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When a clean scent soothes the soul: Developing a positive attitude toward sharing service space with strangers

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In the context of sharing services, this research examines how ambient scent can improve the perception of the presence of other sharers. Four experiments conducted in real conditions (open-plan workspaces, car-sharing services, rail-stations, and library) show that the diffusion of a clean scent promotes positive attitudes toward sharing space with others. Three alternative explanations are assessed: 1) perceived cleanliness of the space; 2) other users' behaviors; and 3) user's mood. The results indicate that throughout the four experiments, the effect of scents is mediated only by the positive mood induced by the scent.

1. Introduction:

Over the last twenty years, the economy of sharing and new collaborative practices **have** increased at such a pace that they are no longer considered a niche phenomenon but as a deep trend, likely to have a significant and lasting impact on our consumption practices (Cheng, 2016; Benoit et al., 2017; Zervas et al., 2017; Nguyen & Llosa, 2020). In the 2000s, innovative technologies have opened up new possibilities for connecting and sharing services such as bartering, Airbnb, and ridesharing. **The sharing economy took off so quickly that, in 2014, PwC projected the B2C sharing economy¹ would grow from \$255 billion in 2013 to \$670 billion by 2025. Even if the COVID-19 pandemic has decimated the sharing economy, which depended heavily on mobility and vacations, it is currently making a strong post-pandemic recovery. Uber lost \$6.8 billion during 2020, but its revenue in the first quarter of 2022 rose 136% year-on-year to \$6.9 billion. While Airbnb posted a net loss of nearly \$4 billion in the fourth quarter of 2020, its revenue in the first quarter of 2022 reached \$1.5 billion, an increase of 70% year-on-year, and 80% compared to 2019. Thus, experts still predict a bright future for the sharing economy (Radjou, 2021).** From car-sharing² services and convivial spaces in train and metro stations to co-working spaces and more, joint consumption efforts increase the way consumers interact with one another and **can contribute** to the creation of a better, more collaborative, and caring society.

Collaborative consumption is the shared use of goods or services by a group. **With traditional consumption**, an individual pays the full cost of a good and maintains exclusive access to it, whereas with collaborative consumption, multiple people have access to a good and bear its cost. However, the benefits of communal experience often come at the expense of the presence of other sharers, who can be perceived as interfering (Simon and Roederer, 2019). Anxiety and mistrust among users are among the biggest threats to the development of the sharing economy (Hossain, 2021). This obstacle to sharing may be even higher since the COVID-19 pandemic has spread, as fear of contagion has increased.

This article examines the role of olfaction in social relations in shared service spaces. More precisely, the objective of this paper is to demonstrate that ambient scents may help to reduce human tendency toward individualism and to decrease the impression that other sharers are interfering in “share-in contexts” (Simon and Roederer, 2019). Several recent studies have

¹ PWC 2014 study considers ten industries: Peer-to-peer lending and crowfunding, online staffing, peer-to-peer accommodation, car sharing, music and video streaming, equipment rental, bed&breakfast and hostels, book rental and dvd rental (https://pwc.blogs.com/files/sharing-economy-final_0814.pdf)

² The car sharing process “allows users to book a vehicle through their phone, use it and then return it anywhere within a designated area of a city” (Sprei et al., 2019, p.128).

explored the psychological mechanisms favoring collaborative consumption (Viglia, 2020), such as trust (Ert and Fleischer, 2020) or commitment to others (Mai et al., 2019), but very few studies have focused on the potential beneficial effects of pleasant ambient scents on the sharing economy. While many studies, particularly those conducted by Professor Chebat, have examined the impact of scents in retail contexts (e.g., Chebat et al, 2003; 2005), their impact on shared service spaces is poorly documented.

This article reports the results of four experimental studies that have **been conducted in France before and during** the COVID-19 pandemic, with a pleasant clean scent (floral musky note) diffused in four different service contexts (shared workplace in a company and university library, car sharing, and rail station concourse). The findings are consistent across studies and confirm that the presence of a pleasant ambient clean scent promotes positive attitudes toward sharing space with other users (other workers in an open-plan workspace, other users in a shared car, and other passengers in a station concourse). Based on the literature on psychological obstacles to sharing (e.g., Söderlund, 2011) and olfaction research (e.g., Chebat and Michon, 2003; Michon et al., 2005; Leenders et al., 2019), this study empirically tests three alternative hypotheses to explain the impact of ambient scents in shared spaces: a positive effect of clean **scents on: (1) perceived cleanliness of the space; (2) other users' behaviors; and (3) the user's mood**. Interestingly, the results rule out the mediating role of perceived cleanliness and perceived behaviors of others and demonstrate that the positive effect of a pleasant and appropriate clean scent in a service space is mediated by the user's mood (Leenders et al., 2019).

This study contributes to the sharing economy research (e.g., Viglia, 2020; Ert & Fleischer, 2020; Mai et al., 2019), by offering a new potential lever (i.e., ambient scents) to foster the use of sharing practices. It also complements the service marketing literature that has emphasized the role of emotional responses (e.g., Petruzzellis et al, 2021; Chebat et al, 2001), in hedonic service settings such as tourism, leisure, entertainment, and luxury (e.g., Chan et al., 2015) and utilitarian service settings such as clinics (Ladhari et al., 2017). Indeed, in shared spaces, this research shows that emotions are crucial and ambient scents promote positive attitudes towards sharing through their ability to foster positive moods. This study has important implications for managers of public spaces, whether employed by public **government institutions (such as libraries and train stations) or private organizations (such as hotels, and shared mobility services)**. Our research suggests that managers can improve social

relations in shared spaces by modifying or enhancing the scent intensity of cleaning products in service settings or by installing artificial scent diffusers in shared-service spaces.

The first part of this article introduces the notion of sharing space and **highlights its psychological** obstacles. Then, the link between olfaction and willingness to share space is explained by mobilizing three concepts that suggest three alternative explanations. Next, the results of the four experimental studies are presented. Finally, the implications are discussed and concrete recommendations for future research are proposed.

2. Theoretical background and hypotheses:

2.1 Sharing spaces with others: psychological obstacles to overcome

Academic research on the phenomenon of collaborative consumption **recently began to flourish** (e.g., Correa et al., 2019; Park et al., 2019). Collaborative consumption is a new form of consumer behavior, in which consumers share access to goods and services. **Simon and Roederer (2019) highlighted that services of the sharing economy rely on sharing the same resources, and a substantial level of physical or symbolic closeness exists between sharers.**

Customers' motives to engage in collaborative consumption are diverse (Benoit et al., 2017) and their drivers may be purely economic as they share or reduce costs (Barnes and Mattson, 2016; Benjaafar et al, 2019), or get access to goods that were normally unaffordable (Rudmin, 2016), which may also refer to hedonic motives (Lawson et al., 2016). Consumers' motivations for sharing goods and services are often linked to their increasing interest in sustainable consumption (Botsman and Rogers, 2010). Sharing consumption also allows people to exchange and maximize their social relations (Isac, 2019; Botsman and Capelin, 2016) and increase their social welfare (Benjaafar et al, 2019).

Even if customers gain the communal benefits of "sharing-in" contexts, these benefits can be reduced by the **presence of other users which may be** perceived as uncomfortable (Simon and Roederer, 2019). The presence of other users which may be viewed as an obstacle to comfort and satisfaction. Sharing the same space or item with other users implies adopting "pro-social" behaviors focused on collaboration rather than individualism (Cavanaugh et al., 2015; Eckhardt et al., 2019; Mai et al., 2019). The literature shows that ambient scents can increase positive consumer attitudes and behaviors (Chebat and Michon, 2003; Leender et al., 2019; Roschk et al., 2020). In particular, the *service scape* model indicates that pleasant and congruent ambient scents positively impact social interactions (Bitner, 1992). For example, individuals exposed to pleasantly scented air are less likely to create conflict in their social

relationships and more likely to favor collaboration and compromise (Baron, 1990). They develop more altruistic behaviors (De Lange et al., 2012; Liljenquist et al., 2010). In pleasantly scented places, strangers are more willing to interact with each other (Zemke and Shoemaker, 2008). In contrast, unpleasant scents trigger space avoidance behaviors (Levine and McBurney, 1986; Bone and Ellen, 1999) and negative mood and emotions (Ehrlichman and Bastone, 1992).

Based on this body of research, our first hypothesis is as follows:

H1: In the presence (absence) of a pleasant ambient scent, users of a shared space have a more (less) favorable attitude toward sharing space with other users.

Several alternative hypotheses have emerged from the literature to explain the potential impact of ambient scents in shared spaces. Pleasant ambient scents could promote the sharing of spaces because they: 1) reinforce perceived space cleanliness and, thus, reduce the fear of contamination; 2) improve attitudes toward other users, and reduce the fear of a lack of reciprocity in relationships; and 3) improve the mood of users. In the following section, these three conceptual frameworks are presented sequentially to suggest three hypotheses.

2.2 Fragrance and perceived cleanliness

Perceived space cleanliness. Shared spaces are places of contact between individuals, who often know little or nothing about each other. Using a shared service (e.g., an open-plan workspace) implies agreeing to establish direct physical contact with objects touched by others. For example, the use of conviviality spaces in a railway station implies that the traveler agrees to touch the same chairs and the same objects as other travelers. Similarly, users of a car-sharing service must implicitly agree to touch the same passenger compartment (the steering wheel and dashboard).

By sharing space, the user of the shared service may fear being “contaminated” by other users (Argo et al., 2006, 2008). The term “contamination” initially referred to the transmission of infectious diseases but the literature has gradually extended this notion to the transfer of certain physical or symbolic characteristics from one person to another (e.g., dirtiness, physical attractiveness, and athletic ability [Kramer and Block, 2014]). The fear of contamination is based on the idea that users of a space leave a part of themselves (odors and

germs amongst others) in the space, potentially transmitting it from one individual to another (Huang et al., 2017; Morales et al., 2018; Nemeroff and Rozin, 1994).

Ambient scent and perceived space cleanliness. The idea of contamination is closely related to that of dirt and may or may not be visible. Indeed, when visible, dirt is usually an indicator that other users have handled the object, and although, objects may appear dirty but not contaminated, the fear of contamination is stronger for an object deemed dirty than for an object that appears clean (Di Muro and Noseworthy, 2013). The literature suggests that the presence of a cleanliness indicator may reduce the fear of contamination (Morales et al., 2018), when contamination may not be as visible as for a virus.

Fragrance is an indicator of cleanliness. In general, the presence of perfumes in a place suggests that the place is clean (Holland et al., 2005; Liljenquist et al., 2010) because the vast majority of detergent products are scented and, by association of ideas, a scented place gives the impression of having been recently cleaned. Studies on olfaction have confirmed that humans rarely believe that pleasant scents are artificial in places (Li et al., 2007). Rather, they tend to believe that fragrances emanate naturally from the place itself, particularly, because they have just been cleaned (e.g., Biswas and Szocs, 2019; Forster and Spence, 2018; Krishna et al., 2010).

To the extent that the fear of contamination, which is a psychological obstacle to sharing spaces, is diminished in the presence of an indicator of cleanliness, such as perfume, we suggest that the presence of a pleasant ambient scent in the space promotes positive attitudes toward sharing space with others.

H2: A greater sense of cleanliness in the shared space mediates the positive effect of the presence (versus absence) of a pleasant ambient scent on the attitude toward sharing space with other users.

2.3 Fragrance and the perception of other users' behaviors

Perception of other users' behaviors. Space sharing is often hindered by a negative perception of the behavior of other users, especially when they are strangers (Söderlund, 2011). People tend to distrust others, particularly if they are unfamiliar (Cavanaugh et al., 2015). However, the sharing economy is based on reciprocity; if the user thinks that other users of the space do not behave altruistically (sharing, cooperation, and mutual aid), then they tend not to behave altruistically either (Batson et al., 1997; Mai et al., 2019). Conversely, a positive perception of

other users leads to an increase in prosocial behavior (Bagozzi and Moore, 1994; Batson et al., 1997; Coke et al., 1978; Keizer et al., 2008). In this logic of reciprocity, altruistic behavior is easier to foster when individuals are convinced that others behave altruistically.

Ambient scent and perceptions of other users' behavior. The presence of a pleasant scent in a place has a positive effect on the way people who inhabit that place are perceived (Li et al., 2007). Numerous studies have shown that pleasant fragrances promote approach (versus avoidance) behaviors toward products, brands, places, and people (e.g., Doucé et al., 2013; Morrin and Ratneshwar, 2003; Spangenberg et al., 1996). The properties of ambient scents are automatically transferred to people and objects in the place, as if the fragrance emanates directly from them (e.g., Biswas and Szocs, 2019; Forster and Spence, 2018; Krishna et al., 2010).

The theoretical framework of symbolic associations (Lakoff and Johnson, 1980) and inference theory (Huber and McCann, 1982) allows us to understand how ambient scents can improve the perception of other users of a place. Inference theory argues that people make judgments about the unknown on the basis of information they receive from cues that are available to them (Huber and McCann, 1982). When evaluating other users of a place, they are unconsciously influenced by ideas and feelings associated with the ambient scent (Baker et al., 2002). For example, individuals placed in a pleasantly scented place are judged more virtuous than those in an unscented place (Liljenquist et al., 2010), and virtuous behaviors are associated with the scent of cleanliness (Zhong and Liljenquist, 2006).

As a pleasant scent is an indicator of other individuals' positive behaviors, we assume that the presence of a pleasant scent in a shared space encourages a more positive attitude toward the behavior of other users of the shared space.

H3: A better perception of the behavior of other users in a shared space mediates the positive effect of the presence (versus absence) of a pleasant ambient scent on the attitude toward sharing the space.

2.4 Fragrance and users' mood

Mood. The third barrier to sharing spaces is the potentially negative mood of the users. Consistent with scholarly discussions, we use the term mood to describe an internal feeling state, in contrast to, for example, more cognitive processes (Leenders et al., 2019). The literature has shown that moods are powerful predictors of altruistic behaviors (e.g.,

Cavanaugh et al., 2015; Isen, 2001; Small and Verrochi, 2009). Individuals subjected to negative moods are less altruistic and adopt fewer prosocial behaviors (e.g., Carlson and Miller, 1987), while positive affect theory shows that individuals subjected to positive moods are more likely to help and share with others (Waugh and Fredrickson, 2006).

Ambient scent and mood. Much of the existing research underlines the link between scents and affect (e.g., Chebat and Michon, 2003; Leenders et al., 2019). Several studies comparing different sensory modalities with brain-imaging protocols (e.g., Herz et al., 2004) confirm that olfaction, more than any other sense, triggers reactions in which affect prevails over cognition.

In general, individuals exposed to a pleasant scent experience feel an improvement in mood (e.g., Leenders et al., 2019; Mattila and Wirtz, 2001; Spangenberg et al., 2005; Vinitsky and Mazursky, 2011). The theory of affective priming (Zajonc, 1980) notes that when an individual is exposed to a pleasant scent, the brain tends to activate thoughts related to pleasure and is influenced by these positive thoughts when judging the place and situation (Anderson and Bower, 1973; Lakoff and Johnson, 1980; Vinitsky and Mazursky, 2011). For example, Baron (1997) suggests that in the presence of a pleasant scent in a shopping mall, the propensity of passers-by to adopt prosocial behaviors (such as picking up a dropped pencil or agreeing to provide change to others) comes from an increase in positive emotions felt. On the other hand, those who are placed in a negative affective state are less altruistic and adopt fewer prosocial behaviors (e.g., Moore et al., 1973; Underwood et al., 1977).

Thus, in a shared space, users' positive moods encourage them to adopt a more positive attitude toward sharing space.

H4: Positive mood mediates the positive effect of the presence (versus absence) of a pleasant ambient scent on the attitude toward sharing space with other users.

3. Research methodology

3.1 Overview of studies

First, we conducted a pre-test to select an appropriate scent that consumers would find pleasant and associate with cleanliness. Then, we performed four experiments to test our hypotheses. The first experiment was a within-subjects design pilot study completed in an actual setting (74 co-working service consumers). It compared the reactions of individuals

before and after being exposed to a pleasant scent in an open-plan workspace, thereby controlling for individual variance, which can be high for odors. This pilot study suggested that the presence of ambient scents may increase the willingness to share spaces with others. The following three studies adopted a cross-subject design, comparing the responses of two similar samples randomly placed in either the scented or unscented condition. The second experiment was conducted in a real-world environment (72 respondents get into a car), designed to replicate the positive effect of ambient scents on the attitude toward space-sharing, and test three alternative explanations for such an effect (perception of cleanliness of the space, perception of the other users' behaviors, and general positive mood). This study indicates that users' mood mediates the effect of scent on their willingness to share the space with strangers and rules out the mediating effect of space cleanliness and perceived other users' behaviors (hypotheses 2 and 3). The third experiment was conducted at a train station in real-world conditions (120 commuters). The fourth study was implemented in the shared workspaces of a university library where one week was unscented and the following week was scented. All studies confirm that ambient scent enhances positive attitudes towards sharing the public place with other people and replicates the mediating effect of the user's mood.

The data of the first three studies were collected in 2017 before the COVID-19 pandemic and the last study was conducted in June 2021 during the pandemic. The measurements used in these studies are described in the appendix and are comparable in the four studies, while being adapted to the characteristics of each context and based on scales validated in published research (Peterson and Sauber [1983³] for the measurement of respondents' mood; Barber and Scarcelli⁴ [2010] for space cleanliness; Churchill et al. [1974] for the perception of other users⁵; and Holbrook and Batra [1987] for the attitude towards sharing⁶). **The scales have been shortened to make them more suitable for real-world data collection.** To demonstrate the validity of the shortened measurement tools, we analyzed using shortened and full scales in the fourth study. The results are similar to those of short and long scales.

3.2. Pretest study: selection of a pleasant and appropriate clean scent

³ Short mood scale (cheerful, good mood, irritable [reverse item], comfortable), Peterson and Sauber, 1983.

⁴ Perceived cleanliness (neat, clean, hygienic, well swept, well maintained, looked after, dust-free, smells clean, smells hygienic, smells fresh, organized, orderly), Barber and Scarcelli, 2010.

⁵ Satisfaction with fellow workers scale (selfish, intelligent, responsible, pleasant), Churchill et al., 1974.

⁶ How much respondents *like* sharing space and how *nice* sharing space is (Holbrook and Batra, 1987). In study 1 and 2, the items are reverse.

The pleasantness and appropriateness of the perceptual environment alter customers' reactions (Babin, Chebat and Michon, 2004). We preselected three scents (woody, floral musky, and orange flower notes) that are considered pleasant and evoke the cleaning concept. We conducted a pre-test on 267 French undergraduate students. Each student was randomly assigned to a fragrance (71 students to the orange flower scent, 121 to the woody scent, and 75 to the floral musky scent). Students had to evaluate the pleasantness of the scent on a seven-point scale. Then, they were asked to describe all the images that came to mind when smelling the scent. We then coded if the respondents cited cleaning-related words (such as soap, bath, shower, and laundry detergent). Indeed, previous studies have demonstrated a higher frequency of listing cleaning-related words when individuals are exposed to clean scents (Holland et al., 2005). Our results showed that the floral musky scent presented a higher liking score than the other two scents ($M_{\text{orangeflower}} = 3.88$; $M_{\text{woody}} = 3.98$; $M_{\text{floralmusky}} = 4.39$; $F=1.553$; $p=0.213$). Moreover, 71% of the respondents associated the cleaning concept with floral musky scent (versus 11% for orange flowers and 29% for woody scents [$p=0.005$]). Thus, we selected the floral musky fragrance for these three studies.

3.3 Pilot study in an open-plan shared workspace

Method

Design and procedure. The field experiment was conducted in an open workspace. The space was equipped with a hidden perfume dispenser. Each respondent was interviewed twice, first before entering the open space (before exposure to the ambient scent) and then at the end of the day (after exposure). This within-subject design controls for inter-individual variability, which is expected to be important for olfactory perception. Respondents were asked to rate their attitude toward the collective workplace and their moods on a seven-point scale. 71 employees agreed to participate in this study. These were primarily men (62%), 65% of whom were aged between 26 and 45 years, and 15% were aged between 18 and 25 years. Almost 60% of the sample had been employed by the company for 1 to 10 years and 20% for more than 10 years.

Results

Manipulation check. Although the perfume dispensers were hidden, 93% of the respondents noticed the presence of perfume in the open space. A small majority of respondents found the

fragrance pleasant and appropriated. 55% of them gave a score of 5 or more for pleasantness (39.5% for appropriateness) and 25.3% gave a low score of 3 or less (out of 7) for pleasantness (38% a score for appropriateness)⁷.

Attitude toward working in an open space. The analysis (repeated custom-factor ANOVA) compared the attitude toward working in the open space before and after being exposed for a day to the pleasant perfume for each respondent. The results indicate that the respondents' attitude toward the open space is more favorable after the open-plan workspace has been scented ($M_{\text{neutral}}= 4.92$, $M_{\text{perfumed}}= 5.13$; $F[1.73]=4.926$, $p=.030$, $\eta^2=.063$), further corroborating H1.

This first office-sharing pilot experiment suggests that the presence of an ambient scent may increase positive attitudes towards sharing spaces. This effect will be investigated in three between-subjects design studies.

3.4 Study 1: A car-sharing service

Design and procedure. This experiment was conducted in partnership with a car manufacturer who provided two identical cars parked in a hangar next to their head office (appendix 3). Only one car was equipped with scented cards on the floor behind the driver's seat. The cards were changed for each respondent to maintain a steady perfume intensity. Respondents were randomly assigned to a car each and sat in the driver's seat. They answered a questionnaire in which they had to rate their attitude toward car sharing, mood, cleanliness of the space, and perception of other users' behaviors. They were asked to imagine that following the booking of car sharing, they received this vehicle, which had just been returned by another user. The idea that the car was not new and had just been used by another user was reinforced by the idea that there was a handkerchief on the floor of the car. They knew they were participating in the study but were not informed of the topic. Their arrival times were staggered such that they could not interact with each other. 72 volunteers (56 men, mean age=35 years, S.D. = 13,50), all white-collar workers, participated (perfumed car: 35 respondents; non-perfumed car: 37 respondents).

⁷ Following Nadler et al.'s (2015) research on the mid-point being a neutral point reflecting no opinion, we did not consider respondents who gave 4 out of 7 to the scent liking and appropriateness (i.e., 19.7% of total sample for scent liking and 22.5% for scent appropriateness). We compared the number of respondents who gave a lower grade than 4 to those who gave a higher grade than 4. On the total sample, the average scores are 4.40 out of 7 for the liking and 3.84 (out of 7) for the scent appropriateness.

Results

Manipulation check. Respondents indicate that the perfumed car smells better than the non-perfumed car (“Does this car smell good?” $M_{\text{neutral}} = 4.08$; $M_{\text{perfumed}} = 5.00$; $F[1,70] = 5.236$, $p = .013$, $\eta^2 = .85$). Following Nadler et al.’s (2015) research on the mid-point being a neutral point reflecting no opinion, we observe that 21.6% a neutral score of 4 out of 7 for the scent pleasantness. However, there is a small majority of respondents liking the scent (56,7% of the respondents gave a higher grade than 4 out of 7 and 21.6% gave a score of 3 or less).

Attitude toward car sharing. The analysis (ANOVA) of the data indicates that respondents placed in the scented car have a more positive attitude towards car sharing than those placed in the unscented car ($M_{\text{neutral}} = 2.58$; $M_{\text{perfumed}} = 3.28$; $F[1,70] = 5.236$, $p = .025$, $\eta^2 = .70$), which corroborates H1.

Cleanliness of the car. A mediation analysis was performed using Preacher and Hayes’ model 4⁸ with the attitude toward car sharing as a dependent variable, the presence (or absence) of the ambient scent as an independent variable, and the perceived cleanliness of the car as a mediating variable. Regression analysis indicated that the presence of ambient scent had no effect on the evaluation of perceived cleanliness ($t = -1.0422$; $p = .301$). Conversely, the evaluation of perceived cleanliness had a significant effect on attitudes toward car sharing ($t = -0.8521$; $p = .006$). An indirect effect analysis showed that mediation is not significant (zero within the confidence interval $[-0.0633; 0.3990]$). In other words, the positive effect of the presence (versus absence) of ambient scent on the attitude toward car sharing does not arise from a more favorable impression of the cleanliness of the car. Thus, H2 is not validated.

Perceptions of other users’ behavior. A mediation analysis was performed using Preacher and Hayes’ model 4 with the evaluation of other car-sharing service users as a mediating variable. A regression analysis indicated that the presence of ambient scent had no effect on a user’s perception of other users ($t = -1.1748$; $p = .244$). How other users are perceived also had no effect on attitude toward car sharing ($t = -1.3307$; $p = .188$). The indirect effect analysis (zero within the confidence interval $[-0.0345; 0.2729]$) indicated that the mediation was not significant. The positive effect of the presence (versus absence) of ambient scent on the

⁸ <http://afhayes.com/>, website consulted on July 11th, 2020.

attitude toward car sharing cannot be explained by an improvement in other users' behaviors. Therefore, H3 is not validated.

Mood of car-sharing service users. Mediation analysis was performed using Preacher and Hayes' model 4 with the user's mood as a mediating variable. A regression analysis indicated that the presence of ambient scent had a significant effect on mood ($t=-2.2113$; $p=.030$). An indirect effect analysis indicates that zero is not included in the confidence index [0.0082; 0.4354], meaning that the mediation was significant. The presence (versus absence) of ambient scent promotes positive attitudes toward car sharing because it improves the user's mood. A contrast analysis confirmed that the user's mood was more positive in the scented car than in the unscented car and the difference was marginally significant ($M_{\text{neutral}} = 4.44$; $M_{\text{perfumed}} = 4.92$; $p = .086$). Mood also had a significant effect on attitudes toward car sharing ($t = -2.2179$; $p = .030$). Note that the direct effect of the presence of ambient scent on attitude toward car sharing is not significant when the indirect effect is included in the model, indicating that the mediation is complete and that there is no other mediating variable that explains the effect of ambient scent in this model ($t= 1.7065$; $p= .092$). Thus, H4 is corroborated.

3.5 Study 2: Shared spaces in railway stations

Method

Design and procedure. This field experiment was conducted in real-world conditions in a Parisian rail station, in partnership with a national rail company that authorized us to install hidden fragrance dispensers in the station concourse and interview travelers therein⁹. First, 61 participants were required to respond to a questionnaire administered by three interviewers equipped with a pad in the non-perfumed concourse (control condition). The next week, 61 other respondents performed the same task during the perfumed concourse (treatment condition). Respondents had to rate their attitude toward sharing the railway station concourse, the cleanliness of the space, their mood, and their perception of others' behaviors. A total of 122 commuters were interviewed, each with one condition only, of which 57% were men. Respondents were between 16 and 94 years old (mean age=43 years; S.D. =

⁹ We ran this experiment with a French scent-marketing company, Sensorys. The company fixed six perfume dispensers in separate places of the concourse. They remained invisible for train station users.

16.55). They were not informed about the real topic of the study and were led to assume that they were participating in an inquiry about their use of the station and their preferences.

Results

Manipulation check. Approximately 70% of the respondents noticed the presence of perfumes in the station concourse. There is a small majority of respondents judging the scent pleasant and appropriate. For the scent liking measure, 38% of the respondents gave a score above 4 out of 7, and 37% a score below. For the appropriateness dimension, 40% of respondents gave a score higher than 4 out of 7 and 38% scored it lower. When evaluating the scent 25% of respondents gave a neutral score of 4 out of 7 for the scent liking and 22% for the appropriateness (Nadler et al., 2015). On the total sample, average scores are 3.83 out of 7 for scent liking and 3.97 out of 7 for scent appropriateness.

Attitude toward sharing station concourses with other users. The analysis (ANOVA) indicated that the respondents who experienced perfume in the station had a more positive attitude toward sharing the space than those who did not ($M_{\text{neutral}}=4.52$; $M_{\text{perfumed}}=5.07$; $F(1,118)=4.214$, $p=.042$, $\eta^2=.034$). The difference between the two conditions is significant, again corroborating H1.

Cleanliness of the station concourse. A mediation analysis (Preacher and Hayes, model 4) was performed by considering the attitude toward sharing with other users as a dependent variable, the presence (or absence) of the ambient scent as an independent variable, and the cleanliness of the concourse as a mediating variable. The presence of ambient scent was found to have no direct effect on the evaluation of cleanliness ($t=-0.8041$; $p=.423$). Thus, the presence of an ambient scent in the concourse does not give the impression that the concourse has just been washed and cleaner. Moreover, the evaluation of cleanliness does not impact the attitudes toward sharing the concourse ($t= 1.6207$; $p= .108$). The cleanliness evaluation does not mediate the link between the presence of the scent and attitude toward sharing the concourse (zero within the confidence interval [-0.1194; 0.0142]). Thus, H2 is not validated.

Perceptions of other users' behavior. A mediation analysis was conducted (Preacher and Hayes, model 4) with the perception of other users as a mediating variable. Other users' perceptions were found to have a direct effect on the attitude toward sharing the space ($t=$

2.4074; $p = .018$). Thus, station users are more inclined to share space with other users if they judge them positively. Nevertheless, the presence of an ambient scent (clean scent) in the station concourse does not have a significant effect on how other users are perceived ($t = 1.3362$; $p = .184$). This shows that the perception of other users' behavior is not a mediating variable, explaining the effect of the presence of the scent on the users' willingness to share the space (zero within the confidence interval $[-0.0088; 0.1271]$) and H3 is not validated.

Mood of station users. A mediation analysis was carried out (Preacher and Hayes, model 4) with the respondent's mood as a mediating variable. The presence of an ambient scent in the station significantly improves the mood of the station concourse user ($t = -2.008$; $p = .047$). A contrast analysis indicates that the difference is significant ($M_{\text{neutral}} = 2.139$; $M_{\text{perfumed}} = 2.539$; $p = .047$). Mood also has a significant effect on attitude toward sharing the station concourse ($t = -4.5614$; $p = .000$). An indirect effect analysis (zero not within the confidence interval $[0.2294; 0.0225]$) shows that the mediation of mood is significant, which again corroborates H4. Mediation is incomplete, as the direct effect of ambient scent on attitude toward sharing the space retains a significant direct effect ($t = 2.7297$; $p = .007$), suggesting that additional variables could be added to the model to complete the explanation.

3.5 Study 3: Shared spaces in university library

Method

Design and procedure. The library is composed of two similar spaces with large tables and chairs that students share to work. This experiment was conducted over two weeks, the library was unscented during the first week and scented with two electric scent diffusers during the second. The interviewers administered the study on a tablet and randomly addressed students present in the library. To avoid interviewing the same students multiple times, all respondents who had heard of the study or had already been approached by an interviewer were eliminated. Students were not informed that the study was about ambient scents. Twenty respondents were interviewed in a scented situation and 28 in an unscented situation¹⁰, of which 52.1% were men. The respondents were between 20 and 25 years old (mean age = 24.6 years, $SD = 7.246$).

Results

¹⁰ Due to the COVID-19 crisis, safe distancing regulations only allowed a few students at the same time in the library, thereby limiting the size of the sample of this study.

Manipulation check. The olfactory atmosphere of the scented room is judged significantly more pleasant than that of the unscented room ($M_{\text{neutral}}= 5.36$; $M_{\text{perfumed}}= 6.15$; $F[1,7.334]= 5.192$, $p= .027$, $\eta^2= .101$). The scent is also perceived as very appropriate for the place (average score of 5.32 out of 7).

Attitude toward sharing the library with other users. The analysis (ANOVA) indicates that the respondents who experienced perfume in the library have a more positive attitude toward sharing the space than those who did not ($M_{\text{neutral}}= 5.26$; $M_{\text{perfumed}}= 6.22$; $F[1,10.688]= 9.740$, $p= .003$, $\eta^2= .175$). The difference between the two conditions is significant, again corroborating H1.

Library cleanliness A regression analysis was performed using the attitude toward sharing with other users as the dependent variable, the presence (or absence) of the ambient scent as the independent variable, and the cleanliness of the library as the mediating variable. The presence of ambient scent was found to have no direct effect on the evaluation of cleanliness ($t= 1.121$; $p= .295$). Finally, the cleanliness evaluation did not mediate the link between the presence of the scent and attitude toward sharing the library (zero within the confidence interval [-0.1976; 0.0266])¹¹. Thus, H2 is not validated.

Perceptions of other users' behavior. A mediation analysis was conducted (Preacher and Hayes, model 4) with the perception of other users as a mediating variable. The perception of other users had a direct effect on their attitude toward sharing the space ($t= 2.8842$; $p= .0071$). Nevertheless, the presence of ambient scent in the library did not have a significant effect on the perception of other users ($t= -1.1714$; $p= .2475$). This shows that the perception of other users' behavior is not a mediating variable explaining the effect of the presence of the scent on the users' willingness to share the space (zero within the confidence interval [-0.2384; 0.0280]), and H3 is not validated¹².

¹¹ We also apply the same statistical analysis with the long version of the cleanliness scale (Barber and Scarcelli, 2010). The results are similar, as there is no direct effect of fragrance on the evaluation of cleanliness ($t= -1.3477$; $p= .1843$) and no mediating effect of perceived cleanliness [-0.2417; 0.0112]). The Barber and Scarcelli (2010) strongly correlates with the short cleanliness scale that we used (.934**).

¹² The results are the same with the full Churchill et al. (1974) scale, as there is no direct effect of fragrance on the perception of other users ($t= -0.9648$; $p= .3397$) and no mediating effect of perceived cleanliness [-0.2270; 0.0542]). The Churchill et al. (1974) scale strongly correlates with the short perception of users' scale that we used (.925**).

Mood of library users. A mediation analysis was carried out (Preacher and Hayes, model 4) with the respondent's mood as a mediating variable. The presence of the ambient scent in the library significantly improved the mood of library users ($t = -2.1606$; $p = .0361$). Contrast analysis indicated that the difference was significant ($M_{\text{neutral}} = 4.7531$; $M_{\text{perfumed}} = 5.4116$; $p = .047$). Mood also had a significant effect on attitudes toward sharing the library ($t = -2.5240$; $p = .0153$). An indirect effect analysis (zero not within the confidence interval $[-0.3438; -0.0006]$) shows that the mediation of mood is significant, which again corroborates H4. Mediation is incomplete, as the direct effect of ambient scent on attitude toward sharing the space retains a significant direct effect ($t = -2.5240$; $p = .0153$)¹³, suggesting that additional variables could be added to the model to complete the explanation.

4. Conclusion

The four empirical studies in real-world environments confirm, in four different contexts (car sharing, station concourse, library, and open-plan workspace), the positive effects of the presence of a pleasant fragrance on space sharing. The presence (versus absence) of ambient scent increases the positive attitude toward sharing space with other users of the library because it improves the user's mood. The results show the mechanism underlying this effect, suggesting that the emotional approach should be favored over the more cognitive approach, according to which the presence of a pleasant fragrance would lead one to think that the place is cleaner or that its users behave in a more virtuous manner.

Contributions

Theoretical contributions. By showing the positive effects of ambient scents in open spaces, train stations, and shared cars, this study adds to the service marketing literature that emphasizes the role of emotional responses (Petruzzellis et al., 2021) in hedonic service settings, such as tourism, leisure, entertainment, and luxury (e.g., Chan et al., 2015), and utilitarian service settings, such as clinics (Ladhari et al., 2017). In particular, this research complements Professor Chebat's extensive research on the role of ambient factors (e.g., Chebat et al., 2003; 2005) by demonstrating that ambient scents promote positive attitudes

¹³ The results are the same with the full Peterson and Sauber (1983) scale, as there is direct effect of fragrance on users' mood ($t = -2.4622$; $p = .0177$) and a mediating effect of users' mood on willingness to share the space $[-0.2897; 0.0053]$. The Peterson and Sauber (1983) scale strongly correlates with the short users' mood scale that we used (.978**).

towards sharing through their ability to generate strong positive emotions. Supporting the theory of positive affect and corroborating the work of Leenders, Smidts, and El Haji (2019), this research highlights the importance of affective mechanisms in olfaction and underlines the need to consider the mood of users when fostering the sharing of collective spaces. To our knowledge, no study has demonstrated the impact of scents on willingness to share the same service space with strangers. However, certain social psychology studies have linked olfaction to altruism (e.g., Baron, 1997; Liljenquist et al., 2010). Some marketing studies have also shown that physical contact with strangers in shopping malls is more acceptable when the mall is pleasantly scented (Martin, 2012; Zemke and Shoemaker, 2008). However, the impact of ambient scents on the sharing economy has not yet been investigated.

Although it would have been intuitive to think that the addition of an ambient scent would have given the impression that the place had just been cleaned, thereby enabling a more positive attitude toward the shared space, the results show that the effects of fragrances do not necessarily involve cognitive reasoning related to the impression of cleanliness of the place (De Lange et al., 2012; Liljenquist et al., 2010). The four studies provide additional insight into the triggering of a purely affective mechanism that pleasant scent triggers an affective state, which is more favorable to sharing and cooperation with others, without any rational analysis of the situation. An important contribution of this research is that it shows that affective mechanism better explains the impact of perfume on individuals' attitudes toward others through four different contexts of shared spaces. Furthermore, the literature does not favor one hypothesis over another. Certain authors argue that analytical thinking prevails over affective processes (Wilson and Brekke, 1994; Wilson et al., 2000), while others argue that it affects change attitudes and behaviors without mobilizing cognitive reasoning (Winkielman et al., 1997).

Managerial and societal contributions. This research demonstrates that, in the context of services, a pleasant scent will be beneficial for customers as far as it promotes the acceptance of others. Moreover, the positive impact of ambient scents on attitudes towards sharing spaces is similar in the experiments conducted before and during the COVID-19 pandemic, although it is expected that the fear of others would be higher during the pandemic and ambient scents may be able to support collaborative consumption in these difficult times. This result is potentially significant for service companies. In the context of social tension created by a health pandemic, and after months of social distancing, people may be less inclined to share the same physical space and tempted to withdraw by favoring individualistic (Belk, 1985) and

self-centered values (Burroughs and Rindfleisch, 2002). This study provides tools to develop “pro-social” attitudes and behaviors, such as mutual aid, generosity, and sharing, which ultimately increase happiness (Dunn et al., 2008).

Limitations and future research

This study is not without limitations. The first is inherent in real-world experiments. While this type of experimentation avoids the artificial nature of laboratory studies, it also obliges researchers to limit the number of items of the scales used, which results in a slightly lower statistical quality than scales with more items. However, these scales remain robust and their effects are significant.

Furthermore, the number of respondents per condition may have been low, especially for the last experiment in the university library. It may be interesting to replicate this study when there are no social distancing measures that restrict the number of respondents at the same place and time. Although this research showed significant effects of pleasant ambient scents in each experiment, the validity of these studies would be strengthened if the results were replicated with larger samples.

Another limitation is the different locations of the experiments. One study was conducted at a transit site, another was a transportation site, and two studies were evaluated at coworking sites. Thus, even though the diversity of shared spaces is well represented in this study (Viglia, 2020), monetary aspects were not addressed and were not measured; yet two of the four services studied required payments from respondents. As the free or paid nature of the shared space can undoubtedly have a strong impact on users’ demands regarding the place and trigger different affects and perceptions on the part of these users or clients, future studies could be conducted within such a framework. Similarly, the motivations of individuals were not checked, although they could have an impact on their perception of the place and initial mood. Future research should incorporate these variables (motivation or purpose) as control variables.

Finally, as the studies were all conducted in France, the results may differ in other countries and cultures. It would be useful to investigate what scents are associated with “clean” according to the culture and if the effects of perfume would be the same. It could also be interesting to replicate these studies among different demographics, as sensitivity to perfume

could be different according to age, sex, or external conditions, such as weather and temperature.

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Appendix 1: The measures used in the four studies

	Pilot study: open-plan shared workspace	Study 1: Car sharing	Study 2: Railway station concourse	Study 3: University library
Attitude toward sharing services <i>Based on (Holbrook and Batra 1987)</i>	<i>-I like open-plan shared workspace</i> <i>- Working in an open-plan shared workspace is nice</i> Spearman-Brown=.797	<i>-I am not sure I did the right thing choosing to share my car (R)</i> <i>-I am not sure if I am going to continue to share my car (R)</i> Spearman-Brown=.796	<i>-I do not care about others in this railway station (R)</i> <i>-The other travelers do not bother me in this railway station (R)</i> Spearman-Brown=.555	<i>-I like open-plan shared library workspace</i> <i>- Working in an open-plan shared library workspace is nice</i> Spearman-Brown=.915
User's mood <i>Based on the Peterson and Sauber (1983)</i>	<i>- I am in a good mood</i> <i>- I am not comfortable (R)</i> <i>- I am nervous (R)</i> $\alpha=.747$	<i>-I am in a good mood</i> <i>-I am not comfortable (R)</i> <i>-I am nervous (R)</i> $\alpha=.609$	<i>- I am in a good mood</i> <i>- I am comfortable</i> <i>- I am nervous (R)</i> $\alpha=.746$	<i>- I am in a good mood</i> <i>- I am comfortable</i> <i>- I am nervous (R)</i> $\alpha=.814$
Perception of other users' behaviors <i>Based on the dimension "fellow worker" of the Churchill et al. (1974) scale</i>		The other users are: <i>- Careful</i> <i>- Concerned about their personal belongings</i> <i>- Bad drivers (R)</i> $\alpha=.680$	The users of the station are: <i>- Pleasant</i> <i>- Polite</i> Spearman-Brown=.685	The users of in the library are: <i>- Pleasant</i> <i>- Polite</i> Spearman-Brown=.814
Perception of the cleanliness of the shared space <i>Based on Barber et Scarcelli (2010)</i>		<i>-The car is dirty or clean</i>	<i>-The lobby was recently washed</i> <i>-The floor of this concourse is clean</i> Spearman-Brown=.679	<i>- The library is dirty or clean</i> <i>- The library was recently cleaned</i> Spearman-Brown=.793

Cronbach's alpha (α) is an appropriate reliability coefficient for a multi-item scale. Spearman-Brown statistic is an appropriate estimate for a two-item scale (Eisinga et al., 2013).

Appendix 2: the results of the four studies

positive attitude toward space sharing	neutral condition	perfumed condition	F	p	η^2
car sharing*	2.58	3.28	5.236	.025	.070
railway station sharing*	4.52	5.07	4.214	.042	.034
open-plan shared workspace Library	4.34	4.66	15.5	.030	.063
	5.26	6.22	9.740	.003	.175

* scales with reverse items have been reversed as to exhibit positive attitude towards car sharing

Car sharing

mediators tested for perfume effect on attitude	neutral condition	perfumed condition	F	p	mediation test
perceived cleanliness	1.946	2.081	0.570	.453	[-0.0633; 0.3990]
perception of other users	2.703	2.865	0.564	.455	[-0.0345; 0.2729]
respondent's mood	4.441	4.919	3.034	.086	[0.0082; 0.4354]

Railway station hall

mediators tested for perfume effect on attitude	neutral condition	perfumed condition	F	p	mediation test
perceived cleanliness	5.41	5.23	0.892	.347	[-0.1194; 0.0142]
perception of other users	4.31	4.64	2.623	.108	[-0.0088; 0.1271]
respondent's mood	2.14	2.54	4.030	.047	[0.2294; 0.0225]

University library

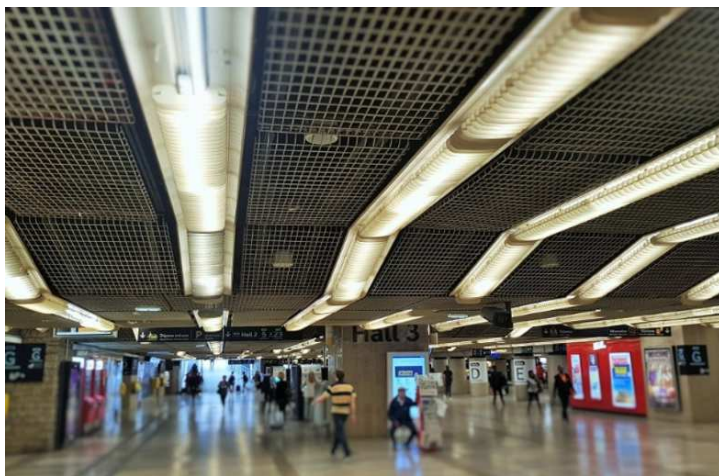
mediators tested for perfume effect on attitude	neutral condition	perfumed condition	F	p	mediation test
perceived cleanliness	6.46	6.65	1.121	.295	[-0.1976; 0.0266]
perception of other users	5.75	6.05	1.372	.247	[-0.2384; 0.0280]
respondent's mood	4.75	5.41	4.030	.047	[-0.3438; -0.0006]

Appendix 3: Cars used for the study 1 car-sharing experiment



Shared cars - Credits: Authors

Appendix 4: Railway station hall of the study 2



Paris Gare de Lyon Hall 2 - Credits: Authors

Appendix 5: University library of the study 3



Toulouse University Library - Credits: Authors