Sensehacking passenger well-being while in the air

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ABSTRACT

Air travel has undoubtedly become a more stressful activity for many passengers in recent years, in part as a result of the global Covid pandemic. Consequently, there has been a growing focus on how to optimize psychological well-being while in the air. This narrative historical review considers how the passenger experience can potentially be hacked through the more intelligent stimulation of the travellers' senses. In particular, the focus is on promoting passenger comfort, enhancing the provision of healthy food and beverage options/experiences, facilitating relaxation and sleep and, when appropriate, boosting passengers' arousal/alertness as well (e.g., prior to arrival). A number of concrete suggestions concerning how to sensehack passenger well-being at the various stages while in the air are made.

KEYWORDS: SENSEHACKING; WELL-BEING; AIR TRAVEL; STRESS; FOOD & BEVERAGE; SLEEP.

1. Introduction

One of the consequences of the recent Covid pandemic has been an increasing focus on customer well-being (e.g., Spence, 2020a), and nowhere is this seemingly more true than while travelling. Indeed, now that the focus on cleaning, health, and hygiene (Holson, 2020), and the necessity for disinfectant and face masks, has thankfully receded, the primary concern of many airline customers is increasingly shifting to other means of enhancing their well-being while in the air (Afshariyan, 2017; Rabbu, 2020). This approach can be framed in terms of the recently-introduced notion of 'sensehacking' (Spence, 2021, 2022b), defined as the use of our senses, and sensory stimulation, in order to more intelligently help to improve our social, cognitive, and emotional well-being. It is important to recognize how the focus on passenger well-being represents something of a step-change in focus from earlier decades when the emphasis was very much on the quality/luxury of the food and drink provision while passengers were in the air (e.g., Foss, 2014; Mars & Mars, 1988; Xie, 2016) and/or on how to deliver a unique and memorable travel experience (Toffler, 1970).[1] At the same time, there is growing interest in the optimization of passenger experience more generally. And while it is undoubtedly the case that airline passengers tend to bring more of their own entertainment content (be it music, podcasts, or video; not to mention food and drink, about which more below) onto the plane than ever before, it nevertheless still feels like there is an opportunity for the airlines to become more proactive in this regard.

1.1. Stressful journeys

[1] For example, writing in 1970, Alvin Toffler, described the themed 'foreign accent' flights that *Trans-World Airlines* had recently started to run between major US cities. According to Toffler (1970, pp. 206-211): *"The TWA passenger may now choose a jet on which the food, the music, the magazines, the movies, and the stewardess's outfits are all French. He may choose a 'Roman' flight on which the girls wear togas. He may opt for a 'Manhattan Penthouse' flight." or "Or he may select the 'Olde English' flight on which the girls are called 'serving wenches' and the décor supposedly suggests that of an English pub"*. Toffler continues: *"It is clear that TWA is no longer selling transportation, as such, but a carefully designed psychological package as well. We can expect the airlines before long to make use of lights and multi-media projections to create total, but temporary, environments providing the passenger with something approaching a theatrical experience."* In the early 1970s, piano lounges with fully-functioning Wurlitzer electric piano were fitted at the back of some *American Airlines* 747 planes (Kovalchik, n.d.). The *British Overseas Airways Corporation* (the precursor to *British Airways*) even considered providing unmarried male passengers with a 'scientifically chosen' blind date when they touched down in London.

The increasing stress associated with air travel has frequently been commented on in recent years (e.g., Zhang, Ramsey, & Lorenz, 2021).[2] As Zhang et al. put it: "Effective air-travel stress management is increasingly crucial in determining tourist satisfaction and travel choices, particularly in a time of intensive fear about virus, terrorism, and plane crashes." However, none of the airlines currently appear to own what might be described as the 'well-being in the skies' space. According to Airports Council International (ACI – Airports Council International, 2017), by 2040 total annual airport passengers was predicted (pre-Covid) to exceed 22 billion (del Chiappa, Atzeni, & Loriga, 2019). Thinking about the situation in which the passenger finds themselves leads to a consideration of sensory factors, such as the deleterious effects of background noise on various aspects of the passenger experience while in the air (Huang & Jiang, 2016; Lee, Kumar, Garg, & Lim, 2022; Ozcan & Nemlioglu, 2006; Pennig, Quehl, & Rolny, 2012; Spence, 2014). Dry cabin air and lowered cabin air pressure, not to mention vibration, are also important environmental factors contributing to a decrease in passenger well-being while in the skies

It is also important here to consider key psychological factors, such as passenger stress (McIntosh, 2017), anxiety (Batouei, Iranmanesh, Nikbin, & Hyun, 2019; Bogicevic, Yang, Cobanoglu, Bilgihan, & Bujisic, 2016; de Syon, 2008; McIntosh, Swanson, Power, Raeside, & Dempster, 1998; Zhang et al., 2021), fear (Fennell, 2017; Kinsman, 2020; Korstanje, 2011), and boredom (Thornhill, 2017), as well. There has been a marked growth of interest in the health and comfort aspects of flight from key stakeholders in the industry (Brown, Shuker, Rushton, Warren, & Stevens, 2001; Brundrett, 2001; Rayman, 1997), with the main concerns expressed by those quizzed in Brown et al.'s study falling into five main areas: deep vein thrombosis, air quality, infection, cosmic radiation, and jet lag and work patterns.

1.2. On the benefits of biophilic design

The benefits of biophilia have become ever more apparent over the last few decades (e.g., Kellert & Wilson, 1993; Spence, 2022a; Wilson, 1984), and biophilic design has, perhaps

[2] Following the events of September 11th, 2001, more than 80% of airplane passengers reported being stressed (Schwarz, 2002).

unsurprisingly, become an increasingly popular trend. Indeed, elements of biophilic design have made their way into a number of airports already, such as green spaces provided at Schipol airport (in Amsterdam), or the nature soundscape that was played at Glasgow airport a few years ago (Spence, 2021). Biophilic design has also been incorporated in airport lounges (e.g., at Venice airport currently) (see **Figure 1**), and even with the water features found in certain airport lounges noted by Spence (2002) a few decades ago.

INSERT FIGURE 1 ABOUT HERE

Certainly, those concerned with hospitality on the ground are increasingly considering ways in which to bring a biophilic element into the design of the spaces they operate (Khozaei, Carbon, Hosseini Nia, & Kim, 2022). And while it is unlikely that we are going to see the introduction of flora/plants on planes any time soon (though see Neilson, Craig, Altman, Travis, Vance, & Klein, 2021, for a recent consideration of the biophilia hypothesis as it might be applied to long-duration human space flight), nevertheless some of the same benefits can potentially be achieved simply by presenting nature-themed videos on the in-flight screens (Spence, 2021).[3] At the same time, listening to 30 minutes of nature sounds has recently been shown to improve sleep quality on the ground (Pickles, 2023). Would the same be true for passengers in the air? Whatever the answer to that question, there would nevertheless seem to be scope for innovation in this space as currently none of the airlines would appear to 'own' the area of well-being while in the air.

Do those sitting by the window on flights over water get some of the benefits of 'the blue gym' (Spence, 2022a) – that is, the health and well-being benefits of being by water (Nichols, 2014)? Research from New Zealand has shown that those individuals living in residential areas of Wellington, New Zealand, with high levels of blue space visibility were less psychologically distressed than those with a view of green space instead (Nutsford, Pearson, Kingham, & Reitsma, 2016). There is thus reason to believe that those sitting by the windows might benefit from the view. Of course, nature also has a smell. One can consider how floral ambient scents may help to promote passenger well-being, by tapping into what might be considered as the olfactory nature effect (Spence, 2020a, b, 2021). Research from Bogicevic et al. (2016) found

[3] Indeed, one carrier already shows a video of a mountain forest waterfall on seat-back screens during boarding and prior to take-off currently.

that those airports where there was a pleasant scent led to a positive influence on traveller enjoyment. In recent years, some of the more innovative airlines have already started to consider how to create distinctive sensory branding, including the incorporation of signature sensory attributes (such as signature scents) into their service experience. Consider only the Stefan Floridan Waters scent that has, for years, been applied to the moist handtowels that were handed out to premium passengers, while also being sprayed in the cabins, not to mention on the flight attendants themselves by Singapore Airlines (Lindstrom, 2005; Wiedmann, Labenz, Haase, & Hennigs, 2016). At the same time, however, the floral notes released in Heathrow currently from scent dispersal machines tend to smell cheap and synthetic, and so likely do little to enhance the passenger experience/well-being (Spence, 2021).

1.3. Background noise

The evidence that has been published to date suggests that the distracting effect of background noise can be mitigated by the introduction of water soundscapes (see Spence, 2021). For example, research in open plan offices which, like airplanes, also tend to be noisy environments, has shown the beneficial effects of introducing water sounds (Hongisto, Varjo, Oliva, Haapakangas, & Benway, 2017). One might wonder whether something similar could be designed for use in the air. Intriguingly, however, when recalling their last flight experiences, less than 1% of air passengers surveyed mentioned noise, as compared to 79% mentioning comfort and service (Vink, Bazley, Kamp, & Blok, 2012). Note also that the sound of other passengers talking and/or babies crying have been identified as a major cause of annoyance for many plane passengers (Lewis, 2015; Lewis, Patel, Cobb, D'Cruz, Bues, Stefani, & Grobler, 2016). It is therefore worth considering whether the sound of engine noise help to mask such annoying sounds. At the same time, however, it is unclear whether the passenger necessarily always fully understands the multisensory impact that engine noise and other aspects of the airplane environment may have on their well-being, not to mention their experience of food and drink while in the air.

2. Sensehacking the passenger experience

There is a growing awareness that something needs to be done to manage the stress that is increasingly associated with air-travel (Zhang et al., 2021). Here, it may be helpful to consider key passenger activities while flying include eating, and, on longer flights, possibly also sleeping. However, it is important to recognize how the multisensory atmosphere on board most planes is simply not conducive to either one of these activities, given a range of physical physiological and psychological considerations (see Spence, 2017a, b). According to research commissioned by Boeing, the plane should be pressurized as if it were flying at 1,829 m (or 6,000 ft), rather than be pressurized to a level equivalent to up to 2,438 m (8,000 ft) that had been the case previously (Burgess, 2018; Muhm, Rock, McMullin, Jones, Lu, Eilers, Space, & McMullen, 2007). Similarly, the dry cabin air that one finds on commercial planes has led to suggestions that well-being on long-haul flights could be enhanced simply by having passengers rub Vaseline up their noses (Afshariyan, 2017).

When considering how to sensehack the passengers' experience while in the air, there are several key activities/elements to consider. The focus in this narrative historical review is on passenger comfort, food and beverage provisions, relaxation and sleep, and arousal/alertness (where appropriate; i.e., at the end of a long-haul flight). According to Kent Craver, Director Cabin Experience & Revenue Analysis at Boeing, the results of their research led them to conclude that: "There is no one single element that drives passenger satisfaction. Everything involved contributes to that experience." (Garcia, 2015). Visual design cues to enhance the feeling of spaciousness, though passengers have sometimes complained that they were being tricked. It is certainly true, as noted by Burgess (2018), that the easy wins in terms of enhancing passenger comfort were mostly introduced years ago, meaning that it is simply much more difficult nowadays to deliver perceptible/measurable improvements to the passenger's comfort, experience, or well-being. As such, it is the psychological rather than physical dimensions that one is playing with.[4]

3. Enhancing passenger comfort

[4] This is not, note, "Psychology meets science" as Shaw (2020) puts it in the title of her article about the strategy of designing commercial aircraft design, given that psychology is considered a hard science these days!

Seat (dis-)comfort is a common complaint of many passengers. Indeed, while legroom on planes has been shrinking for years, the situation has, at least according to Whitley and Gross (2019), recently got much worse. Looking to the future, however, there is talk of seats in 2070 that can adapt to the passenger's shape (see Thornhill, 2023). The concept of comfort is itself a multisensory construct, and is influenced by multiple factors including everything from aircraft noise and vibration (DeHart, 2003; Mellert, Baumann, Freese, & Weber, 2008; Västfjäll, Kleiner, & Görling, 2003) through to the ergonomics of the seat (see also Wang, Xiang, Zhi, Chen, He, & Du, 2021), the legroom (or lack thereof), not to mention the characteristics of the passengers themselves (Richards, Jacobson, & Kuhlthau, 1978). The latest research demonstrates that simply allowing passengers (N = 30) to control of background noise levels (e.g., by offering them noise-cancelling headphones) resulted in their rating their level of comfort as higher than those who had no control over noise levels (Bouwens, Fasulo, Hiemstra-van Mastrigt, Schultheis, Naddeo, & Vink, 2022). In short, engine noise negatively-affected passenger comfort, and the ability to control the background noise levels helped.

Thermal comfort is another tricky issue to manage while in the air, given that male and female passengers prefer ambient temperatures that differ by several degrees (see Chang & Kajackaite, 2019; Spence, 2021). The most striking difference has been documented between European and North American men who prefer an ambient temperature that is an average of 3.1˚C lower than the 25.2˚C preferred by Japanese women. What is clear from the research that has been published to date is that the notion of thermal comfort is itself also a multisensory construct (e.g., Candas & Dufour, 2005). Indeed, it has been suggested that aircraft noise might also play in thermal comfort (Fanger, Breum, & Jerking, 1977). It has been suggested that visual cues can potentially be used to modulate thermal comfort (Winzen, Albers, & Marggraf-Micheel, 2014). In particular, ambient temperature (in a simulated airplane cabin) was felt to be warmer under yellow lighting than under blue lighting, while air quality was perceived as being higher and those taking part in the study felt more alert, when exposed to blue light.

However, while this innovative approach successfully demonstrated that thermal comfort could be influenced by the use of a cool or warm-colour scheme in a mock-up airline cabin, the magnitude of the crossmodal effect fell short of being able to fully address the gap that has been identified in thermal comfort between the sexes. At the same time, however, it should be

noted that offering people the opportunity to control the temperature can help to alleviate the impact of environmental stressors (Ong, 2013). Indeed, this was one of the top 15 predictions of what passengers want in terms of future travel (Thornhill, 2023).[5]

Elsewhere in the world of hospitality, the multisensory approach to sensehacking has led to such interventions as the pillow menu (Spence, 2022b). How long, one might ask, before that is extended to the luxury end of air travel? A few years ago, BA were even experimenting with responsive blankets that would provide a visual cue to cabin crew to help monitor the emotional state of passengers via a Bluetooth connection to a brain monitor (Chakravarty, 2014). Again, the focus here would appear to be on emotional well-being, even if this futuristic solution was, perhaps unsurprisingly, never implemented commercially. At the same time, however, massage and other spa-type treatments have long been offered to premium customers prior to take-off. That said, it is precisely such direct interpersonal contact, and well-being offerings that have often been eliminated/frozen during the Covid pandemic (when 'touch hunger' may have been at its most severe; Field, 2001).[6] The research is though, clear, on the benefits of massage for well-being, whether or not one is about to fly (Heid, 2019).

4. Food and beverage provision in the air

There would appear to be an increasing awareness / interest in eating in the air as a means of supporting sustainability/well-being (Batat, Peter, Moscato, Castro, Chan, Chugani, & Muldrow, 2019). Indeed, it is hard to imagine McDonald's being served on planes, as on United Airlines on flights to Orlando back in the 1970s (see Ritzer, 1993).[7] Given the growing concern about well-being, simply offering more luxurious ingredients is unlikely to meet contemporary airline passengers' needs in the way that once it might have done (e.g., MacClancy, 1992, p. 207; O'Flaherty, 2015; Pemberton, 2015; Severson, 2007; Xie, 2016). This thought was

[5] In particular, 20% of respondents said that ergonomic and biomimetic sensory plane seats that adapt to passengers' body shape, weight and temperature providing ultimate comfort.

[6] Just take BA Terminal 5, or Air France's (Clarins Spa) Paris hub who both suspended their spa offerings during the Covid pandemic. The BA spa is still closed for renovations.

[7] On September 17th, 1991, in both *The Washington Post* and *The New York Times*, McDonalds ran adverts promoting their burgers' availability to children on United flights to Orlando (see Ritzer, 1993, pp. 6-7). Meanwhile, KFC was offered to passengers on Japan Airlines during the holidays in 2012 and 2013 (Lobo, n.d.).

captured recently by the headline of an article that rhetorically posed the question: “The airline industry is in trouble. Is bottomless caviar the answer?” (Drake, 2022). Instead, it is striking how the healthiness (or otherwise) of airline meals increasingly tends to be foregrounded over taste when the food provisions of different airlines are compared (De Graaf, 2016).

Food and beverage provision is undoubtedly important to airline passengers (Lu, 2014; Thornhill, 2017). According to research from Taiwan, 41% of airport travellers buy food and beverages (Lu, 2014). That said, rather different criteria are likely relevant to the food and beverage provision in the airport vs. in the plane. According to data from more than 1,000 airport travellers reported by del Chiappa et al. (2019), atmospherics, staff quality, value for money, and product quality were key factors in the case of food purchased in the airport. Here, it is interesting to consider how passengers ordering food (via airport food delivery apps) to be delivered to the gate prior to boarding has also been identified as an emerging trend in North America (see Diebelius, 2015; see also Gordon, 2017).

This change in emphasis has taken place despite the fact that many are disappointed, and indeed have low expectations concerning the quality of airplane food. It is well-known that food and drink taste different while in the air (Moskvitch, 2015; Pace, 2017). In fact, it is likely that passengers’ generally low expectations play a role as far as the perceived quality of airline food is concerned. Put differently, airline food likely tastes bad because passengers expect it to do so (Adonai, 2017; Beck, 2014; Green & Butts, 1945; McGuire, 2015; Piqueras-Fiszman & Spence, 2015; Smith, 2013a). Survey results suggest that a fifth of people believe bad cuisine is the worst thing about flying long-haul and over half don't like the food that is served on planes (see Thornhill, 2017). Such a negative preconception has led to some pretty striking attempts to get people to reconsider how good airline food can potentially be (see Thornhill, 2017). So, for instance, some of the airlines have been offering high-priced airline meals while on the ground during Covid (AFP & Thornhill, 2021; see also Thornhill, 2021).[8] Of course, a cynic might see such media-friendly stories as nothing more than an effective marketing opportunity. But what role does hypobaric atmosphere influence, dry cabin air, and/or high levels of ambient noise actually have on olfactory and gustatory function? And what are the

[8] Though the publication date of this article suggests that it might be an April Fool’s Day story.

most innovative airlines currently doing to deliver tasty and healthy food offerings.

4.1. Cabin air pressure and low humidity levels

Changes of pressure and humidity deleteriously affect olfactory function (Kuehn, Welsch, Zahnert, & Hummel, 2008; Rahne, Köppke, Nehring, Plontke, & Fischer, 2018). For example, the hypobaric pressure in airplanes while in flight has been shown to impair olfactory sensitivity (of butanol) at threshold but not suprathreshold odour discrimination (i.e., when people have to try and pick the odd one out of three fragrance sticks). Kuehn and colleagues speculated that humidity might support the interaction between odorant and receptor of the olfactory mucosa and/or perhaps the decrease in environmental humidity reduces the capacity of air to carry odorant molecule, with odorant molecules being bound to water in the air. Other researchers have demonstrated a reduction of olfactory sensitivity and intensity ratings when atmospheric pressure was reduced from baseline 520 m above sea-level to equivalent of 4,000 m for several hours (Huppertz, Freiherr, Olzowy, Kisser, Stephan, Fesl, Haegler, Feddersen, Fischer, Mees, & Becker, 2018). Gustatory sensitivity to bitterness also decreases markedly when the atmospheric pressure is changed from sea level to 5,000/10,000 ft (Maga & Lorenz, 1972), in this study leading to a selective reduction in the perception of bitterness.

The lowered cabin air pressure while in flight then deleteriously impacts olfactory and gustatory perception (e.g., Burdack-Freitag, Bullinger, Mayer, & Breuer, 2011). The latter researchers conducted a study at the Fraunhofer Institute for Building Physics, showing that the perception of saltiness falls up to 30 percent on a plane, while the sense of sweetness fell by 20 percent, thus explaining why sweetness needs to be ramped up for meals served in the air (Park, 2017). As such, even if a dish is perfectly cooked and seasoned on the ground, it could end up tasting like rubber (or cardboard) inside the flight. Burdack-Freitag and colleagues had their participants smell and taste flavorants while varying the humidity/pressure/temperature. At the same time, however, it should be noted that there may be a very real difference between the perception of pure tastants in solution and actual foods.

The dry cabin air can also adversely affect tasting, with humidity levels typically being 12-15% lower than on the ground (Beck, 2014). Stress may also result in reduced saliva flow

(Bates & Adam, 1968), and hence something needs to be done to help tackle the problem of dry mouth (Park, 2017), given that tastants need to dissolve in saliva. The problem of stress-induced mouth dryness also made worse by the fact that meals heated in the air tend to dry out rapidly too. Traditionally, one of the solutions has been to have the meat or pasta drenched in sauce (Howe, 1985).[9] Meanwhile, other commentators have playfully suggested moisture squirt up the nostrils – the so-called nasal douche (Spence, 2017a, b).

4.2. On the deleterious impact of engine noise

Another important factor that has emerged recently concerns the impact of engine noise on tasting. In particular, loud noise tends to impair people's sensitivity to sweet and salt (Woods, Poliakoff, Lloyd, Kuenzel, Hodson, Gonda, Batchelor, Dijksterhuis, & Thomas, 2011), while seemingly enhancing the perception of umami (Yan & Dando, 2015), there would appear to be a well-being angle around the increased use of umami-forward ingredients (Spence, Michel, & Smith, 2014; see also Griffiths, 2015; McCartney, 2013). This may also help to explain the 25% of airline passengers who only drink a Bloody Mary while at 35,000 ft, while never ordering one on the ground (Attwooll, 2014; Wolfson, 2018). A secondary benefit here of upping the umami relates to the suggestion that it may represent an effective means of maintaining the perception of salt/flavour while at the same time reducing sodium content of foods(Nakamura, Kawashima, Yamasaki, Lwin, Eguchi, Hayabuchi, Tanoe, Tanaka, Yoneok, Ghaznavi, Uneyama, Shibuya, & Nomura, 2023; cf. Kim, 2013).[10] At the same time, however, it is important to recognize the fact that the public (especially in the West) continue to have reservations over MSG (monosodium glutamate; Kwok, 1968; Sand, 2005). Certainly, in terms of longer-term health outcomes for frequent travellers, one obvious suggestion would simply be to remove the salt sachet from meal trays on board (cf. Sutherland, Edwards, Shankar, & Dangour, 2013), especially given reports from many flight staff of passengers adding lots of

[9] Back in 1973, French Chef Raymond Oliver served beef bourguignon, coq au vin and veal in cream sauce for a new French airline. Fliers loved the menu prepared by Oliver and in no time, other European airlines followed suit. The meals were a part of his 'wetter is better' theory that works in favour of the conditions present on airlines. Adonai, 2017; Spence, 2017b).

[10] According to modelling from Nakamura et al. (2023), replacing salt with umami substances could help UK adults reduce daily salt intake by 9.1%–18.6% (9.2%–18.4% for women; 8.8%–19.4% for men), which is equivalent to 0.45–0.92 g/day of salt reduction (0.41–0.82 g/day for women; 0.50–1.10 g/day for men).

salt to their food (Burdack-Freitag et al., 2011). One of the other suggestions from chefs is to bring a bottle of Tabasco sauce on board to help spice up dishes in the air (Dunn, 2018).[11]

4.3. Comparing food tasted up there to down here

Holthuysen, Vrijhof, de Wijk, and Kremer (2016) served a couple of versions of two top-selling airline meals, namely a chicken curry rice dish and a pasta Bolognese dish to people (N=464) in one of three different conditions – a sensory lab, a simulated airplane cabin environment situated on the ground, and to passengers while on a return flight from Amsterdam to Tenerife. Surprisingly given the literature on atmospheric effects, there was actually little difference between people's ratings (of overall liking and Just-about-Right ratings) in the three different environments. If anything, the food was rated as tasting better in either the simulated or real airline situations than in the lab (consistent with the dishes having been formulated to taste good in the air). Furthermore, a distinction in liking between the two versions of the same dish was only observed in the simulated and real aircraft environments. When interpreting these results it is important to note that the differing demographic of the individuals tested in each of these three locations / conditions complicates the interpretation of these results somewhat.[12]

While much of the previous research can be criticized for its reliance of simple taste stimuli (unlike real foods), Holthuysen et al.'s (2016) might raise questions about the sensitivity of the Just-about-Right response measure. What is more, it is hard to know whether the fact that the passengers on the plane were unexpectedly offered a free meal might not have improved their mood somewhat, and so perhaps have biased their judgments toward giving the food a higher rating than otherwise would have been the case had they had to pay for it (especially given the typically sky-high, if you'll excuse the pun, mark-up on airline food; Smith, 2013b). One can only wonder as to whether ratings would have been lower for those on the return leg of their journey, say, when their mood might well be lower. (It is a little hard to figure out from their

[11] Tabasco, note, also being an ingredient in the Bloody Mary of course (Attwooll, 2014).

[12] And, as the authors of the study note themselves, the sample sizes used in some of the conditions were rather small in this between-participants study.

Methods section how exactly the various dishes were served on the outbound and return legs of the flight.)

4.4. Formulating better-tasting, healthier food for altitude

In a few cases, food and beverage products have been formulated specifically for altitude. This was the case for the beer served on Cathay Pacific Airways a few years ago (Freytas-Tamura, 2017; Gartenberg, 2017). Meanwhile, British Airways collaborated with Twining's to formulate a tea that was specifically designed for drinking at high altitude (White, 2013). Note that given most of what we think we taste we smell, increased use of fruity aromas can help to enhance perceived sweetness in such cases (Spence, 2015). It has also been suggested that New World wines from high altitude may stand up better in the skies (Smith, 2014; Tyrer, 2014). And wine experts also recommend choosing a fruity red wine (such as Pinot Noir, Rioja, or Malbec), given that perception of these aromatics are likely to be impaired at altitude (Pace, 2017).

Monarch Airlines may have unlocked the secret to helping you relax on a flight so you can avoid 'air rage' – this according to the headline of an article that appeared in *The Mirror* (Delahaye, 2017). The story related to a project in which chef Jozef Youssef of Kitchen Theory and I were given the opportunity to develop a meal box for passengers on Monarch Airlines flights that would actively promote passenger well-being (see **Figure 2**). Prior to take off, the passengers were treated to an echinacea and liquorice ice cream which aims to boost immunity (especially handy as 39% of Brits surveyed said they get ill when travelling or on holiday). Liquorice boasts active ingredients with anti-inflammatory and cell protective abilities too. Roughly half an hour into the flight, the passengers were treated to a herbal fusion containing chamomile, fennel seed and kelp. These ingredients have been proven to combat bloating and help digestion (which affects almost 20% of travellers). There's also a touch of lemon balm providing aromatic properties that can aid relaxation too, and a side crunch, seaweed biscuit for a sweet yet salty taste. A chewy element enabled the passengers to help reduce their stress (given the literature on chewing gum being used by those who are stressed; Hollingworth, 1939; Scholey, Haskell, Robertson, Kennedy, Milne, & Wetherell, 2009; Though see also

Walker, Hosiner, Kergoat, Walker, & Somoza, 2016). Finally, prior to landing, an energy bar with nuts and umami shake for enhanced flavour.

INSERT FIGURE 2 ABOUT HERE

4.5. Gastrophysics and the new science of eating

It is, however, important to note that airlines focusing on the recipe to try and enhance the experience in the air (e.g., Connor, 2010; Drake, 2022; Liston, 2011; Michaels, 2010; Mouawad, 2012) are unlikely to succeed in delivering the best passenger experience, given that so much of what we think about wat we eat is dependent on product extrinsic factors, such as place setting, the quality and feel of the tableware, tablecloth etc. (Bschaden, Dörsam, Cvetko, Kalamala, & Stroebele-Benschop, 2020; García-Segovia, Harrington, & Seo, 2015), and the company we keep (see Spence, 2017a, for a review).[13] Naming also plays an important role, as discussed at length elsewhere (see Piqueras-Fisman & Spence, 2014). Relevant to this general point (i.e., about the importance of gastrophysics), research conducted by Boeing found that passengers flying on two almost identical planes (Norwegian's 737 NG and its 737 Boeing Sky Interior Aircraft) were significantly happier when the aircraft had a wider entrance and better lighting. Passengers reported that their seats and meals were better when in fact it was just their surroundings that had changed (Burgess, 2018; Garcia, 2015).

Simply allowing the premium passengers to eat more naturally, e.g., at a table together with their companions might do more to improve the taste of the food than anything else (Steinberg, 2020). After all, a large body of research shows that dining together can help to facilitate the more social aspects of dining (Boothby, Clark, & Bargh, 2014; Spence, 2017a). Meal timing likely also plays a role in the enjoyment (or otherwise) of food (see Brenneman, 1998). There is also an open question here about the personalization of food and beverage experience. This has already started in the higher echelons of gastronomy/hospitality, as when top restaurants google their diners in advance of their visit (Lawrence, 2013; Mattin, 2016; Spence, 2017a, b). Airlines would seem well placed to offer such a personalized service to their regular customers

[13] It is worth noting how fine china was an integral component of the service in the early days of transport, e.g., on the luxury 1930s flying boats (Newton, 2017).

too, given the information that could presumably be made available through frequent flyer programs (privacy concerns permitting). Indeed, according to Drake (2022), Air France already keeps track of their First Class passengers' preferences and peculiarities.

4.6. Sonic seasoning at mealtimes

Given the detrimental effects of noise on tasting while in the air (Kim, 2013), noise-cancelling headphones offers an innovative possibility to enhance the taste of airline food (Spence, 2017a, b). Going one stage further, in a project with British Airways, we worked on a sonic seasoning menu selecting music to complement food and potentially offer an element of 'sonic seasoning' (Skift, 2014; Victor, 2014), with tinkling high-pitched tracks bringing out sweetness, and The Proclaimers to bring out the authenticity of Scottish fish. Meanwhile, in 2017, Finnair brought out a menu of "sonic seasonings", inviting passengers to enhance the richness of, say, their meatballs by eating along to a pre-recorded track of a crackling fire played through headphones. The promotional video for Finnair's menu includes a scene in which celebrity chef Stephen Liu crouches in a Finnish meadow with a microphone, recording the babbling of a brook (Drake, 2022; Silva, 2019; see also Franco, Shanahan, & Fuller, 2017).

5. Relaxation, sleep, and arousal

Helping stressed passengers to relax, and possibly also to sleep would undoubtedly enhance well-being. There are a number of simple sensehacks that might be considered here, given the results of research on the ground. So, for example, offering a night-light setting on in-seat screens might be a good idea given the evidence that normal screen lighting can impede sleep (e.g., Chang, Aeschbach, Duffy, & Czeisler, 2015; Spence, 2021a). It is also worth considering here how many hotels now provide aromatherapy scents to their guests to help the latter to sleep a little more soundly (see Spence, 2022b). Why not do the same on the plane one has to ask? Currently, amenities kits provided to premium passengers would seem to focus on skin care (e.g., often they contain moisturizer, lip-balm, anti-wrinkle creams). All of which are undoubtedly beneficial but what about pivoting to offer a well-being kit? Aromatherapy facial wipes or creams might help to provide a somewhat more personalized sensory well-being

regime (Spence, 2020, 2022c). Relevant here, research on the ground demonstrates that the benefits of relaxing ambient scents tend to be more pronounced under conditions where people are more stressed to begin with (Warren & Warrenburg, 1993; Spence, 2020b). As we have seen, that is likely to be the case for many air passengers currently.

There is undoubtedly an opportunity here to develop a signature well-being scent designed to help stressed passengers to relax while they are in the air (see also Sedgwick, 1992). While lavender is often used to aid relaxation and sleep (Field, Cullen, Largie, Diego, Schanberg, & Kuhn, 2008), the fragrance houses believe that it may be possible to develop even more effective fragrances that could, in due course, presumably become signature scents (see also Warren & Warrenburg, 1993). Consider here only the Stefan Floridan Waters scent used by Singapore Airlines that was mentioned earlier (Lindstrom, 2005; Wiedmann, Labenz, Haase, & Hennigs, 2016). At the same time, however, it has to be recognized that the olfactory environment in the air is more communal than in a guest hotel bedroom, and problems have, on occasion been reported, when smells/aromas have diffused through the cabin, and been misinterpreted (Buaya, 2016; see also Kessler, 2012).

Prior to arrival on an overnight flight one might consider using an arousing scent, something like peppermint (Ho & Spence, 2005; Spence, 2020b), say, perhaps with the alerting blue light (Spence, 2020) (see **Figure 3**). There has been some innovative use of blue lighting to enhance alertness. This may be especially relevant in the context of long-haul flights (see Burgess, 2018). Food options prior to arrival should presumably also be formulated to focus on energizing passengers (Delahaye, 2017).

INSERT FIGURE 3 ABOUT HERE

5.1. ASMR and the 'first night effect

A growing number of people use ASMR (Autonomous Sensory Meridian Response) in order to help themselves to relax before going to sleep (Barratt, Spence, & Davis, 2017; Hardian, Febriani, Sumekar, Muniroh, Indraswari, Purwoko, & Ambarwati, 2020). This may be particularly important given that passenger's sleep is likely to impaired due to the well-known 'first night effect' – this, the name given to the impaired sleep observed (on the ground), when

people sleep in a new location for the first time (Agnew, Webb, & Williams, 1966; Rubin, 2016). Note that one hotel chain even tries to ensure that its repeat customers get to stay in the same room on their second and subsequent stays. Such an approach to personalization might help to convey a benefit for long-haul passengers in terms of reducing the detrimental consequences of the 'first-night effect' on sleep quality, thus delivering a benefit for well-being and promoting better sleep hygiene.

6. Conclusions

There is a growing awareness within the airline/airport industry of the desire/need for stress-soothing service strategies (Kinsman, 2020; Rabbu, 2020; Zhang et al., 2021), especially given the way in which coronavirus has been reshaping the airport/air travel experience (Faraj-Dubz, 2020; Harper, 2020; see also Kinsman, 2020). The multisensory atmosphere while flying is certainly not conducive to promoting passenger well-being while in the air. However, there are a number of proactive steps that airlines can potentially take to help tackle the growing problems of passenger stress (McIntosh, 2017), anxiety (Batouei et al., 2019; Bogicevic et al., 2016; McIntosh et al., 1998), and boredom that may often lie at the route of other unhealthy behaviours while in the air, such as an excessive consumption of alcohol (Draper, 2017), and/or food (de Syon, 2008), given that people tend to eat more when they are stressed (Sproesser, Schupp, & Renner, 2014; see also Thornhill, 2015). It has been suggested that boredom (one of the top complaints of many long-haul passengers; Thornhill, 2017) promotes food consumption. As such, well-meaning recommendations (e.g., from top chefs) to eat while still on the ground (because the food and drink will simply taste better due to the more favourable environmental conditions; e.g., Adonai, 2017) are likely to fall on deaf ears amongst passengers.

It is undoubtedly difficult to predict the future of air travel/tourism (see Kinsman, 2020; Villa-Clarke, 2020). Should the recommendation to enhance the well-being of passengers be taken on board then one of the other key challenges moving forward concerns how to differentiate the different well-being experiences for different classes/cabins of travel on offer (e.g.,

Economy, Premium Economy, Business, and First; see Hwang & Lyu, 2018).[14] While the different levels of service, not to mention the food and drink offerings, if any, have already been well-established by the various airlines, it is currently less clear how to work out the relative value/importance to passengers of different well-being offerings (e.g., how does sleep hygiene compare to offering more healthy eating options)?

The last few years have seen a rapid shift from concerns over Covid (hygiene) to a growing emphasis on well-being while in the air (Hinninghofen & Enck, 2006). While the focus in this review has been very much on commercial air travel, it is worth noting that many of the same issues are likely to crop up in the case of other means of passenger transport (e.g., by boat/cruise or rail; see Spence, 2018a, b), as well as, looking a little further into the future, when space tourism really gets started (Foss, 2014; Silva, 2017; Taylor, Beauchamp, Briand, Demaria Pesce, Heer, Hummel, McGrane, Margot, Pieters, Pittia, & Spence, 2019; Taylor, Beauchamp, Briand, Heer, Hummel, Margot, McGrane, Pieters, Pittia, & Spence, 2020).

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[14] Looking to the future, those aiming to promote their premium offerings (e.g., using virtual reality marketing) might also be well advised to emphasise the well-being being component of the service that they offer (Yerman, 2015).

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FIGURES

Figure 1. Biophilic design in the Marco Polo Airport Lounge in Venice Airport.

Figure 2. Well-being meal box created by chef Jozef Youssef and Charles Spence for Monarch Airlines in 2017.

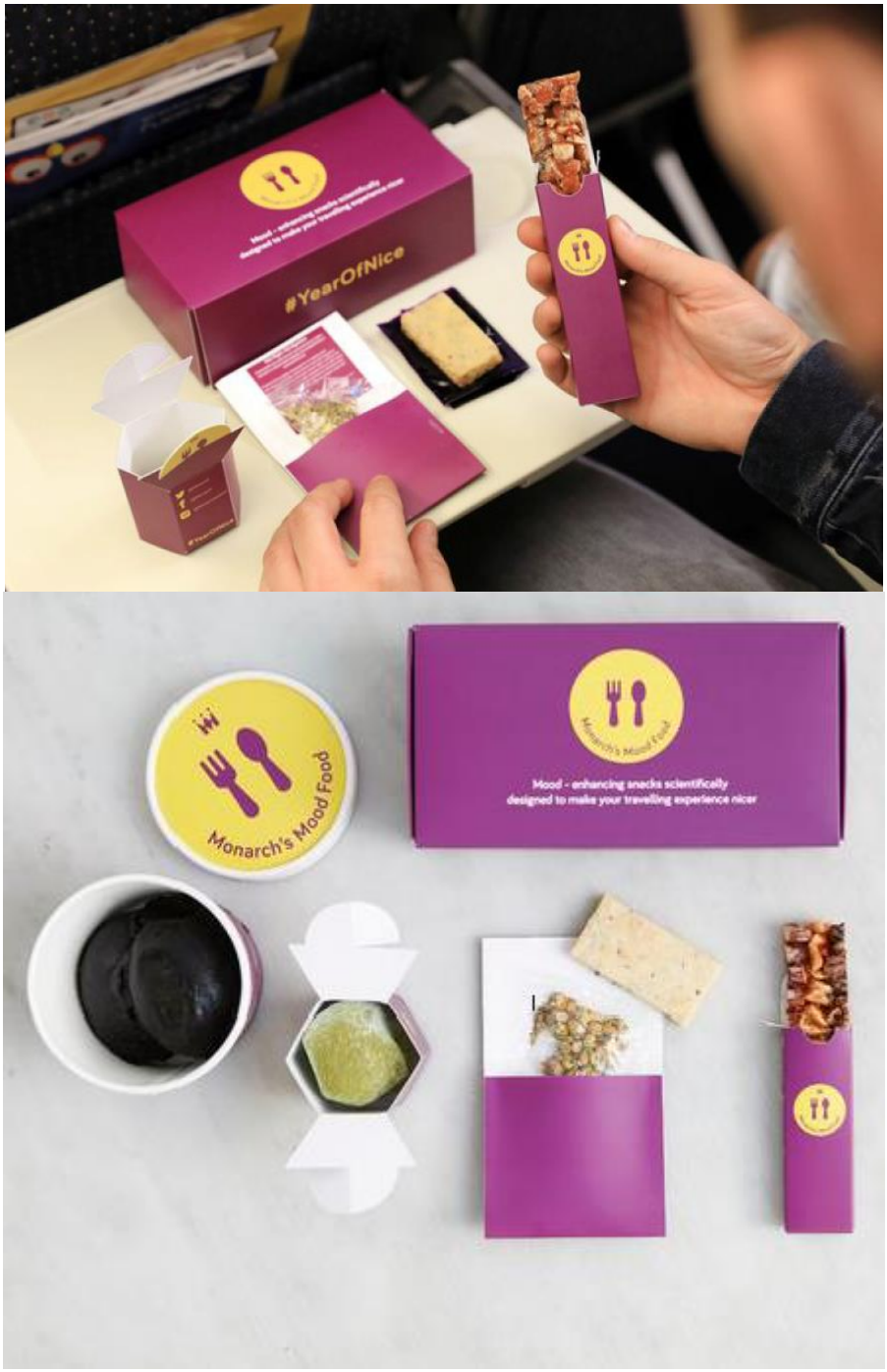

Figure 3. Could the blue light of dawn be used to give long-haul passengers a psychological boost to their alertness after a long-haul flight? [Figure from Burgess, 2018).]