EFFECT OF ACOUSTIC TREATMENT AND TABLE DIVIDERS ON DINERS' EXPERIENCE IN A MONTRÉAL RESTAURANT

Cynthia Tarlao [*1,2], Edda Bild [†1,2] et Catherine Guastavino [‡1,2]
[1]School of Information Studies, McGill University, Montréal, Québec, Canada
[2] Centre for Interdisciplinary Research in Music Media and Technology, Montreal, Québec, Canada

1 Introduction

Acoustic comfort in dining spaces has recently received increased attention (see [1] for a review). It is often characterized through acoustic measurements of the dining room and sometimes using self-reported measures of diners' experience and behavioural intentions. However, there are large variations in operationalization across studies. In addition, given that the main activities in restaurants are eating and communicating, diners' experience can be studied using an audiology framework with a focus on listening effort and vocal effort.

We bring together these different approaches to investigate the effect of acoustic treatment in an upscale restaurant located within ITHQ (Institut de Tourisme et d'Hôtellerie du Québec) in Montréal, Canada. A questionnaire was administered to a total of 225 diners before (N = 140) and after (N = 85) the installation of acoustic panels on the ceiling of the dining room. Participants were asked to rate their overall experience, the soundscape of the restaurant, as well as their vocal and listening effort. Additionally, as this work was conducted during the COVID-19 pandemic, we explored the effect of transparent dividers on tables.

2 Methods

2.1 Restaurant and conditions

The restaurant has high ceilings (4.80 m), large windowpanes, wooden walls and floor (reverberation time of 1.2 s pre-treatment). Wooden tables were covered with heavy tablecloths and chairs with thick leather cushions.

The study was conducted in two phases, during which questionnaires were distributed at the dinner service on weekdays and weekends: the phase before the installation of acoustic treatment in December 2020 (N = 140 over 9 evenings), hereafter referred to as the Before condition, the phase after the installation of acoustic treatment in April and May 2021 (N = 85 over 9 evenings), hereafter referred to as the After condition. The acoustic treatment consisted in Decoustics panels covering about 1/3 of the ceiling surface.

Additionally, in the context of the COVID-19 pandemic, transparent acrylic (i.e., Plexiglas®) dividers were installed on tables to separate and protect diners. Three types of configurations were used: no divider, flat divider for 2 people, and complex configurations for more than 2 people. Under the hypothesis that this would likely influence sound propagation and the ability of diners to communicate, dividers conditions were added (None, Flat, Complex). To control for background music, the same playlist was played at the same volume setting in both conditions.

2.2 Procedure

Due to COVID-19-related health restrictions, data collection was carried out by waiting staff of the restaurant, trained to distribute the questionnaires to diners. The staff approached diners after their meal, inviting them, in English or French, to fill in a short questionnaire about their restaurant experience. Due to health restrictions, the only diners allowed in the restaurant were employees and staff of the ITHQ. Participation was voluntary and diners were first asked if they had filled out the questionnaire before, and completed it only if they had not done so before.

The questionnaire was based on previous research done on restaurant soundscapes [1] and audiology. It included 26 5-point Likert scales grouped into 4 sections on 1) overall experience and satisfaction, 2) sound experience and soundscape evaluation, 3) vocal and listening effort, 4) person-related (e.g., demographics) and situational factors (e.g. number of diners at the table).

Tablets were used for data collection and respondents filled out their answers digitally. The survey took 5-10 minutes to complete. To track the duration of the dining experience and the consumption pattern, we relied on contextual information collected by the waiting staff, namely when diners seated, when they paid their bill, and the amount spent.

2.3 Analysis

The five-point Likert scales (from strongly disagree to strongly agree) were converted to numerical values (from 1 to 5, respectively, no missing data), and MANOVAs and follow-up ANOVAs were conducted to compare scale ratings between Before and After, as well as across the three types of dividers (using a .05 significance level).

3 Results

3.1 Effect of acoustic treatment

The installation of acoustic treatment had a significant effect on overall satisfaction, soundscape evaluations, and vocal and listening effort.

First, the MANOVA on overall ratings shows a significant effect of acoustic treatment ($F(3,221) = 3.06$, $p = 0.029$). The effect is positive with a significant increase in

[*]cynthia.tarlao@mail.mcgill.ca
[†]edda.bild@gmail.com
[‡] catherine.guastavino@mcgill.ca

satisfaction ($F(1,223) = 8.52$, $p = 0.004$), but no effect on conviviality ($F(1,223) = 1.35$, $p = 0.246$) or visual pleasantness ($F(1,223) = 0.37$, $p = 0.545$).

Second, the MANOVA on the general and musical sound experience (i.e. perceived overall level, music attention, perceived music level) shows no significant effect of acoustic treatment ($F(5,219) = 1.11$, $p = 0.36$).

Third, the MANOVA on soundscape evaluations shows a significant effect of acoustic treatment ($F(8,216) = 2.71$, $p = 0.007$). Specifically, acoustic treatment (see Figure 1) significant increases pleasantness ($F(1,223) = 9.28$, $p = 0.003$), eventfulness ($F(1,223) = 5.35$, $p = 0.022$), and vibrancy ($F(1,223) = 1.35$, $p = 0.015$).

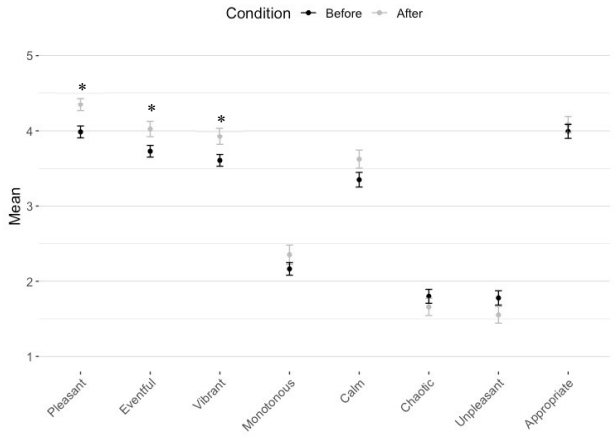


Figure 1: Mean and standard error for soundscape ratings before and after acoustic treatment. * for significant differences

Finally, the MANOVA on conversational effort shows a significant effect of acoustic treatment ($F(6,218) = 3.26$, $p = 0.004$). The effect (see Figure 2) is positive, reducing significant the difficulty to be heard ($F(1,223) = 11.21$, $p < 0.001$), the need to raise the voice ($F(1,223) = 16.87$, $p < 0.001$), the difficulty to understand ($F(1,223) = 13.25$, $p < 0.001$) and to hear ($F(1,223) = 14.54$, $p < 0.001$), but there is no effect on distraction, either from other people's conversations ($F(1,223) = 0.63$, $p = 0.428$) or the overall noise ($F(1,223) = 0.15$, $p = 0.695$).

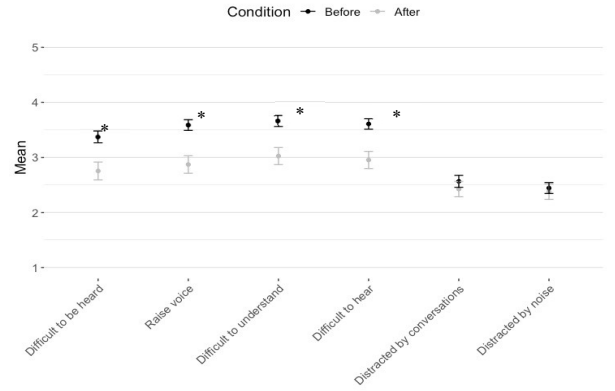


Figure 2: Mean and standard error for vocal and listening effort ratings before and after acoustic treatment. * for significant differences.

Effect of table dividers

The installation of table dividers had a significant effect on vocal and listening effort ($F(12,436) = 2.87$, $p < 0.001$), but not on overall ratings ($F(6,442) = 1.89$, $p = 0.080$), general and musical sound experience ($F(10,438) = 1.48$, $p = 0.144$), or soundscape evaluations ($F(16,432) = 0.91$, $p = 0.556$).
Separate ANOVA on vocal and listening effort shows a significant negative effect of table dividers on difficulty to be heard ($F(2,222) = 9.75$, $p < 0.001$), raising voice ($F(2,222) = 9,13$, $p < 0.001$), difficulty to understand ($F(2,222) = 15.53$, $p < 0.001$), and difficulty to hear ($F(2,222) = 15.34$, $p < 0.001$), but not distraction, either from other people's conversations ($F(2,222) = 1.92$, $p = 0.149$) or the overall noise ($F(2,222) = 1.08$, $p = 0.343$).

4 Discussion

We observed significant effects of both interventions on vocal and listening effort, as well as a significant effect of acoustic treatment on satisfaction and soundscape judgments. Specifically, in the presence of acoustic treatment, participants were more satisfied and found the soundscape more pleasant, eventful, and vibrant. They found it easier to be heard, understand, and hear, and had to raise their voice less, all this, with no decrease in visual pleasantness. Additionally, the presence of table dividers resulted in increased vocal and listening effort.

However, due to COVID restrictions, only employees and students from ITHQ were allowed in the restaurant, which might affect the generalizability of the findings. Additionally, the groups in the divider conditions were highly unbalanced.

In the future, we will explore the effect of personal-related factors (e.g. demographics, noise sensitivity) [2], situational factors (weekdays vs. weekends, number of diners at the table) and the interaction between acoustic treatment and dividers.

5 Conclusion

By comparing diner's experience in a restaurant before and after acoustic treatment, our results highlight the benefits of acoustic treatment on diners' experience as well as the detrimental effect of table dividers. On methodological grounds, the proposed questionnaire could be used to assess acoustic interventions from the user perspective in a wide range of settings.

Acknowledgments

The authors would like to thank Cédric Camier, Sylvain Berger, Pauline Fernandez, and ITHQ. This work was supported by Saint-Gobain Recherche.

References

[1] C. Tarlao, P. Fernandez, I. Frissen, and C. Guastavino, Influence of sound level on diners' perceptions and behavior in a Montreal restaurant. Appl. Acous., 174:107772, 2021.