry – particularly pine and other soft woods. This makes the pine connection far less incongruous, unless we also consider the longer history of cloth as the material for handkerchiefs, as the production of paper tissues only began in the 1920s. Kimberley-Clark, who were at the forefront of this new industry and responsible for Kleenex, made their tissues from a product patented as 'cellucotton': a term that even combined these two elements (Heinrich 2017, 68). Although if we complicate things yet further the original intended use of these tissues was as a tool for make-up removal and the early 'Kleenex marketers suggested that the "sanitary cold cream remover" was a more healthful product than cotton towels' (Heinrich 2017, 68) so the medicinal associations of pine might have been considered efficacious. It may be that the older associations and experiences of cloth handkerchiefs and make-up removal remain, which points to the complexity of ways in which our sensory perceptions

intertwine with each other as well as with use, experience and place, even when the original connections have faded and are hard to establish.

This complexity is important to note at a time when increasing attention is being paid to the sensory environment of healthcare settings and their impact on the health of patients. In particular, it is worth highlighting the role of cultural, as well as personal, histories in order to ensure that diversity of experience is properly accounted for (Drahota et al 2012). New multi-sensory healthcare design has the potential to be powerful, but it may also be problematic if the choices made do not take into account the decision makers' own cultural backgrounds, or consider the historical context of why and how sensory stimuli evoke reactions in particular individuals and groups. Memories and emotion are strongly linked and a recent study on recorded sound, nature and wellbeing noted in particular the importance of the role of the non-visual senses 'in stimulating emotion, imagination and memory' (Bates et al. 2020, no page number).

By examining the cultural associations related to one particular smell, in this case pine, it is possible to highlight the complexities involved as well as note the potential limitations. As Anna Lowenhaupt Tsing (2015, 51) remarks in relation to the formidable Matsutake mushroom:

While some Japanese may smell nostalgia in the forests made by their disturbances, this is not, of course, the only feeling that people bring to such wild places. Consider the smell of matsutake again. It is time to tell you that most people of European origin can't stand the smell.

Here the cultural differences are clear between groups: but individual perception remains important with some associating the smell of the Matsutake with

nostalgia and others unable to cope with the scent at all. Similarly, Victoria Henshaw has noted that ‘people consider unfamiliar odours in more negative terms than known odours’ (Henshaw 2014, 33), which highlights the ways in which diversity of experience and exposure to different sensory environments can impact upon the perception of the same smell and result in different emotional responses. This is in line with the point made by Classen, Howes and Synott when they write that ‘the perception of smell, thus, consists not only of the sensation themselves, but of the experiences and emotions associated with them’ (Classen, Howes and Synott 1997, 2).

This article then will use a sensory approach to trace the attachment of concepts of health in relation to one particular smell, in this case the scent of the pine tree, and how it has been viewed as signaling particular health properties in the forest, the sanatoria and the home. As Tsing notes, ‘smell draws us into the entangled threads of memory and possibility’ (Tsing 2015, 45) which resonates with Jonathan Reinarz’s remark that ‘the senses are saturated with meaning and history’ (Reinarz 2014, 1). In order to provide an in-depth consideration, smell will be the key sense explored here. As Reinarz argues, aromas have ‘always been an integral part of peoples’ lives, possessing distinctive and often shared meanings’ (Reinarz 2014, 18). Similarly, recent neurobiology studies have also posited that the relationship between odour-evoked memories and human health and wellbeing is particularly important because ‘they evoke more emotional and evocative recollections than memories triggered by any other cue’ (Herz 2016, 2). This in turn has led to research on the use of scents such as that produced by lavender within healthcare settings to reduce particular emotional responses such as anxiety (Karan 2019, no page number). Both this potential

power and growing contemporary interest means that it is key that detailed attention is paid to how meaning is created and understood in relation to these sensory introductions

To return to the point above about the role of place, healthcare settings are also very different for instance to the home or the garden, so it is perhaps crucial to consider how the place, or manner, in which someone encounters a sensory element might have an impact on their response. There is again, also the noticeable factor of taking something that is found naturally in the forest and extracting one element which is then added to something incongruous (in the example above tissues) and so might be considered to be 'out of place'.

This relationship to place and experience is superbly summarised by Boddice and Smith in their discussion of what constitutes 'lived experience'. As they write (Boddice and Smith 2020, 32):

[...] the meaning of whatever is happening to the body, and the meaning of whatever the brain does either as a reaction to stimulus or as a constructive or predictive process, is done in a place, in a time, in a context, all of which are irrevocably bound with both the individual's own experience (what they have undergone in their lives) and the cultural framework through which that experience is made meaningful.

When considering the sensory impact of architecture or places or single stimuli, it is then important to place the personal experience within a cultural framework.

By tracing the use of pine as a scent geographically located in the nineteenth century forest to one prevalent in the modern-day home, this paper will outline the cultural and historic context for how the associations of nature

‘out there’ with health have become attached to symbols of nature ‘in here’. This in some ways undermines the classic argument that ‘today’s synthetic scents [...] are evocative of things that are not there, of presences which are absent’, and so have become olfactory signs without meaning (Boddice and Smith 2020, 205). Although we can argue that the scent of pine in the home may now be predominately artificial and the forest itself is absent, a strong connection remains with historical concepts that associate pine odour with health and cleanliness.

The connections between health and cleanliness are self-evident, if culturally contingent and complicated. They are inherently about human survival (Smith 2008, 9). The role that smell plays in this context is similarly complex. The medieval and early modern belief was that smells possessed ‘a real, tangible form, being capable of improving or destroying physical health with remarkable speed and efficiency’ (Rawcliffe 2008, 8). By the Victorian era, public health officials such as Edwin Chadwick were using the framework of miasmatic theory (that disease causation was related to foul air and odours) to explain to a Parliamentary Committee in 1846 that ‘all smells are disease’ (Parliamentary Papers 1846, 651. As quoted in Hempel 2013, 1238). However, as William Tullett has described, by this period it was generally understood that ‘whilst smell was sometimes good to think with, it was no longer a reliable guide to the purity of the atmosphere. Attempts to use it as such were gradually dismissed as superstition or conjecture. It could suggest the presence or absence of effluvia, but not what these were or whether they were dangerous.’ (Tullett 2019b, 87). The quality or composition of the air itself, however, was still of interest and remained so with the advent of germ theory.

This detachment of smell from direct disease causation did not however mean that smells became absent from the narrative, but rather that they signified something different. As Mark Jenner reminds us ‘the deodorized house smelt fresh. Every deodorizing is another olfactory encoding’ and pine is a useful way of approaching this (Jenner 2000, 144). By focusing on a period where germ theory had become the prevalent means of understanding the transmission of disease, this article will explore these new olfactory relationships and in so doing extend the work of smell historians such as Holly Dugan (2011) and Tullett (2019 a, 2019 b), who have focused on earlier time periods. The consideration of the forest rather than the city will also allow for a rural counterpoint to Melanie Kiechle’s investigation of role of smell in relation to health in the nineteenth-century American city (2017).

As well as providing us with a method of exploring cultural meaning, a sensory approach also allows us to explore the intersection between bodies and the environment. This consideration builds in particular on Jenner’s work, as he suggests that in the past ‘the human/environment boundary was neither absolute nor impermeable’ (Jenner 2011, 349). Through this approach the relationship between the body, the sensory experience and the broader environmental conditions will be surveyed. As this introduction makes clear, the responses of people to smells are culturally and socially contingent so the focus will be predominately on British histories of pine, as understood within transnational networks.

The therapeutic forest

Although the emphasis here will be on meanings of pine from the mid-nineteenth century onwards, it is worth noting that there is a longer history of valuing such trees for their effect on the body, particularly for lung conditions. As the *British Medical Journal* reported in 1908, when tracing the history of open-air treatments there was nothing new in the idea itself, stating 'Pliny the Elder speaks of the beneficial effects of sunlight and air charged with the scent of pine forests in consumption' and that other early medical writers such as Galen and Avicenna advised patients with lung conditions to live at high altitudes (Editorial 1908, 403). What is particularly interesting for us is this early mention of the beneficial nature of pine trees. In Pliny's *Natural History* of AD 77-9 he noted:

It is a well-known fact that forests planted solely with trees from which pitch and resin are extracted, are remarkably beneficial for patients suffering from phthisis-or who are unable to recover their strength after a long illness: indeed it is said, that in such cases to breathe the air of localities thus planted, is more beneficial even than to take a voyage to Egypt, or to go on a summer's journey to the mountains to drink the milk there, impregnated with the perfumes of plants (From Bostock 1985, book 24, chapter 9).

As well as this sensory experience of pine trees, which was clearly considered particularly useful for patients with lung conditions, the use of pine nuts in remedies for various diseases were also featured in herbals across the centuries, again, predominately for lung diseases.

Two of the most well read English early modern herbalists, John Gerard and Nicholas Culpepper, recommended the use of pine for lung conditions which suggests this idea had some longevity. Gerard wrote that 'it is a remedy against

an old cough, and long infirmities of the chest', and that 'it cureth the phthisic, and those that pine and consume away through the rottenness of their lungs' (Gerard, 2nd edition 1633, 1456). Culpepper similarly argued that 'Pine-Nuts, restore such as are in consumptions, amend the failings of the lungues, concoct flegm' [*sic.*], which suggests that the pinecones were still commonly indicated for lung conditions at this time (Culpepper 1665, 17). Culpepper also mentions the medicinal use of turpentine, which is made from resin obtained from trees such as pine, as a purgative, so pine products were being used medicinally in various formulations throughout the early modern period. It is, therefore, perhaps not surprising that pine forests became integral to the treatment of tuberculosis as that lung condition usurped other diseases as a prominent cause of death in the late nineteenth century.

It is important at this point to consider where pine forests were located and how they were likely to be associated in the minds of British people with mainland European contexts. In Britain, apart from limited pine woodlands in Scotland (mainly consisting of the of the native Scots pine, *Pinus sylvestris*) coniferous trees were not a common feature of the landscape until the nineteenth century (Elliott, Watkins and Daniels 2019). As a relatively deforested country, Britain relied heavily on the import of timber, including 'notably pine imported from the Baltic States or from North America' where it was used predominately in ship building, so this points to a lack of pine woodland as something that would have been commonly experienced as part of the natural environment (Holmes 1975, 70). When forestry planting occurred it was more likely to be of broad leaved, deciduous species, in England and Wales at least, until the planting of new coniferous plantations became more popular in

the late eighteenth century for patriotic and potentially economic reasons (Elliott, Watkins and Daniels 2019, 14).

Pine trees and their associated smell were then not part of the general smellscape in Britain and it is perhaps notable that Paul Readman describes the late nineteenth-century conflict between the concept of the broad-leaved New Forest as a 'particularly English national environment' and the perception of the "German" sort of forest the Office of Woods allegedly wanted to plant through its schemes of enclosure and conifer plantation' (Readman 182). The conifers Readman refers to in this passage represented both a particular forestry practice as well as something definitively non-native, which suggests that pine woodland would have generally been perceived in this way.

In a European context however the use of pine forests as important sites for the location of sanatoria can be traced to Germany, where pine forests were, and still are, far more extensive. As outlined by Eva Eylers, the German forests became conceived as therapeutic landscapes imbued with health qualities in contrast to the disease-infested city (Eylers 2014). As historians, such as Tullett and Kiechle, have shown, the city was traditionally a place associated with disease, partly because of its smellscape and what dangers such smells might signify. As Tullett explains in relation to eighteenth-century England:

George Cheyne's popular and influential *English Malady* noted that the illness of the nation was in part attributable to the putrid state of the cities. Cheyne listed the sulphurous fires, tallow candles, oil lamps, diseased animals, stinking breaths, burying places, putrefying bodies, slaughterhouses, and dunghills which helped determine the urban atmosphere. (2019b, 71)

Throughout the nineteenth century connections between ‘fresh air and foul smells were simultaneously discussions of environment, health, material progress, and the perils of urban life’ (Kiechle, 15). This led to a choice of the rural over the urban as a therapeutic place, something we also see in Britain throughout the nineteenth century, as specialist hospitals, asylums and sanatoria were moved further out to rural locations, often on hills and away from urban polluted centres (i.e. Hickman 2013).

The sanatorium and the forest

Geography, as well as medical conceptions, no doubt played an important role in what rural settings were seen as the most therapeutic for tubercular patients. The influence of Germany as a pioneer of sanatorium treatment for tuberculosis led to mountainous and forested locations becoming seen as the ideal place for sanatoria. This can be traced to the first German sanatorium opened in the mountains of Silesia in 1854 by Dr Hermann Brehmer [see Figure 1], and Otto Walther’s sanatorium situated soon afterwards in the pinewoods of the Black Forest. As Eylers argues, the ‘theory of the “immune place” served as the impetus for the justification of the sanatorium, which was to be situated far from the damaging city environment in natural surroundings, ideally in the dry air of an unspoilt mountain region’ (Eylers 2014, 670). Although there is not space to develop this idea here, German forests, including pine woods, became part of the development of a new national identity in the nineteenth century as influenced by the Romantic movement, as well as having a particular medical identity as a therapeutic feature (for more on this see Lekan 2004 and Morton

2002). Together this fed into a newly discovered optimism of unspoilt nature, including pine forests, as a setting for human recovery and optimum health.

Despite the long history of therapeutic ideas in Britain regarding the role of air for health, including the work of George Bodington in Sutton Coldfield in the 1840s, such ideas were overlooked by the medical profession and instead it was the later German examples that were feted and emulated (Cooter 1984, 45). When first published in 1840, Bodington's work received a hostile reception from the medical profession: but when the Sydenham Society republished it in 1901, it had 'hosannas raised to it' (Cooter 1984, 45). Roger Cooter has argued that this comparison implies 'that, in the eyes of the medical establishment, while it was quite acceptable for Bodington's generation to recommend fresh air, it was clearly unacceptable for them to advocate open air as the major part of an exclusive medical regimen' (Cooter 1984, 45). By the end of the nineteenth century the idea of fresh air as a therapeutic agent had replaced the older miasmatic theory, where the air was mainly viewed as the carrier of disease. In Britain, Hermann Weber made the case for open-air treatment in Britain in his 1885 Croonian Lectures to the Royal College of Physicians and in 1889 an article describing Dettweiler's regimen in Falkenstein sanatorium in the Taunus Mountains near Frankfurt was highlighted in the *British Medical Journal* (McCarthy 2001, 413). Germany then provided the model for what became the common 'open-air' approach for chronic diseases by the turn of the century. This influence was so strong that many of the English sanatoria were named after early German examples including Nordrach, Wales, Nordrach-on-Dee and Nordrach-on-Mendip (Reinhardt 1902, 35).

As countries such as Britain took up these open-air therapies (including the treatment of diseases such as tuberculosis by spending as much time outside as possible for fresh air and light therapy), they also borrowed the concept of therapeutic pine infused air. In 1902, *The Lancet* reported an address given by C. Theodore Williams, consulting physician to the Hospital for Consumption and Diseases of the Chest at Brompton, in which he stated that, along with the usual considerations of landscape and place, hospitals designed for treating such diseases:

should be surrounded by extensive grounds, partly wooded, with fragrant pine groves, providing dry shelter and permitting exercise in all weathers, and partly with open spaces which should be carpeted, not with rank grass, but with the crisp herbage of the mountain side, abounding in thyme and other sweet-scented plants (Williams 1902, 1676).

Here pine groves were included alongside other sweet-smelling plants as therapeutic agents, which relates to broader ideas about the role of essential oils from plants for healthcare that were also being developed in this period (Guenther 1972-85, 8), but it also demonstrates a lingering connection to earlier ideas of fragrance and health (as explored by historians such as Dugan 2011, Rawcliffe 2008 and Cavello 2016).

The rise in interest in pine scented air appears to suggest a new scientific narrative related to the growing concern with disinfected and antiseptic atmospheres. Dr Horace Dobell, who will feature more below, noted the soothing qualities of the scent of pine alongside the disinfecting properties of air that contained emanations from the trees which he believed could disinfect organic bodies, including humans, in the 1880s. He stated that the mechanism by which

the forest was thought to impact upon the body was hotly contested and described how 'M. Marchel ascribes it to the lowering influence of the terebinthinate vapour constantly floating in the air; others to the disoxygenation of the air by this vapour; others to the action of resinous aromata, etc.' (Dobell 1885, 68). Another common theory was that the emanations from pine trees could convert oxygen into ozone thereby purifying the atmosphere. Despite the issues around how it worked Dobell was clear that:

It has long been recognised that the atmosphere of pine forests has an invigorating and beneficial effect upon people with weak constitutions and suffering from pulmonary disorders. At some of the watering-places of Germany the very simple prescription of the physician is that the patient should spend several hours a day walking or driving through the pine woods (Dobell 1885, 68).

This then reveals one important aspect of the human-forest relationship, that the body should move through the trees in order to achieve the greatest health benefits, thus combining a physical and embodied experience of the landscape.

This argument was taken up by Dr Alfred Loomis in 1887, speaking to the American Climatological Association on the theme of 'Evergreen Forests as a Therapeutic Agent in Pulmonary Phthisis':

Recently terpine, an active principle of turpentine, has been employed in antiseptic surgery, and has proven a most powerful deodorizer and antiseptic, both within and without the body. From these and many other similar facts which might be quoted, it would seem evident that the local and constitutional effects of turpentine are those of a powerful germicide as well as stimulant. Its presence in the atmosphere of pine

forests cannot be questioned. Again, ozone is said to be present in excess in the air of evergreen forests, and the beneficial effects of such an air have been ascribed to this substance alone.

Here the use of elements taken from pine such as terpine and used in the hospital as a germ-killing agent were linked to the ways in which pine could change the atmosphere. Somewhat later in 1901, a writer in *The Lancet* explicitly linked the role of essential oils from trees and their interaction with oxygen as an agent of purification. In an article on 'Scent' they stated that 'pine oil, eucalyptus oil, and turpentine act readily in this manner – a fact which probably accounts for the salubrity of the air of pine forests and eucalyptus woods' (Anon. 1901, 801). In these examples the emanations from the pine changed the constituents of the air and this understanding can be seen as directly related to work on the use of pine as a disinfectant by nineteenth century chemists,

In the late nineteenth century, Charles Kingzett, a chemist in Britain, and John Day, a physician in Australia, both explored the idea that pine had inherent disinfectant and antiseptic properties. In 1878 Kingzett established *Sanitas*, a disinfectant firm, based on his earlier work during that decade in which, as Ian Rae remarks, 'he commented on the antiseptic and disinfecting power of the peroxygenated turpentine, reporting that egg white and beer treated with the substance were 'kept fresh for some time' (Rae 2006, 14). His patented disinfectant product was based on his findings created by 'aerating a mixture of turpentine and water at 40°C' (Rae 2006, 15).

Rae also relates that in 1877 the *Sanitas* products attracted the interest of his professional colleagues. The editor of *The Chemist and Druggist*, 'who made

a practice of visiting manufacturing establishments, reported that at the works he was “greeted with an aroma which recalled an almost forgotten summer day’s drive through the pine forests of Norway” (Rae 2006, 15). Here we have the combination of modernity and Nordic romanticism experienced within the mechanical factory setting where the memories triggered by the smell still provided an imagined evocation of summer’s past. The experience of the scent had both personal and shared cultural meaning and again demonstrates the connections between environment, place and memories triggered by smells.

As mentioned, Kingzett was not alone in his interest in pine for these purposes, as Day was also working on the chemistry of pine in the 1870s. According to Rae when discussing ways in which this chemical reaction could be applied to hospital wards, as well as recommending wooden hospitals, ‘Day advised that they should be lined with fresh pine boards, so that the natural timber “emanations would react with oxygen to produce hydrogen peroxide, and thus hinder the spread of disease,” – hydrogen peroxide being seen by him as an effective disinfectant (Rae 2006, 8). He also suggested that the putrefying organic matter produced by diseased bodies which caused infection could also be reduced by not only the use of pine wood but also by coating the floor with linseed oil and turpentine which he thought would lead to the formation of more hydrogen peroxide, and thereby disinfect the surfaces. The forest was, therefore, being brought inside to purify the indoor air, as well as sanatoria themselves being built in wooded areas such as pine forests for the benefit of patients.

Bournemouth, where the ‘air is heavy with the breath of the pine’

The example of Bournemouth as a health resort, developed particularly for those suffering from tuberculosis, gives us an interesting British case study to explore how the environment was conceived and promoted for particular health qualities. In his 1885 tract, *The medical aspects of Bournemouth and its surroundings*, Dobell devoted whole chapters to the role of pine trees in health, and wrote that when he saw patients suffering from lung complaints at his London practice, he would suggest they travel to Bournemouth, on the south coast of Britain or Arcachon, in South-west France (Dobell 1885, 67). Both landscapes he argued were famous for their pine forests and he stated that, in line with other physicians of the day, he did this ‘with a definite belief that one of the advantages common to these two places was the presence of pine trees’ arguing that this was due to the ‘balsamic emanations from the pines’ (Dobell 1885, 67). [see Figure 2].

The creation of Bournemouth, a town on the Dorset coast, was in part due to the perceived health-giving properties of its pine trees, as noted by Dobell, and its expansion was aided by both Dobell’s publication itself and his association with the spa hotel, the Mont Dore. The Brompton Hospital, specializing in chest conditions and based in London, had already opened a hospital for long term tubercular patients there in the 1850s, which became known as the Royal National Sanatorium, so the nineteenth century history of the place was firmly linked to a growth in health tourism.

The history of the development of Bournemouth as a fashionable seaside resort was also tied to the landscape decisions made by key estate landowners, particularly Sir George Ivison Tapps. Following the Enclosure Acts of 1802, the heathland between Christchurch and Poole was parcelled up and although some

was retained as common land, the rest was sold to landowners, including Tapps, who decided to start planting pine plantations on what was described as 'barren wasteland' (Edwards 1981, 31). These pine trees, along with access to the sea for bathing – also seen as a health promoting activity – formed the backdrop for the development of the village of Bourne (before it became Bournemouth) as a health resort and its eventual expansion into a town.

As Edwards notes 'Dr Dobell considered that the balmy and resinous perfume from the numerous Scotch pines in the district would be beneficial to those with consumptive and bronchial complaints, whilst the trees' other health-giving properties, including tar: the infusion of which was important for pulmonary affections were of vital benefit to invalids' (1981, 42). Interestingly, rather than give German examples, Dobell's central reference was to the Mont Dore spa resort in Auvergne, France, although this too was an area forested with pine and therefore similar in landscape characteristics to the environs of many of the spas and sanatoria in Germany. It is worth noting here that as consulting physician of Mont Dore sanatorium of Bournemouth, Dobell may well have also had a vested interest in encouraging health tourism to the area and a commercial interest in linking the British and European locations together in the minds of potential clients.

The presence of pine trees in the vicinity of Bournemouth did not always have positive connotations, as can be seen in *The Seamy Side*, a novel published in the 1880s by Walter Besant and James Rice. In their depiction the pines symbolised an alternative view that Bournemouth was haunted by death and disease rather than a place for health – it was instead a 'city of Youth and Death' (Besant and Rice 1880, 24). They describe the building of Bournemouth within

the forest as ‘someone made a clearing and built a house just as if he was in Canada. Then another man made another clearing and built another house, and so on. The pines stand still between the houses, along the roads, in the gardens, on the hills, and round the town’ so that ‘the air is heavy with the breath of the pine’ (Besant and Rice 1880, 24). As young people arrive in search of a cure the writers depict their short recovery as ‘the air revives them for a while, and they linger on a little longer, and have time to lie in the sunshine and see the flowers come again before they die’ (Besant and Rice 1880, 24).

Death looms large in their imagination and rather than the optimism featured in the medical journals of pine scented air as a potential cure, here the pines stand as ‘sacred to the memory of some long agony, some bitter wrench of parting, some ruthless trampling down of hope and joy’ (Besant and Rice 1880, 24). They concluded that the great genius that created the site decided that “‘they come here to die: let us make death beautiful”. And they did so. They built a church upon a hill; they left the pines to stand as cypresses; they ran winding walks and planted flowering shrubs; they put up marble crosses on the graves of the youthful dead; they brought flowers of every season, and all sorts of trees which are sweet and graceful to look upon...’ (Besant and Rice 1880, 24). Here the pines were imbued with the symbolism of the funereal cypress tree and the air filled with the scent of death rather than therapeutic hope, which highlights the role of place in the construction of meaning. The pine which was planted in part to enhance the health-giving environment, instead comes to symbolise the reality of death from tuberculosis. This has some parallels with a shift in the associations of rosemary after it was used on a mass scale as a plague preventative in the early seventeenth-century, particularly in London. As

described by Dugan, this led to the 'scent of rosemary [becoming] a harbinger of both erotic, affective promise and diseased peril', where the older positive association was co-mingled with a newer indicator of death (Dugan ,99). In this novel the association of pine scent with health has similarly shifted to also represent death, as those who travelled to the resort looking for a cure often did not make it home again.

One of the key features of the Mont Dore hotel in the town was its thermal baths, and this perhaps points to the use of pine indoors, as well as via the forest. In July 1872 *The Lancet* devoted several columns to accounts of foreign baths by Dr John Macpherson. He recorded a number of visits to different spa places and like Dobell he favourably mentioned Bournemouth and Arcachon as health resorts with clear connections to Germanic forests. Although he was mainly visiting spa resorts he noted that Gernsbach in the Murg Valley of Germany, which despite not having any mineral springs, had become popular 'owing to its extract-of-pine baths and inhalation rooms, and its surrounding pine forests' (Macpherson 1872, 4). In this example he notes that pine was being extracted and used inside the institution, although he does also reflect that 'the air of pine forests appears always to be grateful to the lungs, and has been considered wholesome, although of its absolute curative influence there is little evidence, and, indeed, it must be difficult to procure such' (Macpherson 1872, 4). This suggests that there was both an assumption that the air of the pine forest itself had an effect on the lungs, despite the lack of what he considers to be any real evidence, and a level of modernity in the use of pine inhalation baths. An early antecedent of the ubiquitous pine car freshener also seems to be described here, as he records that, 'the balsam of the mountain pine, as prepared at

Reicherhall, is said to be the most agreeable of all, and it is sufficient for purposes of inhalation to steep a piece of paper in it and hang it up in the room. It is a generator of ozone' (Macpherson 1872, 4).

The choice of pine forests as the ideal and scientifically sanctioned location for sanatoria in Britain perhaps peaked with the example of the Edward VII Sanatorium in Britain, opened in 1906 [See Figure 3]. The *British Medical Journal*, while in August 1902 reporting on the chosen site in Midhurst for the sanatorium, noted that:

This site has been hewn out of a forest of pine trees covering hundreds of acres, and is therefore quite secluded and isolated. With the healthful scent of the pines, and the elevation, standing as it does at some 530 feet above sea-level, it will at once be seen that a more healthy situation could hardly be found (Anon. 1902, 475).

The design of the hospital itself was the result of a 1902 essay competition advertised in twenty-two medical papers in Europe and America resulting in 180 entries from both physicians and architects (Bryder 1988, 50). According to *The Builder*, mottos for entries included: 'Give him air, he'll straight be well', 'Vis medicatrix naturae' [the healing power of nature] and 'Open air everywhere' highlighting the close relationship of many of the designs to the environment and nature (from miscellaneous articles on the Edward VII Sanatorium. NMRC Swindon, National Buildings Record Index Number, 101270). This however did not mean that the hospital was seen as less 'scientific' in its design and therapeutic approach. At the opening of the completed sanatorium in 1906 designed by H. Percy Adams and Charles Holden to provide open-air therapy (it even included a chapel open to the elements on all sides) it was reported by the

Portsmouth Evening Post that 'England may now boast that she is on a level with Continental nations, if not ahead of them, in the means which are being taken to cure and stamp out the insidious disease' (quoted in Bryder 1988, 24). Even though newspapers such as *The Liverpool Post* commented that the new institution possessed 'every up-to-date structural and scientific advantage', there was still a clear role for nature and in particular pine forests on the estate (quoted in Bryder, 49). However, despite this interest in the importance of pine as part of the therapeutic environment, in many ways this marks the beginning of the end for the use of the forest itself as a therapeutic agent.

From this point on, and certainly after the Second World War, the forest as a place seems to lose its potency. In 1928, there was an attempt to remove trees from around sanatoria in Britain in order to improve access to light therapy, a situation that would have been unthinkable earlier. However, there were clearly lingering ideas concerning the role of pine trees, as Dr F. R. Walters of Crooksbury Sanatorium, Surrey, recorded in his letter of concern to *The Lancet*. He argued that 'to clear away all the trees from the vicinity of a sanatorium is a great mistake. Asphalted paths may be undesirably hot in summer for phthisical patients [those afflicted with tuberculosis]; dry walks, carpeted with pine-needles, are preferable' (Walters 1928, 630). The scent is no longer mentioned or the role of pine trees in disinfecting the air, and with the development of successful pharmaceutical and surgical treatments including antibiotics for tuberculosis, the pine forest gradually lost its therapeutic significance.

The home sanatorium

In tandem with this shift, there was also a move away from a belief in the curative nature of the forest itself and greater interest in the products it produced, including their potential use within the home rather than the sanatorium. Eylers has charted the move towards fewer mountainous or wooded sites in Germany, noting that at the Tuberculosis Conference of 1899 in Berlin, Dr von Unterberger, surgeon and director of the military hospital in Zarskoje-Selo, a small city south of St Petersburg, argued that with the 'Haus Sanatorium', the house or home sanatorium, tuberculosis therapy could be administered in 'every hospital, and every house' (Eylers 2014, 676-7). Unterberger suggested that the alpine environment with its real pine woods could be replaced by small pine trees in containers and pine tree branches in vases, and that 'their smell should be increased by sprinkling scented oils [...] onto them whenever their natural scent had faded' (Eylers 2014, 677). As she writes, it is at this point that 'the holistic approach, ..., where the natural site was regarded as the very key to the patient's recovery, was dissected into single elements and reproduced elsewhere – temperature, light etc.' (Eylers 2014, 677-8). The forest then is brought indoors and enhanced, and the landscape is seen as component parts that can be recreated on an individual basis and in any place within the building.

At the same time there was also re-orientation back to the home as a key site of medical care – something which had been common before the nineteenth century. As Graham Mooney has discussed in detail, domestic care of the sick, particularly those with tuberculosis, became common again in the Edwardian period (Mooney 2013). Based on his argument that 'the regime of home treatment replicated as far as possible that of the sanatorium', it is perhaps not surprising that pine disinfectant, previously used in medical settings also moved

into the home (Mooney 2015, 166).

Similarly, Kiechle also notes that ‘domestic practices and technologies after germ theory blended old beliefs about smells with new knowledge of germs and microbes. When scientific research demonstrated the efficacy of ozone as a disinfectant that would kill germs, many interpreted the science as also validating olfactory practices that diffused pleasant fragrance throughout the home’ (Kiechle, 195). According to Alecia Simmonds, by 1910 *The New Idea* (an Australian weekly magazine aimed at women) was advertising household disinfectants in the form of air fresheners: ‘In and around the home you need to keep everything pure, sweet and clean. Lavozone creates that pleasantly healthful pine forest aroma and absolutely checks all bacterial infection. It is for all purposes where prevention of disease is necessary’ (Simmonds 2019, 238). This advertisement was clearly drawing on earlier elements as seen in the spa with its pine freshener, as well as the placement of sanatoria in pine forests and the medicinal use of pine as a disinfecting agent in various forms.

This relationship can also be seen by returning to Kingzett’s company *Sanitas*, where as early as 1879 they were advertising the product range as ‘The Health Giver; Or, the Pine Forest at Home’ (Sanitas advertisement 1879, front page). The advertisements merged the scientific idea of disinfectant with the concept of bringing the forest fragrance indoors, which suggests that there were commercial opportunities in appealing to both these elements when targeting women as defenders of the healthy home. It would also seem to be a way of implying that this industrial product was in line with the regularly invoked ‘natural disinfectants’ of sunshine and fresh air (Tomes 1990, 524).

The early work of Day and Kingzett also highlighted the important role of

nature as a curative element. Kingzett's tract, published in 1880 and outlining his experiments with pine, was called *Nature's Hygiene*: in this volume he argued that science and nature were more effective when they were closely working together (Kingzett 1880 and c.1908). Indeed he described his work as being conducted in the 'laboratory of nature' (Kingzett 1880, preface, v). In all these examples there was a clear sense of a return to nature as a beneficial therapeutic approach, and a revoking of the urban and industrialised landscape, even whilst embracing the modernity of factory produced disinfectant and new ways of utilizing pine.

This breaking down of the environment into its component parts perhaps also mirrors the development of both synthetic elements and the understanding of disease in ever smaller units such as bacteria and viruses. There was also a strong relationship between the development of synthetic colours (dyes) and synthetic drugs for treating disease such as acetylsalicylic acid (aspirin) (Nicolaou 2014, 3). As Esther Leslie argues, this 'pursuit aided a wider effort of inversion: the transformation of all nature into its artificial counterpart, as *natural* materials are remade *synthetically* in laboratories' (Leslie 2005, 7). The invention and manufacture of these representations of nature was also led by Germany and by the start of the twentieth century 'a synthetic world was emerging' spearheaded by companies such as Bayer (Leslie 2005, 118-9).

It is this use of pine in household disinfectant and cleaners such as Toilet Duck, Dettol and Pine-Sol, which has lasted in relation to domestic cleaning practice, and the one that is meant to signal hygiene when we smell it, even if it is now only a synthetic additive. Advertisers throughout the period have played on this idea of the healthy forest in the home and there is clearly still an underlying

association with pine as 'clean' and 'healthy', even though the product itself may not contain any actual pine. As Martens and Scott argue, 'by the middle of the twentieth century, when germ awareness was declining in cultural prominence, standards of cleanliness became symbolically increasingly associated with a domestic sphere that both looked and smelled good' (2005, 382). The continued use of pine in cleaners suggests that it has remained an indicator of cleanliness and still considered to smell 'good', even if it is gradually being usurped by other smells or even products that promise not to smell at all. From a physical embodied relationship created by moving through and being situated within the forest, pine is now generally signified in a bathroom scent that briefly lingers in the air.

This breaking down of large environmental ecosystems into synthetic representations, which still retain some memory or meaning is both part of modernity and embedded in our twenty-first century lives. It is, therefore, important to recognize, this as well as the role of personal memory, if we are to appreciate what is culturally shared and/or different in the places we construct. To briefly return to the US, Michelle Obama relates in *Becoming* that 'it's because of my mother that still to this day I catch the scent of Pine-Sol and automatically feel better about life' (Obama 2018, 46). Here the lived experience of the personal and the cultural underpinnings of home are intertwined and together they give a fleeting scent in the air meaning. Although given the attention to place in this piece, it is worth considering here that pine forests in North America are far more extensive than in Britain and therefore have a different significance, which may explain the longer US based associations as a general household cleaner. Pine-Sol and other similar brands were large scale manufacturers that

used local US pine oil, and advertisements, such as those by artist Les Kouba for Watkins in the 1950s to advertise their brand of pine oil disinfectant, which depicted idyllic Minnesota pine woods as part of its sales pitch to US based customers: these all suggest a different cultural connection to particular and more local coniferous forests. In the British context, significant treescapes have generally been perceived as consisting of broad leaved, deciduous trees, particularly oak, rather than pine forests, and this is perhaps one reason pine detergents are now relegated to the bathroom rather than used throughout the house in the same way. The bathroom is probably the place in the home where medicinal and germ-killing qualities are still most valued and perhaps the lingering association with institutions, such as sanatoria, are more likely to be tolerated.

Conclusion

Tracing the history of pine scent thus gives us an insight into the breakdown of environmental features into their constituent parts as part of the process of becoming modern, and the move of pine as a therapeutic agent via the institution to the home. However, despite this industrialization of nature which is mirrored by the microscopic understanding of bodies and disease agents into ever smaller parts, cultural connections remain. The forest is still represented in our associations and emotions and thereby retains more meaning than a mere sniff from a bottle would suggest. These are, however, all culturally as well as personally contingent and so may become exclusive when used to create new multisensory spaces that are designed to promote feelings of wellbeing.

This may be particularly significant when introducing smells into the

modern hospital. Bettina Hitzer (2020) has noted that in Germany the move towards deodorization also had an impact on the smellscape of modern hospitals: 'the hospital developed its own smellscape that was characterized by the smell of phenol, zinc chloride solutions, iodoform, and other antiseptics' (Hitzer 2020, 159). This has now been translated into an atmosphere which is described as 'olfactory neutrality' by Annette Stenslund (2015, 353). This points to the idea that the modern global hospital is now neutral in terms of the environment in which it is placed, unlike the open-air sanatorium in the pine forest which, with its open windows and balconies, shared the same sensescape in as well as out as air moved freely across the threshold. In comparison, today's hospital is more likely to share its smellscape with other hospitals than with the external environment in which it is located. The olfactory neutrality in particular, or perhaps even just the unfamiliarity of the atmosphere created by aseptic cleaning methods can, as Stenslund states 'be experienced as a lack, negatively identified and valued as a longed for habitual smell of homeliness' (Stenslund 2015, 356). This in turn she argues can be 'compensated for through the introduction of smells that are missing' (2015, 356) but then the question again arises as to who chooses which smells are appropriate and whether that is necessarily an inclusive practice, particularly if the aim is 'homeliness' which is highly personal and culturally coded?

Given current research interest regarding how odours, and other sensory stimuli, might positively affect our health and wellbeing and how these could in turn be usefully utilized in various settings, it is clearly important that we place them within their cultural and historical framework, alongside neurological studies, in order to fully understand how sensory meaning is constructed and

understood. It is only by taking this blended approach that we might be able to develop better sensory healthcare, and other, settings that aim to promote wellbeing for a diverse range of people, rather than for a culturally similar subset or inadvertently create something that is uncomfortable because it is 'out of place'. The example of pine also provides an argument for the role of microhistories as a method for developing a deeper understanding of the connections between the environment, the body and health.

Note: It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

References

- Anon. 1901. "Scent". *The Lancet*. 21 September 1901, 801.
- Anon. 1902. "The King's Sanatorium". *British Medical Journal*. 16 August, 474-5.
- Bates V, Hickman C, Manchester H, Prior J and Singer S. 2020. "Beyond landscape's visible realm: Recorded sound, nature, and wellbeing". *Health & Place*. 61, 102271. <https://doi.org/10.1016/j.healthplace.2019.102271>
- Besant, W. and Rice, J. 1880. *The seamy side*. London: Chatto and Windus.
- Boddice, R. and Smith, M. 2020. *Emotion, sense, experience*. Cambridge: Cambridge University Press.
- Bostock, J. 1855. *The natural history. Pliny the Elder*. London: Taylor and Francis.
- Bridges, B. 2002. "Fragrance: emerging health and environmental concerns". *Flavour and Fragrance Journal*. 17, 361-371. <https://doi.org/10.1002/ffj.1106>
- Bryder, L. 1988. *Below the magic mountain: A social history of tuberculosis in twentieth-century Britain*. Oxford: Clarendon Press.

- Cavello, S. 2016. "Health, air and material culture in the early modern Italian domestic environment". *Social History of Medicine*. 29, no. 4, 695-716.
<https://doi.org/10.1093/shm/hkw029>
- Classen C, Howes D, and Synnot, A. 1997. *Aroma: The Cultural History of Smell*. London: Routledge.
- Colgate Palmolive Company. No date. "Ajax Pine Forest All Purpose Cleaner". Last accessed 25 October 2020. <http://www.colgatecommercial.com/product-detail.aspx?ID=43>
- Cooter, R. 1984. "Open-air therapy and the rise of open-air hospitals". *The Bulletin for the Social History of Medicine*, 35, 44-46.
- Culpepper, N. 1815. *Culpepper's complete herbal: to which is now added, upwards of one hundred additional herbs, with a display of their medicinal and occult qualities* [...]. London: Published by Richard Evans, No. 8, White's Row, Spitalfields.
- Dobell, H. 1885. *The medical aspects of Bournemouth and its surroundings*. London: Smith, Elder and Co.
- Drahota A, Ward D, Mackenzie H, Stores R, Higgins B, Gal D, Dean T. P. 2012. "Sensory environment on health-related outcomes of hospital patients". *Cochrane Database of Systematic Reviews*. 3, No. CD005315.
doi:10.1002/14651858.CD005315.pub2
- Dugan, H. 2011. *The ephemeral history of perfume: Scent and sense in early modern England*. Baltimore: Johns Hopkins University Press.
- Elliott P, Watkins C, Daniels S. 2019. *The British arboretum: Trees, science and culture in the nineteenth century*. Pittsburgh: University of Pittsburgh Press.

- Editorial. 1908. "The modern treatment of consumption". *British Medical Journal*. 15 February, 403-4.
- Edwards, E. 1981. *A history of Bournemouth: The growth of a Victorian town*. Chichester: Phillimore.
- Eylers, E. 2014. "Planning the nation: The sanatorium movement in Germany". *The Journal of Architecture*. 19, no. 5, 667-692.
doi:10.1080/13602365.2014.966587
- Gerard, J. 1633. *The herball, or Generall historie of plantes*. London: Printed by Adam Islip, Joice Norton and Richard Whitakers.
- Guenther, E. 1972-85. *The essential oils*. 6 vols. Malabar, FL: Krieger.
- Heinrich, T. 2017. *Kotex, Kleenex, Huggies: Kimberly-Clark and the Consumer Revolution in American Business*. Ohio: Ohio State University Press
- Hempel, S. 2013. "Commentary: on 'On the supposed influence of offensive trades on mortality.'" *International Journal of Epidemiology*. 42, no. 5, 1238.
doi:10.1093/ije/dyt140
- Henshaw, V. 2014. *Urban smellscape: Understanding and designing city smell environments*. New York and London: Routledge.
- Herz, R. S. 2016. "The role of odor-evoked memory in psychological and physiological health". *Brain Sciences*. 6, no. 3, 1-13.
doi:10.3390/brainsci6030022
- Hickman, C. 2018. "Care in the countryside: The theory and practice of therapeutic landscapes in the early twentieth-century". In *Landscape and green spaces: gardens and garden history in the West Midlands*. Edited by Dick, M and Mitchell, E, 160-85. Hatfield: Hertfordshire University Press.

- Hickman, C. 2013. *Therapeutic landscapes: A history of English hospital gardens*.
Manchester: Manchester University Press.
- Hitzer, B. 2020. “The odor of disgust: Contemplating the dark side of 20th-century cancer history”, *Emotion Review*. 12, no. 3, 156–67.
<https://doi.org/10.1177/1754073919897293>
- Holmes, G. 1975. ‘History of Forestry and Forest Management’. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*. 271, no. 911, 69-80.
- Jenner, M. 2011. “Follow your nose? Smell, smelling, and their histories”. *The American Historical Review*. 116, no. 2, 335–351. doi:10.1086/ahr.116.2.335
- Jenner, M. 2000. “Civilization and Deodorization? Smell in Early Modern English Culture” in *Civil histories: Essays presented to Sir Keith Thomas*. Oxford: Oxford University Press.
- Karan, N. B. 2019. “Influence of lavender oil inhalation on vital signs and anxiety: A randomized clinical trial”. *Physiology & Behavior*. 211, 112676.
doi:10.1016/j.physbeh.2019.112676
- Kiechle, M. 2017. *Smell detectives: An olfactory history of nineteenth-century urban America*. Seattle and London: University of Washington Press.
- Kingzett, C. 1880. *Nature’s hygiene*. London: Baillière, Tindall and Cox.
- Kingzett, C. c.1908. *The Sanitas (pine-oxygen) treatment of consumption*. London: Sanitas Company.
- Lekan, T. M. 2004. *Imagining the nation in nature: Landscape preservation and German identity, 1885–1945*. Cambridge MA: Harvard University Press.
- Leslie, E. 2005. *Synthetic worlds: Nature, art and the chemical industry*. London: Reaktion.

- Loomis, L. 1887. “Evergreen Forests as a Therapeutic Agent in Pulmonary Phthisis”, *Transactions of the Annual Meeting of the American Climatological Association*. 4, 109–120.
- Macpherson, J. 1872. “Notes of visits to foreign baths”. *The Lancet*. 6 July, 3-5.
- Martens, L and Scott, S. 2005. ““The unbearable lightness of cleaning’: Representations of domestic practice and products in *Good Housekeeping* magazine (UK): 1951–2001”, *Consumption Markets & Culture*. 8, no. 4, 379-40. doi: 10.1080/10253860500241948
- McCarthy, O. R. 2001. “The key to the sanatoria”. *Journal of the Royal Society of Medicine*. 94, no. 8, 413-7. doi:10.1177/014107680109400813
- Mooney, G. 2015. *Intrusive interventions: Public health, domestic space, and infectious disease surveillance in England, 1840-1914*. Woodbridge: Boydell and Brewer.
- Mooney, G. 2013. “The material consumptive: Domesticating the tuberculosis patient in Edwardian England”, *Journal of Historical Geography*. 42, 152-166. <https://doi.org/10.1016/j.jhg.2012.12.007>.
- Morton, M. 2002. “German Romanticism: The search for ‘A Quiet Place’”. *Art Institute of Chicago Museum Studies*. 28, no. 1, 89–107. doi:10.2307/4113048
- National Monuments Record Collection (NMRC). “Edward VII Sanatorium: miscellaneous articles”. Swindon: National Buildings Record Index Number: 101270
- Nicolaou, K C. 2014. “Organic synthesis: the art and science of replicating the molecules of living nature and creating others like them in the laboratory.” *Proceedings. Mathematical, Physical, and Engineering Sciences*. 470, no. 2163, 1-17. doi:10.1098/rspa.2013.0690

- Obama, M. 2018. *Becoming*. London: Viking.
- Ragan's PR Daily. 2014. "Pine-Sol's altered scent prompts flood of social media rage". *Crisis Communications*. Last accessed October 2020.
<https://www.prdaily.com/pine-sols-altered-scent-prompts-flood-of-social-media-rage/>
- Rae, I. D. 2006. "Ozonised oils as disinfectants". *Ambix*. 53, no. 1, 3-20.
doi:10.1179/174582306X93192
- Rawcliffe, C. 2008. "'Delectable sightes and fragrant smelles': Gardens and health in late medieval and early modern England". *Garden History*. 36, no. 1, 3-21.
- Readman, P. 2018. *Storied ground: Landscape and the shaping of English national identity*. Cambridge: Cambridge University Press.
- Reinarz, J. 2014. *Past scents: Historical perspectives on smell*. Champaign, Illinois: University of Illinois Press.
- Reinhardt, C. 1902. *A handbook of the open-air treatment and life in an open-air sanatorium*, Second edition. London: John Bales, Sons and Danielson.
- Sanitas. 1879. "Sanitas the health-giver; or, the pine forest at home". *The Spiritualist*. 8 August 1879. 363, 1.
- Shiver, J. 1987. "Pervasive in products: These days, lemons are cleaning up", *Los Angeles Times*, 25 August 1987.
- Simmonds, A. 2019. "Sex smells: olfaction, modernity and the regulation of women's bodies 1880–1940 (or how women came to fear their own smells)". *Australian Feminist Studies*. 34, no. 100, 232-247. doi:10.1080/08164649.2019.1576503
- Smith, M. 2007. "Producing sense, consuming sense, making sense: Perils and prospects for sensory history". *Journal of Social History*. 40, no. 4, 841-858.
doi:10.1353/jsh.2007.0116

- Smith, V. 2008. *Clean: A history of personal hygiene and purity*. Oxford: Oxford University Press.
- Spence, C and Deroy, O. 2013. “On why music changes what (we think) we taste”. *I-Perception*. 4, no. 2, 137–140. doi:10.1068/i0577ic
- Stenslund, A. (2015). ‘A Whiff of Nothing: The Atmospheric Absence of Smell’, *The Senses and Society* 10, no. 3, 341-360. doi: 10.1080/17458927.2015.1130305
- Thompson, K. 1978. “Trees as a theme in medical geography and public health”. *Bulletin of the New York Academy of Medicine*. 54, no. 5, 517-531.
- Tomes, N. 1990. “The private side of public health: sanitary science, domestic hygiene, and the germ theory, 1870-1900”, *Bulletin of the History of Medicine*. 64, no. 4, 509-539.
- Tullett, W. 2019a. “Re-odorization, disease, and emotion in mid-nineteenth-century England”, *The Historical Journal*. 62, no. 3, 765-788.
doi:10.1017/S0018246X18000286
- Tullett, W. 2019b. *Smell in eighteenth-century England: A social sense*. Oxford: Oxford University Press.
- Tsing, A. L. 2015. *The mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton, NJ: Princeton University Press.
- Waitrose and Partners. 2021. ‘12 easy spring cleaning tips’, *Weekend*. 15 April 2021.
- Williams, C. T. 1902. “An address on the treatment of Pulmonary Tuberculosis by hygiene”, *The Lancet*. 14 June, 1675-1677.
- Wilkos, product information for toilet duck pine foaming bleach, last accessed 22 April 2021, <https://www.wilko.com/en-uk/toilet-duck-pine-foaming-bleach-750ml/p/0453215>

Captions for images:

Figure 1: 1930s postcard showing what was then Görbersdorf, the location of Brehmer's sanatoria in the pine woodlands and mountains of lower Silesia. Wikimedia Commons, public domain.

Figure 2: The sanatorium for consumption and diseases of the chest in Bournemouth with pine trees both on the hill behind the hospital building and in the foreground on the right. Lithograph by Day and Son, no date. Wellcome Collection CC BY 4.0.

Figure 3: 1950s Aerofilm image of the Edward VII Sanatorium showing its location within pine woodland. [EAW035199] King Edward VII Hospital, Easebourne, 1951. This image has been produced from a print. Copyright: Historic England.