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**An upbeat crowd: Fast in-store music attenuates the
negative effects of high social density on customers' spending**

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Abstract

Research suggests that in-store crowding can lower customers' spending, thus limiting overall benefits of high store frequentation. Here, we propose that this negative effect can be mitigated by adjusting store ambiance, specifically by using certain types of in-store music. To test this idea, we conducted a longitudinal field experiment in which we manipulated in-store music tempo and measured social density in six European retail stores. Analyzing over 40,000 individual shopping baskets, we found that social density had an inverted u-shape effect on customer spending. This effect was moderated by in-store music tempo, such that fast music strongly increased spending under high-density conditions. The increase in shopping basket value was driven by customers buying more items rather than buying items that were more expensive. Fast music thus alleviated negative effects of social density. We discuss the theoretical implications of these findings and describe how practitioners can use in-store music to counter negative effects of high customer density.

Keywords: in-store music; social density; crowding; retailing; field experiment

INTRODUCTION

The ambiance of retail stores has become an important success factor in recent years. A study conducted by retail store design agency Dalziel & Pow found that shoppers consider store ambiance to be more important than store location, staff friendliness, and customer service (The Agency, 2014). Practitioners' surging interest in the topic is reflected in an increasing number of academic studies that examine how various ambiance factors influence retail outcomes (e.g., Herrmann, Zidansek, Sprott, & Spangenberg, 2013; Kaltcheva & Weitz, 2006; Morin, Dubé, & Chebat, 2007; Roschk, Loureiro, & Breitsohl, in press; Spence, Puccinelli, Grewal, & Roggeveen, 2014).

One ambient factor that has received considerable research interest is social density—the number of shoppers per store area size (Andrews, Luo, Fang, & Ghose, 2015; Levav & Zhu, 2009; Xu, Shen, & Wyer, 2012). Social density often results in feelings of crowding—shoppers' subjective experience of limited personal space and control (Harrell, Hutt, & Anderson, 1980; Hui & Bateson, 1991; Machleit, Eroglu, & Mantel, 2000; Schmidt & Keating, 1979). The retail crowding phenomenon presents retailers with an interesting dilemma: On one hand, a busy store with many customers is desirable from a shop owner's perspective, as more customers typically lead to higher overall sales. On the other hand, high social density and resultant feelings of crowding are known to have negative psychological effects on customers in utilitarian settings like a supermarket (for a review, see Mehta, 2013). Consequently, retailers will be interested in ways to mitigate high social density's negative effects.

Besides being of practical relevance, this question is relevant from a theoretical perspective. While literature on social density and retail crowding has traditionally assumed negative effects of high social density on retail outcomes in utilitarian settings, literature on social contagion and herding (e.g., Freedman & Perlick, 1979) implies the opposite by emphasizing shoppers'

influence on each other. However, neither literature stream provides a comprehensive answer on (a) up to which point the effect of additional customers on sales is positive, and (b) how this turning point can be shifted upwards to allow for more customers in a store without producing negative crowding effects.

Consequently, and following repeated calls for research (Bitner, 1992; Machleit, Kellaris, & Eroglu, 1994; Mehta, 2013; Worchel & Brown, 1984), we investigate here whether negative effects of retail crowding on retail outcomes can be compensated by supplementary store ambiance factors. Specifically, we propose that the tempo of in-store music (i.e., the speed of a detectable pulse in music; Bruner, 1990) will moderate the impact of retail crowding on retail outcomes. Music tempo seems particularly relevant as a potential moderator because of its strong effects on consumers' emotions (Balch & Lewis, 1996; Chebat, Chebat, & Vaillant, 2001; Husain, Thompson, & Schellenberg, 2002; Kellaris & Kent, 1993) and behavior (Knöferle, Spangenberg, Herrmann, & Landwehr, 2012; Milliman, 1982), and because it can easily be varied in most types of music. Below, we develop our hypotheses regarding how in-store music tempo might moderate high social density's negative effects, and then test them in a large-scale field experiment.

CONCEPTUAL BACKGROUND

Effects of Social Density and Retail Crowding on Retail Outcomes

As mentioned, social density at the point of sale creates a dilemma for retailers. On one hand, maximizing the number of customers per store area size (i.e., increasing social density) is usually desirable for retailers because (1) having more customers typically leads to more sales and (2) because economic reasoning demands using the minimum store area. On the other hand,

the crowding literature has primarily reported negative psychological consequences of high social density in utilitarian (as opposed to hedonic) settings (for a recent review, see Mehta, 2013). A higher number of customers reduces the space and freedom of movement available for others in the store, making it more difficult for them to achieve their shopping goals. When customers' need for space exceeds the available space either because of the presence of other shoppers (social density), spatial limitations (spatial density), or personal factors, they may experience feelings of crowding (Stokols, 1972).

Perceived crowding has primarily been associated with negative outcomes such as stress (Stokols, 1978), negative feelings (Harrell et al., 1980), reduced feelings of control (Van Rompay, Galetzka, Pruyn, & Garcia, 2008), and reduced spending (Eroglu & Machleit, 1990; Machleit et al., 2000). In crowded stores, consumers adjust their behavior by buying less so they can use express checkout lanes, and they postpone purchases, stick to shopping lists, and reduce exploration behavior (Eroglu & Harrell, 1986; Harrell et al., 1980). In addition, crowded environments have been shown to induce an avoidance motivation in consumers and make them more risk averse (Eroglu & Machleit, 1990; Machleit et al., 1994; Maeng, Tanner, & Soman, 2013). Finally, recent research has shown that consumers use social density cues to make inferences about the price level of stores' merchandise. Because crowded stores signal lower social class of their customers, in-store crowding decreases consumers' valuations of stores' products and, consequently, their willingness to pay (O'Guinn, Tanner, & Maeng, 2015). Given these negative psychological effects, high social density should reduce customers' spending.

While the crowding literature thus converges on the view that the link between social density and retail outcomes in utilitarian settings is linear and negative, some authors have proposed that it may be more complex and non-linear (e.g., Uhrich & Luck, 2012). For instance, *low* social density may have negative effects if shoppers interpret it as a symbolic cue (Pan & Siemens,

2011). Specifically, low social density may be perceived as a cue for poor product quality, high prices, or a negative image, which in turn should reduce consumers' patronage and purchase motivations. Alternatively, increased social density may trigger purchase behavior through a social contagion mechanism (Freedman & Perlick, 1979). Such a mechanism would imply that observing how other shoppers select and buy products stimulates the observer's buying behavior. In denser environments, purchasing behavior is witnessed more often, making contagion and imitation more likely. Because of such positive effects, high social density should increase customers' spending.

To reconcile these negative and potentially positive effects of high density, research has proposed and demonstrated that intermediate (rather than low or high) levels of crowding have the most positive effect on consumers' self-reported store attitudes and shopping intentions (Mehta, Sharma, & Swami, 2013; Pan & Siemens, 2011). For instance, Pan and Siemens (2011) showed that in a goods setting, the effect of crowding on store attitudes, patronage, and purchase intentions follows an inverted u-shape pattern. Specifically, they found consumers' store attitudes and shopping intentions were enhanced at intermediate levels of crowding, but diminished at lower and higher levels of crowding. While a non-linear effect of crowding was thus confirmed for self-reported measures, it is unclear whether a similar effect would obtain for objectively measured sales outcomes.

In sum, to the extent that positive and negative effects of social density are multiplicative (Haans, Pieters, & He, 2015), and that findings of Pan and Siemens (2011) and Mehta et al. (2013) translate from self-report measures to objective sales measures, we predict that social density's effect on spending follows a non-linear, inverted u-shape pattern.

Alleviating Negative Effects of High Social Density Through In-Store Music

How can retailers counter negative effects of high social density on spending? We propose that in-store music may be particularly suitable to alleviate aversive effects of high social density. Music is a well-researched point of sale ambiance factor. It has been shown to influence consumers' store evaluations, store satisfaction, time perception, time spent in the store, product choice, and spending (Garlin & Owen, 2006; Hagtvedt & Brasel, 2016; Kellaris, 2008; Knöferle et al., 2012; Milliman, 1982; North, Hargreaves, & McKendrick, 1997; North, Sheridan, & Areni, 2016; Spangenberg, Grohmann, & Sprott, 2005; Turley & Milliman, 2000).

Tempo is one of the most salient and impactful parameters of in-store music, because tempo is a musical property applicable to most musical genres and cultures (Brown & Jordania, 2013; Stevens & Byron, 2016), and because different tempi can strongly affect humans psychologically and physiologically (Egermann, Fernando, Chuen, & McAdams, 2015; Husain et al., 2002; Kellaris & Kent, 1993). In particular, tempo can modulate listeners' physiological arousal, with higher tempi increasing arousal, and lower tempi decreasing arousal (Balch & Lewis, 1996; Chebat et al., 2001; Mattila & Wirtz, 2001). Further, tempo influences the rhythm of various bodily processes, such as movement (Van Dyck et al., 2015), heartbeats and respiration (Bernardi, Porta, & Sleight, 2006), and brain waves (Doelling & Poeppel, 2015). Consistent with these findings, slow and relaxing music has been shown to decrease consumers' pace and to increase the time they spend in shopping environments, thereby enhancing the likelihood of unplanned purchases. Consequently, slow or low-arousal music increases sales in supermarkets (Milliman, 1982), restaurants (Milliman, 1986), and department stores (Knöferle et al., 2012).

How will the tempo of in-store music moderate the effects of social density in retail stores? Two scenarios seem possible: On one hand, *slow* music might positively affect spending in high-density conditions. High social density's negative effects on retail outcomes are primarily caused

by negative arousal and stress that accompany feelings of crowding. Slow music has been shown to reduce arousal in listeners, and may therefore help reduce the negative arousal induced by crowding (Bernardi et al., 2006). However, such soothing effects of slow music may be offset by its decelerating influence on shoppers' walking pace (Milliman, 1982). Shoppers who move slower will likely spend more time in the store, which in turn may increase social density and feelings of crowding. Therefore, slow music might fail to alleviate negative effects of high social density.

On the other hand, particularly since slow music's beneficial role seems unclear, *fast* music might be more effective in high-density conditions. This result could obtain because of an arousal misattribution process that is predicted by the *attribution model of crowding* (Patterson, 1976; Worchel & Brown, 1984; Worchel & Teddie, 1976; Worchel & Yohai, 1979). Building on two-factor models of emotion, the attribution model of crowding holds that the subjective experience of crowding requires two steps: (1) individuals become aroused when their personal space is violated, and (2) they attribute their arousal to others in their environment (Patterson, 1976; Worchel & Teddie, 1976). As the attribution stage is a necessary precondition, the feeling of crowding can be alleviated by modifying the attribution process, particularly by preventing individuals from attributing their arousal to others (Worchel & Brown, 1984; Worchel & Teddie, 1976; Worchel & Yohai, 1979).

In support of this attribution account, Worchel and Brown (1984) demonstrated that experiment participants misattribute arousal that in fact resulted from limited personal space to arousing (but not to non-arousing) movies. While the perceived intensity of arousing movies (comedy, horror, sexual) was amplified by the misattributed arousal, participants' feeling of crowding was reduced through the misattribution process. Worchel and Yohai (1979) provided further evidence for this mechanism by showing that individuals misattribute arousal induced by

violations of personal space to a supposedly (but not actually) present arousing noise. Groups of participants were seated in a room in which their personal space was either violated or not violated. Some were told that either an arousing or a relaxing subliminal noise would be played during the experiment (in reality there was no noise), while others were told nothing about subliminal noise. Participants then worked on several tasks and reported how crowded they felt. When their personal space was violated, participants who expected an arousing noise performed better and reported feeling less crowded than did participants in the “relaxing” and “no noise” conditions. These results suggest that participants attributed their crowding-induced arousal to the supposedly arousing noise, and that this misattribution of arousal reduced their feeling of crowding and any resulting negative effects.

We propose that fast music may alleviate negative effects of high social density at the point of sale through a similar arousal misattribution mechanism. Shoppers experiencing negative arousal because of violations of personal space may attribute at least some such arousal to alternative, plausible causes in the environment, resulting in a reinterpretation of the original arousal state and thus reducing perceived crowding. Because fast in-store music is a plausible cause for arousal, it may “capture” crowding-induced arousal, and hence reduce perceived crowding and its negative downstream effects on spending. Non-arousing music would not lead to such beneficial effects because it cannot plausibly cause arousal, and thus does not afford a misattribution of arousal.

In sum, we propose a three-way interaction between music tempo and social density squared at the point of sale. Specifically, we propose that in-store music moderates the inverted u-shape effect of social density such that fast music attenuates the negative effect of high social density on spending.

FIELD EXPERIMENT

Data and Measures

Data. A longitudinal field experiment was designed to test the predicted interaction between manipulated music tempo and measured social density. As part of an unrelated research question (that goes beyond the scope of this study), in-store radio advertising was also manipulated, resulting in a 3 (music: fast, slow, none) \times 2 (advertising: present, absent) design, and thus a total of six experimental conditions.

Six branches of a large Northern European grocery chain (convenience stores; 460 branches in total, average store size ca. 100 m²) located in a North-European capital participated in the field experiment. Stores varied in area size and customer sociodemographics, but were homogenous regarding offered products and store layout. The experiment was conducted during six weeks in May and June 2014. Because of management-imposed restrictions, music was played on six days per week (Tuesday–Sunday), for four hours per day (3 pm–7 pm). Music conditions in stores were varied daily to ensure there was no change of music during a specific shopper’s store visit. Special care was taken to counterbalance experimental conditions across stores, weeks, and days of the week, and a blocking design was used (Morrison, Gan, Dubelaar, & Oppewal, 2011). For instance, in week 1, store 1 started with condition 1 on day 1, and then cycled through all conditions, while store 2 started with condition 2 on day 1, and then cycled through all conditions. In week 2, store 1 started with condition 2 on day 1, while store 2 started with condition 3, etc. (see Appendix). This counterbalancing method minimized any time- or store-related confounds, because no store ran the same condition simultaneously, and the six music conditions were evenly distributed across different stores, weeks, and days of the week.

Dependent variables. The main dependent variable was individual customer spending. To measure this, throughout the experiment, checkout transactions were recorded electronically on a per-customer basis. Specifically, each customer's total shopping basket value (SBV) (in the country's currency) and number of purchased products were recorded. Transactions involving in-store activities unrelated to grocery shopping (e.g., money withdrawals, postal services, and bottle deposit refunds) were removed from the data set to the extent they were identifiable. The final data set had 43,676 observations. On average, customers spent the equivalent of US\$20.50 ($SD = 19.59$). Because of the non-normal distribution of sales data, a logarithmic transformation was applied to the SBV variable (Fox, 2008). To obtain additional insights into consumers' shopping basket composition, the number of products per shopping basket ($M = 4.53$, $SD = 4.09$) and the average price of each item per shopping basket ($M = 5.07$ USD, $SD = 3.91$) were used as additional dependent variables.

Independent variables. The two crucial independent variables are social density and in-store music tempo. Social density was measured as the number of transactions within an hour, divided by store size in m^2 (Levav & Zhu, 2009). This metric captures the two central factors that determine social density in a store—number of shoppers and available physical space (Mehta, 2013). Important to note is that this density measure captures social density while controlling for spatial density (store size as a denominator). On average, 69.3 customers per hour frequented the stores ($SD = 39.2$). The average store size, including shelf space, was $106 m^2$ ($SD = 13.56$). To test our assumption on the curvilinear, inverted u-shape effect of social density, we followed common practice, mean-centered the original social density variable, and built a squared term. This variable is used in a further interaction term to test our assumption about how in-store music moderates social density's inverted u-shape effect on consumer spending.

To not disrupt business in participating stores, familiar and current popular music targeting a young urban audience was used. Music tempo was manipulated by playing playlists containing music with varying tempo (Knöferle et al., 2012; Milliman, 1982). Playlists were created as follows: An initial music corpus of 184 songs was created by logging all music played on the largest national commercial radio station during a two-week period. Each logged title's tempo was measured (in beats per minute, BPM) using professional sound-studio software (Avid ProTools). Using tempo measurements, two playlists differing in tempo (fast vs. slow) were created from the initial playlist: Songs with a tempo of 107 BPM or more (87) were categorized as fast. Songs with 82 BPM or less (41) were categorized as slow (these thresholds lie inbetween values used in earlier research; cf. 135 vs. 95 BPM in Knöferle et al., 2012; 93 vs. 73 BPM in Milliman, 1982). Songs that fell inbetween these tempo thresholds were discarded.

For the non-focal advertisement manipulation, four ads lasting 15 s each for four products available in the stores were produced by an advertisement agency using professional copywriters, actors, sound designers, directors, and producers (downloadable at www.soundcloud.com/crossmodal/sets/instoreads). The four ads were arranged in randomized order in 60 s blocks framed by two harp sounds. Advertising blocks were inserted into the music stream after every two songs (i.e., every 7.5 minutes on average), resulting in approximately seven commercial breaks per hour. In no-advertisement conditions with music, tempo-congruent music was played during advertisement blocks.

Standardized audio equipment (a Proson RV 2050-B amplifier and 4-6 Zachry SPX-3V speakers, depending on store size, connected with Bostrom 0.75 mm cables) was installed in each of the six stores to minimize sound quality differences. As ambient noise levels varied across the six stores because of different cooling machines and other store equipment, an audio expert

visited each store and decided on an optimal volume level for each store (guidelines: songs should be recognizable, but not disrupt shopping activities).

Control variables. While our counterbalanced assignment of experimental conditions to the different stores and days minimizes the influence of confounding variables, dummy-coded covariates for week, day of the week (Tue.–Sun.), and hour of the day (3 pm–7 pm) were included. As weather has been shown to affect in-store spending (Murray, Di Muro, Finn, & Popkowski Leszczyc, 2010), meteorological data for the experiment period (hourly outside temperature, hourly rainfall; Knöferle et al., 2012; Murray et al., 2010) were acquired from the national weather report database and included as additional covariates ($M_{\text{Temp}} = 20.3^{\circ}\text{C}$, $SD_{\text{Temp}} = 4.61$; $M_{\text{Rain}} = 0.51$ mm, $SD_{\text{Rain}} = 3.80$).

Estimation approach. Because of the nature of our dependent variable, we first ran an ordinary least squares regression that predicted the effects of the experimentally manipulated and focal independent variables on SBV. Specifically, the model predicted SBV from ad, music (slow, fast, no music), social density (centered), social density (centered) squared, and the interaction terms for music and density (centered) as well as music and density (centered) squared (Model 1). Next, our main model included all terms contained in Model 1 and control variables for the effects of week, day of the week, hour of the day, store, outside temperature, and rainfall (Model 2). Finally, two additional models tested whether any interaction effect of music tempo and social density on SBV might be due to a change in the number of products per shopping basket (Model 3), or to a change in the average price of an item per shopping basket (Model 4). These models were identical to Model 2, but used different dependent variables (number of products per shopping basket and average item price, respectively).

Results

Model 1 revealed a significant positive effect of advertisement and, consistent with our prediction, a significant interaction effect of fast music and density squared (Table 1). Model 2 revealed significant positive effects of advertisement and density, a significant negative effect of density squared, and a significant interaction of fast music and density squared. Results confirmed the predicted inverted u-shape pattern of social density on SBV. Fast in-store music had, on average, a positive effect on SBV. Importantly, we found evidence for the predicted moderating role of music on the effect of social density on SBV: When social density was low to medium, in-store music tempo did not significantly affect SBV. However, when social density was high, fast in-store music positively affected SBV (Figure 1). At a centered social density value of 0.5, the average SBV was roughly 8% greater in the fast-music condition than in the no-music condition. This centered value corresponds to a value of 1.13 on the non-centered social density measure (i.e., proportion of number of transactions within an hour, divided by store size in m^2).

An incremental F -test revealed that Model 2 explained significantly more variance than Model 1 ($p < .001$). While Model 1 accounted for 1% of the total variance in SBV, Model 2 accounted for approximately 2% (i.e., adding time, weather, and store variables roughly doubled the amount of explained variance). While these R^2 s may seem low, one should bear in mind that real-life data, such as customers' SBV, are inherently noisy. The amount of money individuals spend in stores is determined by a vast number of factors, of which many are probably more impactful than social density and in-store music (e.g., shopping goals, available money and time). Nevertheless, our results demonstrate a robust effect of music and social density on shopping basket size, evidenced by the significant parameter estimates.

Table 1: Results of regression models

Dependent variable	Model 1 (no control variables)		Model 2 (all variables)		Model 3		Model 4	
	Basket value		Basket value		Number of items		Average item price	
Predictor	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
INTERCEPT	4.44***	0.011	4.32***	0.041	4.52***	0.178	28.66	1.024
ADVERTISEMENT	0.03**	0.009	0.02*	0.009	-0.10**	0.039	-0.06	0.223
MUSIC FAST	-0.02	0.014	-0.02	0.015	-0.16*	0.063	0.27	0.362
MUSIC SLOW	-0.02	0.015	-0.03	0.016	-0.09	0.067	-0.16	0.385
DENSITY	0.34	0.030	0.38***	0.038	1.76***	0.166	-1.89	0.955
DENSITY^2	-0.43	0.064	-0.55***	0.071	-2.27***	0.305	-1.72	1.753
OUTSIDE TEMPERATURE			0.00**	0.002	-0.02**	0.007	-0.02	0.039
RAINFALL			0.00	0.002	0.00	0.006	0.00	0.037
MUSIC FAST × DENSITY^2	0.44***	0.088	0.40***	0.091	2.30***	0.394	1.09	2.271
MUSIC SLOW × DENSITY^2	0.04	0.108	0.15	0.109	0.46	0.471	2.26	2.714
MUSIC FAST × DENSITY	-0.02	0.042	-0.01	0.042	0.01	0.181	-1.96	1.041
MUSIC SLOW × DENSITY	-0.06	0.042	-0.06	0.043	-0.22	0.184	-1.44	1.059
<i>R</i> ²	0.010		0.021		0.027		0.01	
<i>df</i>	43666		43646		43646		43646	

Note: Models 2, 3, 4 include dummies for week (5), day of the week (5), hour of the day (3), and store (5). Asterisks indicate the significance of coefficients on different alpha levels (*** $p < .001$; ** $p < .01$; * $p < .05$).

[Insert Figure 1 about here.]

To gain further insight into the underlying process, we conducted two additional OLS regressions. Both models were identical to Model 2 in the included independent variables, but included different dependent variables: number of products per shopping basket (Model 3), and average item price per shopping basket (Model 4). First, we tested the predictors' effects on the number of products per shopping basket (Model 3). The model revealed significant negative effects of advertisement, fast music, temperature, and density squared, and a significant positive effect of density. Results confirmed an inverted-u shaped pattern for customer density. Importantly, as in Models 1 and 2, the interaction of fast music and density squared was also

significant. When social density was low to medium, in-store music tempo did not significantly affect the number of products. However, when social density was high, fast in-store music had a strong positive effect on the number of products. Overall, the pattern of results for the number of products per shopping basket closely resembled the pattern observed for SBV. Second, we tested the predictors' effects on the average item price per shopping basket (Model 4). The model revealed no significant effects for any focal predictors. Results of the two additional analyses thus suggest that the effect of customer density and music on SBV is due to customers buying more products rather than buying products that are more expensive.

DISCUSSION

Our study examined how in-store music modulates the effects of social density in retail settings. We hypothesized that arousing (fast-tempo) music may mitigate negative effects of high social density. Controlling for time and store variables (both experimentally and statistically), we found: (1) social density had an inverted u-shape effect on spending, as medium levels of social density increased SBV, while low and high levels of social density lowered it; (2) our results confirmed the hypothesized moderating influence of music tempo on the effect of social density on spending. When social density was low to medium, in-store music tempo did not influence the effect of social density on SBV. However, when density was high, fast in-store music had a strong positive effect on SBV, relative to slow or no music. Thus, (3) fast music can mitigate negative effect of high density on customers' spending. Additional analyses suggested that (4) the beneficial effect of fast music on per-customer spending may be due to customers buying more products rather than buying products that are more expensive.

Our study has implications for several streams of research. By examining joint effects of in-store music and social density on objective sales data, our study connects two previously separate literatures (i.e., crowding and in-store music). Following previous calls for research into interactions between various store ambiance factors (Bitner, 1992; Mehta, 2013; Worchel & Brown, 1984), our study examined the combined effects of social density and music tempo at the point of sale. Interaction effects were observed for specific combinations of social density and music cues. Specifically, our study demonstrated that negative effects of high density can be mitigated by fast, arousing background music.

Further, our results advance the literature on in-store crowding by investigating social density's effects on objective retailing outcomes. As far as we know, no study has examined effects of customer density or crowding on objective sales data (rather than on self-report data). Specifically, most studies in this area highlight direct consequences of in-store crowding on consumers, such as their patronage intention, satisfaction, or store perception, but lack insights into direct consequences for the retail stores themselves. Although consumer-related factors are rightfully believed to positively correlate with sales performance, the extent to which they translate into actual sales is uncertain. While studies have mainly documented crowding's negative effects on consumers' self-reports (Eroglu & Machleit, 1990; Hui & Bateson, 1991), and limited evidence exists for positive effects, our results confirm an inverted u-shape effect of customer density on actual, per-customer sales. This finding directly extends recent studies that proposed and demonstrated inverted u-shape effects of crowding on self-reported retail outcomes (Mehta et al., 2013; Pan & Siemens, 2011).

We also contribute to the literature on in-store music by describing, for the first time, conditions under which fast music is more effective than slow music (cf. Knöferle et al., 2012; Milliman, 1982, 1986). Specifically, our results conflict with results from earlier research into the

effect of musical tempo on in-store sales. Previous studies have demonstrated that slow music leads to higher spending than fast music in supermarkets and department stores (Knöferle et al., 2012; Milliman, 1982), supposedly because slow music reduces the speed with which customers move through stores, thereby facilitating impulse purchases. The diverging effect observed here may be due to differences in the retail setting: Whereas previous studies tested the effect in larger supermarkets and department stores that invite browsing and exploration, the current research was conducted in smaller convenience stores. Customers in such stores typically do not stay long and have a goal-driven motivational orientation. Under these conditions, the relaxing, decelerating effect of slow music may be dysfunctional, especially in crowded conditions.

Theoretical Implications

While the field experiment reported here does not constitute a strong theory test (which would require a series of more controlled laboratory studies) and did not allow direct measurement of the process underlying our findings, the observed results warrant discussion from several theoretical perspectives. First, our findings seem to be at odds with conventional wisdom suggesting that slow music should be more effective in crowded stores. Given the finding that music tempo influences the rhythm of various bodily processes, such as movement (Van Dyck et al., 2015), heartbeats and respiration (Bernardi et al., 2006), and brain waves (Doelling & Poeppel, 2015), one could argue that slow music should, through its calming effects, reduce the negative arousal induced by crowding. However, no positive effect of slow music on sales was observed, suggesting that the presumably relaxing effects of slow music either do not increase sales, or are offset by additional, negative effects. Similarly, our findings contradict the intuitive idea that the negative arousal of high social density and fast music might accumulate and result in additive (or even superadditive) negative effects on spending (indeed, we observed the opposite).

Second, our findings warrant discussion in light of an arousal congruency account. This account posits that matching ambient cues in terms of their arousal value increases customers' perception of the overall shopping environment because of coherent ensemble effects (Bell, Holbrook, & Solomon, 1991). Accordingly, congruent levels of arousal in ambient music and smell are known to increase consumers' self-reported satisfaction and behavioral intentions (Das & Hagtvedt, 2016; Mattila & Wirtz, 2001). In our study, however, combining slow music and low social density did not yield positive congruency effects, which contradicts an arousal congruency explanation. Additionally, arousal congruency is not a likely driver of our results, because it usually occurs in contexts in which ambient factors (and the arousal they induce) have been purposefully designed by the retailer (which does not apply to social density).

Finally, our results do not support an overstimulation account. Fast music may have been more effective in combination with high social density because of the combined arousal induced by both fast music and high social density. High arousal impairs self-regulation and people's ability to think-through their actions (Baumeister, 2002; Baumeister, Bratslavsky, Muraven, & Tice, 1998), and thus may trigger impulse buying (Mattila & Wirtz, 2008). However, store-induced arousal has positive effects only on customers with recreational motivational orientations, but not those with task-oriented motivations (Kaltcheva & Weitz, 2006). Because the convenience stores in our study are utilitarian, task-oriented shopping environments, this account seems implausible.

Since our results seem inconsistent with the accounts discussed above, and keeping in mind the limited ability of our field-experimental approach to test theory, we propose an arousal misattribution mechanism as the most likely explanation for our findings. Shoppers who experienced negative arousal because of violations of personal space may have attributed at least some of this arousal to alternative, plausible causes in the environment, resulting in a

reinterpretation of the original arousal state and thus a reduction of perceived crowding. Because fast in-store music can plausibly cause arousal, it may have “captured” crowding-induced arousal, and hence reduced perceived crowding and its negative downstream effects on spending. Non-arousing music had no such beneficial effects because it was not a plausible cause of arousal, and thus did not afford a misattribution of arousal.

Limitations and Avenues for Future Research

The lack of clear process evidence in our study creates opportunities for future research. Researchers could replicate our field experiment and extend it by surveying a subset of customers to identify potential mediators of our results, such as arousal and perceived crowding. As field experiments are generally not well-suited to test theory, process evidence may also be obtained in laboratory store environments that allow studying the underlying mechanism(s) end-to-end, by manipulating both music and social density and capturing mediators and shopping outcomes under controlled conditions. Laboratory experiments may also use more tightly controlled operationalizations of tempo. Direct manipulations of tempo (while keeping musical content identical across conditions) are problematic in field experiments because shoppers may notice even slight tempo manipulations in familiar songs. Using less familiar songs is often prohibited because of management concerns, and creating custom music is infeasible because of the need for long playlists with many songs. Laboratory experiments are not subject to these issues and can thus use custom-made music with low versus high tempo (and all other musical parameters kept constant across conditions). Further, while we assume that objectively measurable, “hard” behavioral indicators such as spending will be of greatest interest to retailers, future research could examine whether interactive effects of music and social density are limited to short-term effects (e.g., spending), or whether they translate into longer-term effects such as customer

satisfaction, loyalty, and repeated store frequentation. A final and important avenue for future research is to test whether our findings generalize to different cultural and store contexts. Because our study used small convenience stores in a European capital, it is possible that our results do not generalize to all retail settings, such as large malls or rural stores. Also, cultural differences in shopping behavior per se, in social density perception, and in music preference could play an influential role for the obtained effect.

Managerial Implications

Our study provides clear implications for management practice, particularly for retail store managers. First, retail store owners should be aware of the inverted u-shape effect of customer density, and monitor it carefully. Our results suggest that retailers can, to a certain extent, harness the positive effect of moderate social density if they employ measures to carefully control perceived social density. Those measures could, for instance, include increasing or decreasing mutual visibility of shoppers in the store, to elevate or reduce perceived social density to the optimal level (i.e., the turning point of the inverted u).

Second, retail managers should be aware of the interplay between ambient music and customer density. As evidenced by our findings, music may be a useful tool for retailers to counter negative effects of high density. Compared to other strategies that have been shown to alleviate crowding effects, such as providing shoppers with a greater degree of choice (Hui & Bateson, 1991), or varying the store's interior design (Baum & Valins, 1977), adjusting a store's ambient music will be more efficient and easier to implement. In addition, music tempo is an attractive variable for marketers because it is easily manipulated, and because it is a musical property that applies to most musical genres and cultures (Brown & Jordania, 2013; Stevens & Byron, 2016).

Third, besides providing evidence for the interactive effect of music tempo and social density on spending, we provide managers with a provisional decision tool to determine when to play fast music in their stores. In our study, fast music was found to be superior to no or slow music at values of 1.13 and higher on the non-centered social density measure. Note that the social density measure represents the number of transactions within an hour divided by store size in m².

Knowing thus that $\frac{\text{number of transactions per hour}}{\text{store size}} = 1.13$ and given a specific store size, a retailer can solve the equation for the number of transactions per hour above which fast music will likely beneficially affect spending (compared to no or slow music). For instance, assuming a store size of 100 m², one would predict beneficial effects of fast music when 113 or more customers per hour frequent stores. Using this estimate, retailers may assign the right music tempo for stores at given times either (a) heuristically by using dedicated musical playlists for different times of day with known average visitor numbers, or (b) automatically by adjusting in-store music via electronic customer-counting systems. However, this decision tool should be regarded as provisional because it is derived from a single (albeit large-scale) field study, and thus requires further validation.

Finally, to maximize cost efficiency and save on royalties and electricity, our results suggest that stores (at least smaller convenience stores) should abstain from playing music during hours when customer attendance is low (i.e., in low-density conditions). Indeed, our results suggest that music does not significantly improve customer spending in such stores when customer crowding is low. Another suggestion arises from our finding that the increase in SBV was due to customers buying more products rather than products that were more expensive. Thus, fast music's beneficial effects should be more pronounced in store areas or aisles having products designed to evoke impulsive purchasing (e.g., FMCG).

To conclude, retailers trying to maximize store frequentation should bear in mind the complex effects of social density. A sales increase resulting from a higher number of customers might be lessened (or even negated) by the negative effects that high social density has on spending. However, such negative effects of social density can be alleviated and even reversed through the use of fast in-store music. The strategies discussed above can be implemented easily on an individual basis and can have positive effects for retail businesses.

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LIST OF FIGURE CAPTIONS

Figure 1: Fast in-store music increases customers' shopping basket value in conditions of high social density (compared to slow music and no music), controlling for time, store, and weather variables. The figure is based on Model 2. Colored areas are 95% confidence bands.

