Journal of Environmental Psychology xxx (2018) 1–4

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

The impact of coffee-like scent on expectations and performance

Adriana Madzharov [a, *], Ning Ye [b], Maureen Morrin [b], Lauren Block [c]

[a] School of Business, Stevens Institute of Technology, 1 Castle Point on Hudson, Hoboken, NJ 07030, USA
[b] Fox School of Business, Temple University, 1801 Liacouras Walk, Philadelphia, PA 19122-6083, USA
[c] Baruch College, The City University of New York, One Bernard Baruch Way, New York, NY 10010, USA

ARTICLE INFO

Article history:
Received 22 August 2017
Received in revised form
14 April 2018
Accepted 21 April 2018
Available online xxx

Handling Editor: Florian Kaiser

Keywords:
Olfaction
Performance
Coffee-like scent
Placebo effects

ABSTRACT

The present research explores the effect of an ambient coffee-like scent (versus no scent) on expectations regarding performance on an analytical reasoning task as well as on actual performance. We show that people in a coffee-scented (versus unscented) environment perform better on an analytical reasoning task due to heightened performance expectations (Study 1). We further show that people expect that being in a coffee-scented environment will increase their performance because they expect it will increase their physiological arousal level (Study 2). Our results thus demonstrate that a coffee-like scent (which actually contains no caffeine) can elicit a placebo effect.

1. Introduction

Many people experience the scent of coffee on a daily basis: in the workplace, at coffee shops, and in retail and service environments. Coffee houses such as Starbucks are known as the "third place" where people spend hours of their day working, socializing, or relaxing while immersed in a coffee-scented atmosphere (Oldenburg, 1989, pp. 39; Walton, 2012, pp. 1). Beyond stand-alone coffee shops, numerous retailers have built coffee counters into many of their outlets (e.g., Uniqlo, Club Monaco; Cheng, 2014). Given the prevalence and popularity of coffee-scented environments in people's daily lives, it is important to understand how coffee scent might influence behavior. Can merely smelling a coffee-like scent without actually ingesting coffee have an effect on people's behavior?

The vast majority (80%) of the world's population consumes caffeinated products such as coffee or tea every day, making caffeine "the single most widely consumed psychoactive ingredient" (Einöther & Giesbrecht, 2013, pp. 251). Studies suggest that ingesting caffeine can enhance self-reported levels of alertness and feelings of "energy," and decrease perceived mental fatigue (Glade, 2010). In addition, caffeine has been shown to boost performance on tasks requiring sustained vigilance, and improve accuracy in solving reasoning problems and making correct decisions (Einöther & Giesbrecht, 2013; Glade, 2010; Smith, 2002).

We posit that because of these well-known effects of coffee and caffeine, people will associate not only the ingestion of coffee but merely the smell of coffee with the same types of effects. Prior research has shown that ambient scent can enhance people's ability to recognize and recall brand stimuli (Morrin & Ratneshwar, 2003) and promote approach behavior online (Vinitzky & Mazursky, 2011). The scent literature has also established that scents can bias perceptions and prime certain behaviors because of the semantic associations they evoke (Doucé, Poels, Janssens, & De Backer, 2013; Guéguen, 2012; Krishna, Elder, & Caldara, 2010; Madzharov, Block, & Morrin, 2015). In a similar way, we propose that coffee scent will be associated with the positive effects that caffeine is known to have on alertness and behavioral performance. Specifically, we propose that an ambient coffee-like scent will produce a placebo effect such that it will lead people to feel and behave in ways similar to drinking coffee. Thus, we extend knowledge on ambient scents by identifying for the first time *coffee-like scent* as an environmental stimulus that can influence behavior.

A placebo is "an inert substance or procedure that alters one's physiological or psychological response" (Geers, Kosbab, Helfer, Weiland, & Wellman, 2007, pp. 563). A placebo effect is "a

* Corresponding author.
E-mail addresses: adriana.madzharov@stevens.edu (A. Madzharov), ning.ye@temple.edu (N. Ye), maureen.morrin@temple.edu (M. Morrin), lauren.block@baruch.cuny.edu (L. Block).

https://doi.org/10.1016/j.jenvp.2018.04.001
0272-4944/

positive outcome resulting from the belief that a beneficial treatment has been received" (Beedie & Foad, 2009, pp. 314). Placebo effects, from both the actual and perceived ingestion of caffeine, have been demonstrated. In one study (Beedie, Stuart, Coleman, & Foad, 2006), competitive cyclists were told they would receive in random order a placebo, a low dose of caffeine, and a high dose of caffeine (when in fact all were placebos), and their cycling power would be measured after each treatment. The authors found a dose-response relationship such that cycling improved with increases in the perceived doses of caffeine (Beedie et al., 2006, pp. 2160).

Expectancy theory describes how individuals learn relationships among events via repeated exposure, over time (e.g., when A occurs, B occurs). Such learning allows individuals to predict outcomes in their environment (e.g., if A is observed to have occurred, B is expected to occur). Expectancy theory thus helps to explain placebo effects (Rescorla, 1988). Expectancy is the "experienced likelihood of an outcome or an expected effect" (Price, Finniss, & Benedetti, 2008, p. 571). What seems to be critical in placebo studies is not whether or not an individual is in the placebo or true treatment group, but whether or not the individual *expects* the treatment they receive will work (Price et al., 2008). Thus, it is largely the expectation or belief that the placebo will work that elicits the expected outcome. In the present research, expectancy is the extent to which a participant expects that smelling a coffee-like scent will enhance their performance on an analytical reasoning task.

We thus extend prior research by showing that merely smelling a coffee-like scent leads to a placebo effect. We propose:

H1. A coffee-like ambient scent (vs. no scent) will lead to improved performance on an analytical reasoning task. This effect will be mediated by higher performance expectations.

2. Study 1

2.1. Method

2.1.1. Design and subjects

One hundred and fourteen (87% aged 18-21, 41% female) undergraduate business students participated for course credit in a study that was run, in groups of about 30, as a single factor (ambient scent: yes = coffee-like scent, no = unscented control) between-subjects design with random assignment to condition.

2.1.2. Procedure

The experiment was conducted in a computer laboratory where participants entered either a coffee-like-scented or unscented environment and filled out a computer survey. We used a commercial electric diffuser to emit the coffee-like scent into the room (Madzharov et al., 2015). The scent smelled like coffee but contained no actual caffeine or other stimulants. The scent diffuser (kept hidden from view) was run for five minutes before the beginning of each scented session, and then was used to emit the odor every 15 s during the experimental sessions.

After entering the scented (or unscented) room, participants were told that they would take part in an analytical reasoning task. While in the room, participants indicated their performance expectations ("How confident are you that you will do well on the task?"; "How well do you expect to do on the task?"; "How certain do you feel you will score highly on the task?"; from 1 = not at all to 7 = very; $\alpha = 0.97$). Then they completed the analytical reasoning task, which consisted of ten multiple-choice algebraic math problems from the GMAT (Graduate Management Admission Test), which the subject population was expected to be familiar with, and which has previously been used to measure performance (Ilyuk & Block, 2015). Performance was measured by the number of correct responses (out of ten possible).

To minimize demand effects, participants were asked questions about the ambient scent only after responding to the other measures. They were asked whether they noticed any scent when they first came into the room (yes, no) and whether they noticed any scent right now (yes, no). The majority of participants in the coffee-like scent condition reported they remembered noticing a smell when they first came in (63%), and noticed a scent at the end of the survey (70.4%). Finally, participants answered demographic questions and a hypothesis probe.

2.2. Results

An ANOVA on expectations with ambient scent as a between-subjects factor was significant ($F(1, 112) = 9.56$, $p < .01$, $\eta^2 = 0.079$). Participants in the coffee-like scent condition expected to perform better than those in the unscented control ($M_{\text{CoffeeLikeScent}} = 4.94$, SD = 1.45 vs. $M_{\text{NoScent}} = 4.18$, SD = 1.73).

An ANOVA on performance with ambient scent as a between-subjects factor was significant ($F(1, 112) = 11.83$, $p < .01$, $\eta^2 = 0.096$). Participants in the coffee-like scent condition scored higher than those in the unscented control ($M_{\text{CoffeeLikeScent}} = 5.44$, SD = 1.95 vs. $M_{\text{NoScent}} = 4.22$, SD = 1.86).

Using standardized variables, we performed a mediation test using a bias-corrected bootstrap procedure (Hayes' Model 4, Hayes & Preacher, 2013), with scent as the independent factor (unscented control = 0, coffee-like scent = 1), expectations as the mediator, and the number of correct responses on the GMAT task as the dependent variable. The results showed a significant indirect effect of scent on performance via expectations ($\beta_{\text{IndirectEffect}} = 0.13$, 95% CI [0.03, 0.29]), but the results indicated only partial mediation. The analysis revealed that scent condition predicted expectations about performance ($\beta_{\text{ScentToExpectations}} = .56$, $p < .01$) and that expectations predicted actual performance ($\beta_{\text{ExpectationsToPerformance}} = .24$, $p < .01$; see Fig. 1).

We conducted a follow-up study to better understand the underlying process. We wanted to see whether people expect that a coffee scent would improve performance because they believe it would lead to higher levels of physiological arousal (an effect traditionally associated with the ingestion of caffeine). In Study 2, we ask people what the effect would be of being in an environment with a regular coffee scent (or a decaffeinated coffee scent, a floral scent, or no scent at all). In this study we also seek to understand whether the imagined presence of *any* scent would have a similar effect on expectations regarding both performance and physiological arousal.

3. Study 2

3.1. Method

3.1.1. Design and subjects

Two hundred and eight participants from Amazon Mechanical Turk took part for a small payment ($\text{Age}_{\text{mean}} = 33$, SD = 9.70; 55% female) in a single-factor design (imagined scent condition: regular coffee, decaffeinated coffee, floral, no scent control), with random assignment.

3.1.2. Procedure

We asked participants to imagine they were about to perform on an analytic reasoning task in the presence of either: regular coffee scent, decaffeinated coffee scent, floral scent, or no scent. Participants were asked to indicate how alert and energetic they

Please cite this article in press as: Madzharov, A., et al., The impact of coffee-like scent on expectations and performance, *Journal of Environmental Psychology* (2018), https://doi.org/10.1016/j.jenvp.2018.04.001