The Effect of Social Crowding on Self-Improvement Product Preference

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Abstract

This study investigates how social crowding influences individuals' cognition and behavior through three experiments and systematic analysis of data from the China General Social Survey. The results reveal that social crowding can significantly enhance individuals' preference for self-improvement products, with self-improvement needs playing a mediating role. Furthermore, perceptions of social fairness and regional employment rates moderate this preference-enhancing effect of social crowding; specifically, when individuals perceive high social fairness or are in low-employment-rate regions, the facilitating effect of social crowding on preference for self-improvement products is strengthened; conversely, the main effect is weakened.

Full Text

The Effect of Social Crowding on Preference for Self-Improvement Products

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Abstract

This research examines how social crowding influences individual cognition and behavior through three experiments and systematic analysis of Chinese General Social Survey data. The findings reveal that social crowding significantly enhances individuals' preference for self-improvement products, with the need for self-improvement serving as a key mediator. Furthermore, perceived social equity and regional employment rates moderate this effect: when individuals perceive high social equity or live in low-employment areas, the positive effect of social crowding on self-improvement product preference is strengthened; conversely, the main effect is attenuated.

Keywords: social crowding; self-improvement products; perceived social equity; employment rate

1. Problem Introduction

As global population continues to grow, an increasing number of people are concentrated on our limited planet, making social crowding an increasingly severe problem. As the world' s most populous country, China faces particularly prominent social crowding issues. Dense crowds during morning and evening rush hours, throngs of tourists at holiday attractions, and packed consumers in shopping malls and supermarkets—all represent ubiquitous manifestations of social crowding in daily life.

The escalating phenomenon of social crowding has attracted considerable scholarly attention. Research in psychology on crowding effects has found that crowded environments significantly impact individuals' physiology, cognition, and behavior (Zhao, Wang, & Liu, 1989). Some scholars have explored how social crowding affects consumer behavior—for instance, crowded retail settings reduce product evaluations (O' Guinn, Tanner, & Maeng, 2015), decrease interactions with others in-store (Huang, Huang, & Wyer, 2018), shorten shopping duration, lower consumption satisfaction (Eroglu & Machleit, 1990), and increase unhealthy food intake (Hock & Bagchi, 2018). Evidently, existing literature on social crowding has predominantly focused on its negative consequences (Baker & Wakefield, 2012), with scarce research examining potential positive effects of social crowding on individual behavior. The literature on how people actively cope with social crowding remains notably underdeveloped.

Social crowding essentially triggers a sense of threatened personal territory (Worchel & Teddlie, 1976), motivating individuals to engage in various compensatory behaviors to mitigate its negative effects. Self-improvement represents a positive strategy for seeking self-development. Through self-improvement activities or purchasing self-improvement products, individuals can acquire greater personal capabilities, thereby entering better social strata and ultimately changing their crowded environmental conditions. Therefore, this paper investigates whether social crowding influences individuals' engagement in self-improvement behaviors—specifically, whether self-improvement products can serve as a coping mechanism for crowding. Through three experiments and secondary data analysis, this research addresses three questions: (1) Does exposure to crowded social environments increase individuals' preference for self-improvement products? (2) What is the psychological mechanism underlying this enhanced preference? (3) Are there boundary conditions that moderate the effect of social crowding on self-improvement product preference? This investigation not only enriches theoretical research in social crowding and self-improvement domains by revealing a positive behavioral outcome from a consumer choice perspective, but also provides practical guidance for government allocation of self-improvement resources

and corporate marketing management during crowded periods.

1.1 Social Crowding and Self-Improvement

Social crowding refers to the subjective psychological experience that occurs when the actual space provided by an environment becomes insufficient to meet individual needs due to a large number of people within a given unit area (Stokols, 1972). Individuals perceive crowding differently even in the same crowded environment. Worchel and Teddlie (1976) emphasize that beyond spatial constraints, crowding more essentially makes individuals feel their personal territory has been invaded—that is, being in a crowded environment poses a threat to the self.

In daily activities, individuals reserve certain spaces to maintain comfortable interpersonal distances. However, in crowded social environments, interpersonal distances are greatly reduced, generating feelings of private space and personal territory infringement, which diminishes individuals' sense of environmental control (Hock & Bagchi, 2018). Additionally, scholars O' Guinn et al. (2015) propose that people in crowded environments are perceived as belonging to lower social classes. From a social psychology perspective, higher-status individuals typically possess more territory and activity space, maintaining greater social distances in interactions to differentiate themselves from lower-status groups, whereas lower-status individuals seek closer social distances to gain collective advantages.

Consequently, social crowding represents a common external environmental threat to the self. Based on compensatory consumption theory (compensatory consumption; Jin, Zhao, Cui, Xu, & Li, 2017; Zheng & Peng, 2014; Rucker & Galinsky, 2008), when facing external environmental threats, individuals consume specific products to compensate for corresponding psychological disadvantages or cope with self-threats, thereby returning to a normal psychological state. To restore an ideal state and reduce perceptions of others invading their private space, people employ coping strategies that can be categorized as either active intervention or passive withdrawal (McCallum, Rusbult, Hong, Walden, & Schopler, 1979). Existing research has primarily approached crowding from the perspective of passive strategies—for example, seeing a crowded store leads individuals to avoid interacting with others and reduce their dwell time (Hwang, Yoon, & Bendle, 2012) and become more conservative (Maeng, Tanner, & Soman, 2013). Other studies have demonstrated that individuals may adopt active strategies to repair the negative effects of threats. Huang et al. (2018) showed that individuals in crowded environments use products as substitutes for people, strengthening connections with products to satisfy belongingness needs. While both strategies can alleviate the crisis brought by social crowding, passive strategies ultimately harm personal interests, and existing positive strategies cannot fundamentally solve the problem. We argue that the more essential solution to social crowding is to elevate social status to gain power over activity space and interpersonal distance. Based on this premise, engaging in self-improvement

activities can more fundamentally address the threats posed by social crowding.

Self-improvement refers to individuals' motivation to actively seek personal growth to achieve better development, including various self-related aspects such as enhancing temperament and image, improving skills and abilities, and bettering health status and wealth levels (Sedikides & Strube, 1997). Self-capability represents a relatively fundamental factor in individual growth; improvements in personal capability can drive development in image, wealth, and even social class. Therefore, this paper focuses more on self-capability improvement, particularly abilities relevant to academic and career development, making products that enhance certain capabilities self-improvement products, such as professional books and various learning apps (Allard & White, 2015).

From an individual development perspective, self-improvement products can enhance skills and improve task performance. Through attempts and efforts at self-improvement, individuals gain more comprehensive self-knowledge and experience progress, growth, and hope (Sun & Li, 2012; Sedikides & Strube, 1997). Second, self-improvement actively changes self-related knowledge, representing a process of discovering self-potential and realizing self-worth (Armenta, Fritz, & Lyubomirsky, 2017). Finally, when self-improvement motivation emerges, individuals more accurately evaluate their strengths and weaknesses and adopt a more open attitude toward criticism (Green, Sedikides, Pinter, & Van Tongeren, 2009). Thus, self-improvement products bring positive changes to individuals, and the enhancement of skills and capabilities as personal advantages helps individuals change their current situation and propel themselves toward higher social levels.

In summary, we contend that in situations of social crowding, self-improvement can better help individuals escape the negative effects induced by crowding. Social crowding motivates individuals to achieve positive self-change through self-improvement, propelling themselves toward higher social strata and increasing the possibility of possessing more activity territory, thereby resolving the self-threat caused by social crowding. In other words, social crowding enhances individuals' self-improvement needs, which in turn increases their preference for self-improvement products in consumption. Therefore, we propose the following hypotheses:

H1: Social crowding increases individuals' preference for self-improvement products.
H2: The need for self-improvement mediates the effect of social crowding on preference for self-improvement products.

Based on motivational goal theory, whether individuals experiencing social crowding will choose to consume self-improvement products as compensatory behavior depends on two aspects: attainability and desirability (Jiang & Guo, 2003; Shah & Higgins, 1997; Zhang & Huang, 2010). When individuals believe that social class advancement is possible through self-improvement (e.g., high perceived social equity) or when they consider self-improvement valuable in

crowded environments (e.g., living in low-employment areas), their likelihood of engaging in self-improvement increases significantly. Conversely, when individuals believe they cannot change social class through self-improvement (e.g., low perceived social equity) or that self-improvement lacks value (e.g., living in high-employment areas), the promoting effect of crowding on self-improvement is weakened. Accordingly, we propose perceived social equity and regional employment rate as moderators addressing the attainability and desirability of self-improvement, respectively.

1.2 The Moderating Role of Perceived Social Equity

Social equity represents society' s equal treatment of different individuals (Chen & Cai, 2017). Perceived social equity refers to individuals' judgments about whether their own inputs and outcomes are proportional, or whether they have received deserved social resources when comparing themselves with others (Adams, 1965; Hegtvedt, 1988). When perceiving high social equity, individuals believe their efforts and rewards are equivalent, with adequate resources supporting their development, and that they can equally achieve class advancement and higher social status through effort (Adorno, Fields, Cronley, Parekh, & Magruder, 2018). Therefore, when perceiving high social equity, individuals judge upward mobility as possible, thereby generating motivation and purchase intention to improve themselves and elevate their class.

When perceiving low social equity, individuals judge social resources as unequal, with power being more critical in social class advancement, and that their own efforts will only receive unfair treatment, thereby suppressing their motivation for self-improvement and subsequent purchasing behavior.

In summary, we argue that when individuals perceive high social equity, the effect of social crowding on preference for self-improvement products is significantly enhanced; conversely, when perceiving low social equity, individuals believe that regardless of effort, they cannot receive equivalent returns, and the possibility of changing status and climbing upward is minimal. Thus, low social equity dampens individuals' motivation for self-improvement and weakens the effect of social crowding on preference for self-improvement products. Accordingly, we propose:

H3: The effect of social crowding on preference for self-improvement products is moderated by perceived social equity. Specifically, when individuals perceive high social equity, social crowding significantly enhances preference for self-improvement products; when individuals perceive low social equity, this effect is attenuated.

1.3 The Moderating Role of Regional Employment Rate

The public constantly competes for scarce market resources such as occupations (Esses, Jackson, & Armstrong, 1998). Employment is a process of individual resource competition, a natural selection of "survival of the fittest," ultimately

securing a position (O'Leary, 1997). When market employment rates are low, indicating more job seekers or fewer available positions, intense employment competition makes individuals more acutely aware of limited survival resources and more eager to defeat competitors to achieve personal success. In such contexts, crowded environments make individuals perceive greater threats from surrounding populations, necessitating the establishment of competitive capabilities (Sng, Neuberg, Varnum, & Kenrick, 2017)—capabilities that are often highly valuable and irreplaceable, such as proficiently mastered skills (Chabowski & Mena, 2017). Therefore, individuals in low-employment/high-population-density areas judge self-improvement as more valuable, generating stronger self-improvement needs to enhance their advantages and ultimately showing greater preference for self-improvement products.

By contrast, individuals in high-employment areas judge employment resources as relatively abundant and can easily obtain job opportunities. Even when the surrounding environment is crowded, they exhibit higher tolerance for crowding, thereby reducing the value of self-improvement and weakening self-improvement needs. Therefore, for individuals in low-employment areas, social crowding does not significantly enhance their preference for self-improvement products. Accordingly, we propose:

H4: The effect of social crowding on preference for self-improvement products is moderated by regional employment rate. Specifically, when regional employment rates are low, social crowding significantly enhances individuals' preference for self-improvement products; when employment rates are high, this effect is attenuated.

[Figure 1: see original paper]

2. Research Methods

Figure 1 illustrates our theoretical framework. This paper simultaneously employs a field experiment in subways, laboratory experiments, and secondary data analysis to validate the research framework and hypotheses. Experiment 1 tests the enhancing effect of social crowding (vs. non-crowding) on preference for self-improvement products, establishing causality. Experiment 2 conducts a field experiment in subway stations, distinguishing crowding through peak and off-peak hours to examine the main effect and verify the mediating role of self-improvement need. Experiment 3 primarily rules out perceived busyness as a competing explanation. Additionally, using Chinese General Social Survey data and multiple regression models, this paper demonstrates the robustness of the main effect and specifically examines the moderating roles of perceived social equity and regional employment rate. The four studies complement each other, demonstrating both in real and experimental settings that social crowding significantly enhances preference for self-improvement products while testing the boundaries of this preference enhancement effect.

Previous research on social crowding has mostly been conducted in laboratories,

primarily manipulating participants'crowding perception through pictures, fixed laboratory space with varying participant numbers, or fixed participant numbers with varying laboratory space (e.g., Huang et al., 2018; Maeng et al., 2013; O' Guinn et al., 2015). While laboratory manipulation offers good environmental control and allows each participant to complete the process relatively independently, the artificial control is too obvious, and the reliance on college students as the core participant group somewhat weakens the applicability of findings to real life (Boots, 1979). Conversely, field studies allow participants to naturally complete experiments in authentic contexts, maximizing external validity. Moreover, real-life crowding enables individuals to genuinely experience resource scarcity and privacy invasion, which is difficult to achieve in laboratory crowding manipulations (Epstein, 1981). Given these considerations, this paper uses laboratory experiments to demonstrate causality between social crowding and preference for self-improvement products, while employing field experiments and secondary data analysis to enhance external applicability.

3.2 Experiment 1 Results and Analysis

Experiment 1 adopted a single-factor (social crowding vs. non-crowding) between-subjects design, with 124 college students participating (30.6% male; mean age = 21.66, SD = 2.96). Participants were randomly assigned to either the social crowding group (n = 64) or the non-crowding group (n = 60). All participants received a small gift upon completion.

Social crowding manipulation. Following Huang et al. (2018), we manipulated social crowding using pictorial stimuli. Participants viewed corresponding images (a crowded street vs. a sparsely populated street), imagined themselves in the depicted scene, and described the scene from perspectives such as number of people, interpersonal distance, and private space size based on their genuine feelings. After completing the description task, participants responded to a social crowding manipulation check on a 7-point Likert scale (1 = not crowded at all, 7 = very crowded).

Preference for self-improvement products. Participants then entered the product preference survey stage. A reading app recommended two e-books: *Eloquence Enhancement* (self-improvement product) and *Humor Collection* (non-self-improvement product). *Eloquence Enhancement* aims to improve individuals' speaking abilities in communication, persuasion, and public speaking, helping them "learn the wisdom of speaking" ; *Humor Collection* provides jokes and humorous materials, curated amusing content for laughter and "humor to embellish life." Participants evaluated both e-books (0 = not interested at all, 100 = very interested) and indicated the extent to which each could help achieve self-improvement (1 = not possible at all, 7 = very possible; see Appendix 1).

Measurement of other variables. Subsequently, participants completed emotion items (1 = very negative, 7 = very positive; 1 = very unhappy, 7 = very happy; 1 = very calm, 7 = very anxious) and indicated their adaptation

to crowded environments in daily life (1 = not adapted at all, 7 = completely adapted). Finally, participants provided personal information.

Manipulation check. A one-way ANOVA tested the manipulation effectiveness. Results showed that participants in the social crowding condition experienced significantly higher crowding (M = 6.14, SD = 0.97) than those in the non-crowding condition (M = 2.27, SD = 1.09; F(1, 122) = 437.94, p < 0.001, Cohen' s d = 3.75), confirming successful manipulation. Moreover, social crowding did not cause changes in positive emotion (M_crowded = 4.36, SD = 1.24 vs. M_uncrowded = 4.65, SD = 1.21, F(1, 122) = 1.75, p = 0.188), happiness (M_crowded = 4.22, SD = 1.12 vs. M_uncrowded = 4.47, SD = 1.31, F(1, 122) = 1.29, p = 0.258), or anxiety (M_crowded = 4.44, SD = 1.26 vs. M_uncrowded = 4.23, SD = 1.42, F(1, 122) = 0.72, p = 0.398). Additionally, a paired-samples t-test revealed that *Eloquence Enhancement* (M = 4.44, SD = 1.78) was perceived as significantly more helpful for self-improvement than *Humor Collection* (M = 3.18, SD = 1.50; t(123) = 6.78, p < 0.001, Cohen' s d = 0.77), confirming appropriate stimulus selection.

Evaluation of self-improvement products. Using participants' evaluation of *Eloquence Enhancement* as the dependent variable, crowding condition as the independent variable, and adaptation to crowding and positive emotion as covariates, ANOVA results indicated that participants in the social crowding condition showed marginally significantly higher interest in *Eloquence Enhancement* (M = 56.72, SD = 27.64) than those in the non-crowding condition (M = 48.67, SD = 31.52; F(1, 120) = 3.56, p = 0.062, Cohen' s d = 0.27). The coefficient for adaptation to crowding was significant (F(1, 120) = 9.96, p = 0.002), while positive emotion was not (F(1, 120) = 1.93, p = 0.168). In contrast, when using evaluation of *Humor Collection* as the dependent variable with the same covariates, no significant difference emerged between crowding conditions (M_crowded = 54.83, SD = 28.33 vs. M_uncrowded = 47.22, SD = 29.40; F(1, 120) = 1.85, p = 0.177, Cohen' s d = 0.26), though adaptation to crowding was marginally significant (F(1, 120) = 3.30, p = 0.072) and positive emotion remained non-significant (F(1, 120) = 0.03, p = 0.871). Thus, social crowding enhanced preference for self-improvement products to some extent without significantly altering preference for non-self-improvement products.

3.3 Discussion

Experiment 1 demonstrated in a laboratory setting that social crowding (vs. non-crowding) can enhance individuals' preference for self-improvement products to some degree, establishing causality while showing that crowding does not change preference for non-self-improvement products. To enhance external validity, Experiment 2 was conducted in a typical crowding context—subway stations—with different experimental stimuli to investigate product choice behavior in more authentic crowded scenarios.

4.1 Selection of Experimental Stimuli

To select appropriate stimuli for Experiment 2, we conducted a pretest using a 2 (product category: self-improvement vs. non-self-improvement) between-subjects design. Participants rated two WeChat public account columns—*Learning English Through Movies* (self-improvement) and *Passing Time With Movies* (non-self-improvement)—on the self-improvement dimension. Following Allard and White (2015), both columns featured 20-minute daily English movie clips, but differed in focus: *Learning English Through Movies* emphasized "listening to original audio, learning vocabulary, practicing difficult sentences, and correcting pronunciation," highlighting "word-by-word, sentence-by-sentence English skill improvement" to "boost workplace survival and career development" ; *Passing Time With Movies* highlighted making commutes less boring, allowing passengers to "experience light and shadow stories" as the "top choice for passing time." The columns were identical in layout, main colors, and font size, differing only in advertised self-improvement level. The questionnaire also measured functional/hedonic attributes, attractiveness, and liking.

Sixty participants completed the pretest (30% male; mean age = 23.68, SD = 3.69). Independent-samples t-tests revealed that *Learning English Through Movies* (n = 31, M = 4.68, SD = 1.28) was perceived as significantly more helpful for self-improvement than *Passing Time With Movies* (n = 29, M = 3.69, SD = 1.23; t(58) = 3.05, p = 0.003, Cohen' s d = 0.79). No significant differences emerged in liking (M_English = 4.71, SD = 1.19 vs. M_Time = 4.48, SD = 1.57; t(58) = 0.63, p = 0.533, Cohen' s d = 0.17), attractiveness (M_English = 4.58, SD = 1.59 vs. M_Time = 4.21, SD = 1.37; t(58) = 0.97, p = 0.335, Cohen' s d = 0.25), or hedonic/functional evaluation (M_English = 4.61, SD = 1.15 vs. M_Time = 5.03, SD = 1.45; t(58) = -1.25, p = 0.215, Cohen' s d = -0.32). These results confirmed the suitability of these columns as experimental stimuli.

4.2 Experiment 2 Procedure and Measures

This experiment employed a single-factor (social crowding vs. non-crowding) between-subjects design conducted as a field experiment. We collected data at four adjacent major stations on Beijing Subway Line 4: Haidian Huangzhuang, Renmin University, Weigongcun, and Peking University East Gate. These stations are located in densely populated residential areas with high passenger flow. To avoid disrupting subway operations, we recruited waiting passengers as participants, excluding those who had reached their destinations. Sixty subway passengers (38.3% male; mean age = 24.23, SD = 3.31) completed Qualtrics online questionnaires and received 10 RMB compensation, representing diverse occupations.

Social crowding manipulation. Based on preliminary observations, we distinguished crowding conditions by whether data collection occurred during subway rush hours. Participants were classified into social crowding or

non-crowding groups (n_crowding = 30 vs. n_non-crowding = 30). First, participants completed a brief daily travel habits survey to enhance contextual fit. They then rated their current environment' s crowding on a 7-point scale (1 = not crowded at all, 7 = very crowded) as a manipulation check.

Preference for self-improvement products. Participants were then invited to an ostensibly unrelated product preference survey, viewing introductions to Column A (*Learning English Through Movies*) and Column B (*Passing Time With Movies*) and indicating their relative preference (1 = strongly prefer Column A, 8 = strongly prefer Column B; see Appendix 2).

Mediation measurement. After indicating column preference, participants self-reported their self-improvement need: "Right now, self-improvement is very important to me" and "Right now, I expect to improve myself through certain actions" (1 = strongly disagree, 7 = strongly agree; Allard & White, 2015).

Other measures. Participants also completed emotion (1 = very negative, 7 = very positive) and arousal (1 = very calm, 7 = very excited) measures before providing demographic information and receiving compensation.

4.3 Experiment 2 Results and Analysis

Manipulation check. One-way ANOVA confirmed the manipulation: participants during rush hours perceived significantly higher crowding (M = 5.03, SD = 1.33) than during off-peak hours (M = 3.83, SD = 1.95; F(1, 58) = 7.78, p = 0.007, Cohen' s d = 0.72). The manipulation did not affect emotional state (M_crowded = 4.57, SD = 1.65 vs. M_uncrowded = 4.70, SD = 1.34, F(1, 58) = 0.12, p = 0.733) or arousal level (M_crowded = 3.00, SD = 1.53 vs. M_uncrowded = 3.30, SD = 1.29, F(1, 58) = 0.67, p = 0.415). Additionally, *Learning English Through Movies* (M = 4.07, SD = 1.55) was rated as significantly more helpful for self-improvement than *Passing Time With Movies* (M = 3.67, SD = 1.40; t(59) = 2.07, p = 0.043, Cohen' s d = 0.27), confirming appropriate stimulus selection.

Preference for self-improvement products. One-way ANOVA on column preference revealed significant differences between crowding conditions (F(1, 58) = 10.27, p = 0.002). In the crowding condition, participants showed stronger preference for the self-improvement column (*Learning English Through Movies*; M = 3.77, SD = 1.65), whereas in the non-crowding condition, preference leaned toward *Passing Time With Movies* (M = 5.07, SD = 1.48). Cohen' s d analysis also supported significant mean differences in preference between conditions (Cohen' s d = -0.83).

Mediation mechanism. The two self-improvement need items showed high reliability (= 0.85). After averaging them, bootstrap analysis (Hayes, 2013: Model 4) with 5,000 samples and 95% confidence interval revealed a significant mediation effect (LLCI = 0.0108, ULCI = 0.6388), with effect size = 0.2053 and direct effect = -1.5053. Thus, self-improvement need mediated the effect of

social crowding on preference for self-improvement products.

Other measures. With age and gender as covariates, the relationship between social crowding and column preference remained significant ($F(1, 56) = 7.85$, $p = 0.007$), and the mediation effect of self-improvement need remained significant (LLCI = 0.0044, ULCI = 0.7121), with effect size = 0.2104 and direct effect = -1.3664.

4.4 Discussion

Experiment 2 replicated H1, demonstrating that relative to non-crowded scenarios, social crowding increases preference for self-improvement products, with self-improvement need mediating this effect. Using authentic subway contexts to manipulate social crowding substantially enhanced the generalizability and external validity of our findings.

Experiment 2 revealed a potential alternative explanation: perceived busyness. Being in crowded environments may create perceptions of busyness, which diminish the experiential value of non-self-improvement products (i.e., having no mood to enjoy movies for passing time). Conversely, self-improvement products that utilize fragmented time (i.e., learning English through movies) become relatively easier to use in busy states, leading people to choose them. Therefore, Experiment 3 primarily excludes this competing explanation of perceived busyness. Additionally, Experiment 3 randomizes product presentation order to avoid sequence effects.

5.1 Experiment 3 Procedure and Measures

Experiment 3 had two main objectives: first, to replicate the main effect of social crowding on enhanced preference for self-improvement products; second, to rule out the alternative explanation of perceived busyness.

The experiment used a single-factor between-subjects design with 95 college students (20% male; mean age = 23.43, SD = 3.38), randomly assigned to social crowding (n = 45) or non-crowding (n = 50) conditions. Participants received a small gift upon completion.

Social crowding manipulation. To demonstrate that the main effect is not driven by enhanced perceived busyness, we maintained the subway context from Experiment 2 but manipulated crowding using different subway car images (a packed car vs. an empty car; see Appendix 3). Participants imagined themselves in the depicted scene and described it in detail regarding number of people, interpersonal distance, private space size, and overall feelings. They then completed the crowding manipulation check (1 = not crowded at all, 7 = very crowded) and rated their perceived busyness (1 = very leisurely, 7 = very busy).

Product choice. Participants then entered the product preference survey, viewing "leisure books" and "self-improvement books" (presentation order randomized). They were told that self-improvement products enhance certain ca-

pabilities or performance, and indicated their current reading preference by entering the desired book category in a text box.

Other measures. Finally, participants completed emotion items (1 = very negative, 7 = very positive; 1 = very calm, 7 = very anxious; 1 = very unhappy, 7 = very happy) and provided demographic information.

5.2 Experiment 3 Results and Analysis

Manipulation check. One-way ANOVA confirmed successful manipulation: participants in the crowding condition perceived significantly higher crowding (M = 6.71, SD = 0.55) than those in the non-crowding condition (M = 1.22, SD = 0.55; F(1, 93) = 2386.91, p < 0.001, Cohen' s d = 9.98). Although the manipulation affected positive emotion (M_crowded = 3.24, SD = 1.37 vs. M_uncrowded = 4.96, SD = 1.21, F(1, 93) = 42.03, p < 0.001), anxiety (M_crowded = 4.87, SD = 1.36 vs. M_uncrowded = 3.42, SD = 1.74, F(1, 93) = 20.10, p < 0.001), and happiness (M_crowded = 3.31, SD = 1.64 vs. M_uncrowded = 4.92, SD = 1.03, F(1, 93) = 33.67, p < 0.001), these emotional changes did not significantly affect book category choice (_positive = 0.003, Wald ^{2} < 0.01, p = 0.985; _anxiety = -0.02, Wald ^{2} = 0.03, p = 0.853; _happiness = 0.22, Wald ^{2} = 2.18, p = 0.140).

Product preference choice. Using book category choice as the dependent variable (0 = leisure books, 1 = self-improvement books), social crowding as the independent variable, and happiness as a covariate, logistic regression revealed a significant effect of social crowding (= 1.07, Wald ^{2} = 4.12, p = 0.042). The proportion choosing self-improvement books was higher in the crowding condition (40%) than in the non-crowding condition (30%). The happiness coefficient was also significant (= 0.39, Wald ^{2} = 5.12, p = 0.024; collinearity diagnosis with happiness as dependent variable and crowding as independent variable showed VIF = 1, indicating no severe collinearity). Thus, we further validated that social crowding enhances preference for self-improvement products.

Ruling out perceived busyness as a mechanism. One-way ANOVA showed that social crowding significantly affected perceived busyness (M_crowded = 4.93, SD = 1.70 vs. M_uncrowded = 2.34, SD = 1.47; F(1, 93) = 63.85, p < 0.001, Cohen' s d = 1.63). However, bootstrap analysis (Hayes, 2013; Model 4) with 5,000 samples and 95% confidence interval revealed that the mediation effect of perceived busyness included zero (LLCI = -1.2613, ULCI = 0.4922), indicating that although social crowding changed perceived busyness, busyness was not a mediating variable. We therefore ruled out this alternative explanation.

Experiment 3 successfully excluded the mediating role of perceived busyness. Across three experiments, we demonstrated the enhancing effect of social crowding on preference for self-improvement products, ensuring both internal and external validity while ruling out the alternative explanation of perceived busyness. However, this positive effect of social crowding is not inevitable and has

boundaries. In the following study, we examine the potential moderating effects of perceived social equity and regional employment rate.

6.1 Data Source

The 2015 Chinese General Social Survey (CGSS 2015) serves as the core individual-level data source for this research. CGSS 2015, officially released in January 2018, is the latest available open data. The survey employs multi-stage stratified sampling with face-to-face interviews, covering 28 provinces with 10,968 valid questionnaires. Conducted by the National Survey Research Center at Renmin University of China, it features large sample size, broad coverage, and comprehensive information (Lu, Liu, & Li, 2017). Variables relevant to this study are detailed in Appendix 4. Regional variables such as permanent population density and employment rates were obtained from provincial statistical bureau data.

6.2.1 Independent Variable

We used permanent population density to measure regional social crowding. While population density objectively describes the number of people per unit area and crowding reflects subjective perception, scholars widely acknowledge that high population density is a prerequisite for crowding perception (e.g., Boots, 1979). Fixing space size while varying the number of occupants is also the most common crowding manipulation method in laboratory settings. The population density indicator values were obtained from provincial statistical yearbooks (for provinces not directly reporting "permanent population density," we calculated it as year-end permanent population / administrative area or year-end permanent population / total land area; for provinces not reporting year-end permanent population data, we used year-end total population as a substitute).

6.2.2 Dependent Variable

The dependent variable—individual preference for self-improvement products—was measured using the question: "During the past year, how often did you engage in the following activity in your spare time?—Learning to recharge (1 = never, 5 = very frequently)." This response reflects actual behavioral outcomes. Learning to recharge is a self-improvement behavior that helps people master new skills, strive for self-perfection, and bring positive changes. More frequent learning in spare time indicates higher actual usage frequency of self-improvement products, reflecting preference for such products.

6.2.3 Moderating Variables

Perceived social equity. This indicator was derived from the survey item: "Overall, do you think today' s society is fair? (1 = completely unfair, 5 = completely fair)."

Employment rate. We used provincial-level employment rate data. Since provinces do not directly publish employment rates, we calculated them as total employment (three industries) / permanent population. Lower employment rate values indicate regions 偏向 low-employment areas; higher values indicate regions 偏向 high-employment areas.

6.2.4 Control Variables

We identified control variables based on factors affecting self-improvement motivation from existing literature, primarily including well-being and personal economic status.

Well-being. Well-being is a positive emotional perception. Research generally suggests that positive emotions enable individuals to view their weaknesses and defects more openly and make positive self-changes (Green et al., 2009). The well-being indicator was derived from CGSS 2015: "Overall, how happy do you think your life is? (1 = very unhappy, 5 = very happy)."

Personal social status. Previous research indicates that social status correlates with territory size (Edney, 1974). High-status individuals need more distance from others (Inesi, Gruenfeld, & Galinsky, 2012) and attempt to demonstrate control and power by occupying larger personal space (O' Guinn et al., 2015). Conversely, lower-status individuals require less personal space. Thus, social status may directly affect tolerance for and reactions to social crowding. We therefore included social status as a control variable to examine whether social crowding still significantly affects self-improvement behavior after controlling for this variable.

We measured personal social status based on economic capacity using the item: "Compared with your peers, what is your socioeconomic status? (1 = relatively high, 3 = relatively low)."

6.2.5 Other Variables

Additional variables included several demographic variables: gender, age, annual personal income, and regional socioeconomic development (urban vs. rural location). During data preprocessing, we excluded samples with missing information on any variable, yielding 10,229 observations covering 28 provinces for examining the moderating effects. We also applied natural log transformations to population density, age, and annual personal income.

We thus propose the following models to test moderating hypotheses and the robustness of the main effect, with consistent control variables across all models.

Formula (1): Main effect
Learning frequency = _i + ln(population density) + Well-being + Personal economic status + ln(age) + Gender + ln(personal income) + Location (urban vs. rural) + _i

Formula (2): Moderating effect of perceived social equity
Learning frequency = _i + Population density (high vs. low) + Perceived social equity + Perceived social equity × Population density (high vs. low) + Well-being + Personal economic status + ln(age) + Gender + ln(personal income) + Location (urban vs. rural) + _i

Formula (3): Moderating effect of regional employment rate
Learning frequency = _i + Population density (high vs. low) + Employment rate + Employment rate × Population density (high vs. low) + Well-being + Personal economic status + ln(age) + Gender + ln(personal income) + Location (urban vs. rural) + _i

6.3 The Moderating Role of Perceived Social Equity

Before testing the moderating effect, we first examined the main effect using Formula 1, regressing learning frequency on population density (N = 10,229). Results showed that increased population density significantly enhanced learning frequency in spare time (Model 1: = 0.18, p < 0.001). More importantly, after adding demographic variables, location, well-being, and personal economic status as controls, the model remained significant (F(7, 10221) = 407.01, p < 0.001), with population density coefficient still significant (Model 3: = 0.11, t(10221) = 10.96, p < 0.001).

We then analyzed the moderating effect of perceived social equity using Formula 2. Results indicated that the interaction between social crowding and equity perception significantly affected learning frequency (= 0.04, SE = 0.02, t(10219) = 2.21, p = 0.027). Using the Johnson-Neyman technique (Spiller, Fitzsimons, Lynch, & McClelland, 2013), we examined the significance of the crowding main effect at different equity levels. When perceived equity exceeded 1.6292 (i.e., high perceived social equity), crowding significantly affected learning frequency (= 0.13, SE = 0.02, t(9649) = 6.58, p < 0.001). When perceived equity fell below 1.6292 (i.e., extremely low perceived social equity), crowding had no significant effect on learning frequency (= 0.17, SE = 0.08, t(564) = 2.07, p = 0.039). Thus, at high perceived social equity, social crowding strengthened self-improvement behavior (above the Johnson-Neyman point); at low perceived equity, no clear relationship existed between crowding and self-improvement behavior. This supports Hypothesis 3 regarding the moderating role of perceived social equity.

[Figure 2: see original paper]

6.4 The Moderating Role of Regional Employment Rate

We examined the moderating effect of employment rate using Formula 3. Results showed a significant interaction between population density and employment rate (= -1.41, SE = 0.38, t(10219) = -3.73, p = 0.0002). Using the Johnson-Neyman technique (Spiller et al., 2013), we found that when employment rate fell below 0.6661 (i.e., low employment), crowding significantly affected learning

frequency (= 0.17, SE = 0.02, t(8040) = 7.68, p < 0.001). When employment rate exceeded 0.6661 (i.e., high employment), no difference in learning frequency existed across population density levels (= 0.10, SE = 0.06, t(2173) = 1.55, p = 0.122). Additionally, the regression coefficient for crowding was significant (= 1.01, SE = 0.22, t(10219) = 4.52, p < 0.001), indicating that learning frequency increased significantly with crowding level. Thus, in low-employment regions, social crowding strengthened self-improvement behavior (below the Johnson-Neyman point); in high-employment regions, no clear relationship existed between crowding and self-improvement behavior. This supports Hypothesis 4 regarding the moderating role of regional employment rate.

[Figure 3: see original paper]

6.5 Discussion

Analysis of CGSS 2015 data replicated the main effect of social crowding on preference for self-improvement products and further supported H3 and H4 regarding the moderating roles of perceived social equity and regional employment rate. Additionally, using CGSS 2011, 2012, and 2013 data, we consistently found that social crowding affects self-improvement behavior—individuals in high-population-density areas had higher learning frequencies—but due to space limitations, we report only the latest CGSS 2015 results.

7. Conclusion and Discussion

This research systematically examined the effect of social crowding on preference for self-improvement products, its underlying mechanism, and potential boundaries. Across three experiments and secondary data analysis, our hypotheses received support. Experiment 1 established causality between social crowding and preference for self-improvement products, showing that crowding enhances preference for self-improvement but not general products. Experiment 2, a field experiment collecting data during subway rush vs. off-peak hours, replicated the main effect and demonstrated mediation by self-improvement need. Experiment 3 used different subway car images to manipulate crowding and ruled out perceived busyness as an alternative explanation. Analysis of CGSS 2015 and related statistical data validated the moderating roles of perceived social equity and regional employment rate.

7.1 Theoretical Contributions

Across four studies using authentic subway contexts, laboratory experiments, and broad-coverage secondary data, we addressed our research questions while ruling out perceived busyness as an alternative explanation. Our findings supplement and extend theories in social crowding and self-improvement domains.

First, we provide a new research perspective for the social crowding literature. On one hand, we examine social crowding' s influence from a novel consumer

choice angle. Existing research has primarily focused on psychology and sociology, discussing crowding' s effects on physiological activity (Zhao et al., 1989; Hwang et al., 2012), cognitive ability (Goeckner, Greenough, & Mead, 1973), and social behavior (Boots, 1979). This research connects social crowding with consumer product choice behavior, examining how crowding alters product preferences. On the other hand, we test a positive behavioral outcome variable. As an environmental factor in marketing contexts, existing literature has focused predominantly on negative behavioral consequences—how crowding inhibits consumption through product evaluation, shopping time, and satisfaction (Eroglu & Machleit, 1990; Eroglu, Machleit, & Barr, 2005; Huang et al., 2018; O' Guinn et al., 2015). This research reveals a positive effect, demonstrating that social crowding enhances self-improvement need and subsequently increases preference for self-improvement products. This preference enhancement suggests that individuals can actively cope with social crowding, providing a new coping strategy.

Second, this research proposes and tests moderating mechanisms different from previous social crowding studies—perceived social equity (individual level) and regional employment rate (societal level). Prior research on boundaries of crowding effects has focused on individual characteristics (independent vs. interdependent self; Huang et al., 2018), venue characteristics (functional vs. entertainment venues; Hui & Bateson, 1991), or crowd composition (in-group vs. out-group members; Maeng et al., 2013; O' Guinn et al., 2015). From a social development perspective, we validated that high perceived social equity or low employment rates intensify the effect of social crowding on preference for self-improvement products. This provides a new perspective for discussing boundaries of crowding effects.

Furthermore, this research extends self-improvement literature. Existing research shows that individuals universally possess self-improvement motivation (Sedikides, 1999), but its strength is influenced by individual emotions (Allard & White, 2015; Breines & Chen, 2012) and interpersonal factors (Hui & Bond, 2009; Hui, Bond, & Molden, 2012). However, few studies have examined how social environmental factors affect self-improvement motivation. This paper demonstrates that social crowding, as a social environmental factor, has an enhancing effect on self-improvement motivation. Moreover, previous self-improvement research has focused on motivation or behavior (i.e., performance on tasks) rather than direct effects on product choice behavior. This research directly examines how social crowding affects self-improvement product choice behavior, deepening the behavioral manifestation of self-improvement and extending self-improvement research in consumption contexts.

7.2 Limitations and Future Directions

This research examined the effect of social crowding on preference for self-improvement products and analyzed its underlying mechanism, yet several limitations remain, offering directions for future research. First, our product stimuli focused only on skill-based improvement. Future research could examine self-

improvement products targeting personal temperament or health improvement. Second, perceived social equity and regional employment rate may interact; future studies could more finely compare intra-provincial regional differences and examine whether employment rate differences caused by different reasons (e.g., voluntary vs. involuntary unemployment) affect results. Finally, other individual belief-related variables may moderate these effects. For example, according to implicit theories (Hong, Levy, & Chiu, 2001), entity theorists who believe self-improvement and change are unlikely may not show significantly enhanced preference for self-improvement products under social crowding. For incremental theorists who believe people continuously grow and change, the crowding effect may be stronger. Additionally, self-affirmation may be another moderator: based on compensatory consumption, when external factors provide opportunities for self-affirmation (Sivanathan & Pettit, 2010) and enhance self-confidence, social crowding may not increase preference for self-improvement products. Future research could explore these variables' specific roles.

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Note: Figure translations are in progress. See original paper for figures.