Building and Environment 121 (2017) 148–157

Contents lists available at ScienceDirect

Building and Environment

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

Effects of typical dining styles on conversation behaviours and acoustic perception in restaurants in China

Qi Meng [a, b], Shilun Zhang [a], Jian Kang [a, b, *]

[a] Heilongjiang Cold Region Architectural Science Key Laboratory, School of Architecture, Harbin Institute of Technology, Harbin, 150001, China
[b] School of Architecture, University of Sheffield, Western Bank, Sheffield, S10 2TN, UK

ARTICLE INFO

Article history:
Received 15 March 2017
Received in revised form
14 May 2017
Accepted 15 May 2017
Available online 17 May 2017

Keywords:
Restaurants
Dining styles
Conversation behaviour
Acoustic perception

ABSTRACT

The acoustic environment of restaurants is important for diners. Based on acoustic measurements and a questionnaire survey of typical restaurants, differences in diners' conversation behaviour and acoustic perception were analysed. Three dining styles were compared (centralized, separate, and dispersed), and crowd density and background music were considered. Several interesting findings were gained. First, dining styles affected conversation behaviour. When there were four or more diners per table, conversation increased compared to when there were three or fewer; and background music did not reduce conversation. With the centralized style, the proportion of speech diners heard was greater than for the other two dining styles, even as crowd density increased. Second, dining styles affected sound pressure level. With background music, the separate style decreased sound pressure level more effectively than the other two styles when crowd density was low, and without background music, the separate style decreased sound pressure level more effectively than the other two dining styles irrespective of crowd density. Dining styles also affected acoustic comfort: with the centralized and separate styles, acoustic comfort took on a parabolic shape, first increasing and then decreasing as crowd density increased, while with the dispersed style, as crowd density increased, the acoustic comfort of diners decreased.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

Restaurants have expanded their significance beyond dining alone and become places of emotional communication, family gatherings, and commercial negotiations. Field research by Heung and Gu [1] found that customers' choice of restaurants is not limited to the consideration of food factors any longer; the restaurant environment, particularly the sound environment, considerably affects diners' evaluation of their comfort and the overall dining experience.

The sound environment and users' acoustic perception in restaurants are a common focus of research, since the evaluation of meals and the income of restaurants can be affected strongly by sound factors [2]. Various studies have examined acoustic problems in dining spaces, including those related to noise control, speech intelligibility, and acoustic comfort [3–5]. Regarding noise control, Kang and Lok [6] found that the background noise level in restaurants is generally 80–90 dBA, while the ideal noise level is 70–75 dBA [7]. The acoustic environment in restaurants can be substantially affected by equipment noise, including lampblack machines and fans, and using any type of stone material for sound absorption in restaurants is not optimal [8,9]. To examine speech intelligibility in restaurants, Kang [10] used a radiosity-based computer model to establish a mathematical model which revealed that increasing boundary absorption typically increases the speech transmission index (STI) by 0.2–0.4. With certain reverberation times, unintelligible speech sounds are expected to act as masking sounds, so that communication among diners around the same table will not be disturbed by the noise of diners at neighbouring tables. While the sound level, threshold of background noise that sheltered the noise interference of diners at neighbouring tables and guaranteed their speech articulation was found to be relatively narrow, at 69–71 dBA [11–13]. In terms of acoustic comfort, Leccese et al. [14] proposed a simplified analytical model to evaluate the acoustic conditions required to ensure the intelligibility of conversations in restaurant dining rooms, and found that the 'cocktail party effect' significantly affected the level of comfortable acoustic conditions. Another

* Corresponding author. School of Architecture, Harbin Institute of Technology, Harbin, 150001,China; School of Architecture, University of Sheffield, Western Bank, Sheffield S10 2TN, UK.
E-mail addresses: j.kang@hit.edu.cn, j.kang@sheffield.ac.uk (J. Kang).

http://dx.doi.org/10.1016/j.buildenv.2017.05.025
0360-1323/© 2017 Elsevier Ltd. All rights reserved.

study, on two typical large dining spaces, found that background music, other diners' speech sounds, and impact sound from tableware had the dominant impacts on acoustic comfort evaluations by diners [7].

The conversation of diners is one of the main behaviours influencing the sound environment and diners' acoustic perceptions in restaurants. Ariffin et al. [15] studied the influence of environmental factors including colour, lighting, design, and layout on the conversation behaviour of diners. The Lombard effect or Lombard reflex is the involuntary tendency of speakers to increase their vocal effort when speaking amid loud noise, to enhance the audibility of their voice [16]. Field research has found that the listener may follow conversation of interest despite many concurrent sources of sound [17].

The indoor and outdoor sound environment and users' acoustic perception can also be affected by crowd density [18,19], since a crowd is a special sound source in that it gives rise to certain sound absorption effects [20–22]. Studies have found that the sound environment in commercial pedestrian streets and underground shopping streets has undergone many changes, and acoustic comfort—as a key evaluation index of acoustic perception—varies substantially with crowd density [23]. Meng and Kang put forward a crowd acoustic model applicable to large spaces and applied a method of equivalent sound source calculation along with a simplified method for crowd sound sources [24]; in a separate study, Nie and Kang also analysed the relationship between crowd density and sound pressure level and between the number of persons present and the number of persons conversing [25]. However, few studies have considered the influence of the crowd factor on conversation behaviours and acoustic perception in restaurants.

Background music, which is a common sound source in restaurants, may also affect the sound environment and users' acoustic perceptions. Previous studies have indicated that the acoustic comfort of customers in commercial spaces is higher with than without background music [26]. In restaurants, previous studies have been confined to the influence of background music on eating behaviour, dining rate, meal volume, and sensitivity to food, without taking the influence of background music on conversation behaviour into account [27–30].

Thus, the aim of this study is to find out the effects of typical dining styles on conversation behaviours and acoustic perception in restaurants in China. First, this study examined the influence of dining styles on conversation behaviours, such as diners' frequency of conversation and frequency of speech sound. Second, the influence of dining styles on sound pressure level in restaurants was studied. Third, the influence of dining styles on acoustic comfort of diners was investigated. Three typical dining styles, including centralized, separate, and dispersed styles, were compared. Crowd density and restaurants with and without background music were considered in this study, as two factors which may affect conversation behaviours and acoustic perception in restaurants.

Some key terms used in this paper are defined/explained below: (1) Dining styles. Based on the analysis of relevant studies [31–34], this study divides dining styles into three categories: centralised, separate, and dispersed, as shown in Fig. 1. The centralised style refers to diners sharing a dish, such as a hot pot; the separate style means that diners do not share dishes with others but eat their own food; while in the dispersed style, diners share many dishes, which is common in family gatherings (see Fig. 1). Previous studies have shown that these three dining styles are common not only in China but also in other countries in Europe and Asia [35]. (2) Conversion behaviours. This study considers two kinds conversion behaviour, namely the frequency of conversation and the frequency of speech sound. The former indicates the proportion of the time of a diner having conversation with any diner at the same table. The latter indicates the proportion of the time of a diner heard surrounding speech. (3) Sound pressure level. It is a logarithmic measure of the effective pressure of a sound relative to a reference value, and the unit of sound pressure level is dB [11]. (4) Acoustic comfort. It is the subjective evaluation of a diner on the dining environment, with a five-point scale in this study: 1, very uncomfortable; 2, uncomfortable; 3, neither comfortable nor uncomfortable; 4, comfortable; 5, very comfortable [26].

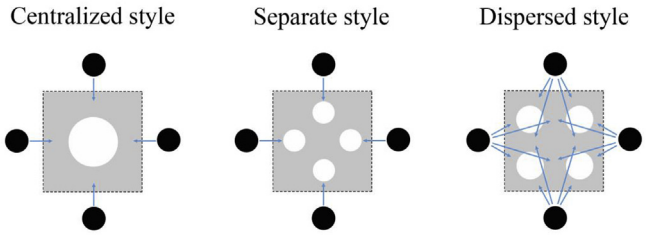

Fig. 1. Three dining styles: centralized, separate and dispersed.

2. Methodology

2.1. Survey site

The selection of case restaurants for acoustic studies is important, since many factors may affect sound environment and acoustic perception in restaurants [7,10,36,37]. A study has indicated that compared with general restaurants, fast-food restaurant may be less noisy, since dining periods of less than half an hour will involve less conversation than those of more than 1 h [36]. Kang pointed out that the different geometry of restaurants may change their reverberation time (RT) [10] Previous studies have also pointed out that sound environment can change with the interior layout of the restaurant; for instance, a restaurant with the kitchen inside usually has higher sound level than one with the kitchen adjacent [7]. Some recent studies have indicated that table shape can also affect users' acoustic perceptions in indoor spaces; for example, when the length of the table is 5 times the width [37].

Thus, based on a preliminary study, 523 Chinese restaurants were surveyed to find out their typical features, considering dining style, geometry, and layout and the social and behaviours characteristics of diners [38]. Each of the above mentioned three dining styles in this study was investigated, with and without background music. Consequently, six restaurants were chosen to cover all these situations.

The restaurants with music were Hongming Hot Pot (HHP), with a centralized style, Alpine Buffet (AB), with a separate style, and Bee Kitchen (BK), with a dispersed style. The restaurants without music were Si Chuan Ren (SCR), with a centralized style, Hawaiian Pizza (HWP), with a separate style, and Chuan Ren Bai Wei (CRBW), with a dispersed style. To avoid unusual influences of space and scale on sound distribution [39], the proportions of these six restaurants (length, width, and height) were within a ratio of 1:3, in order to avoid extremely non-diffuse sound fields [40]. Some details of the case sites, such as restaurant style, capacity, geometry, and indoor photographs, are shown in Table 1. As previous studies have indicated that the evaluation of acoustic environment can be influenced by reverberation time [41], the measured unoccupied RT for each of the six restaurants is also given in Table 1. It can be seen that the difference in RT T30 is less than 0.1s; therefore, the influence of reverberation time was not taken into account in this study [42–44]. Rindel [45] found that the typical number of persons at a

Download English Version:

https://daneshyari.com/en/article/4911509

Download Persian Version:

https://daneshyari.com/article/4911509

Daneshyari.com