

Effects of Background Music on Socially Reinforced Problem Behaviors
in Children With Autism Spectrum Disorders

Marc J. Lanovaz and Sarah C. Huxley

Université de Montréal

Author Note

The research project was supported in part by a grant from the Fonds de Recherche du Québec – Société et Culture (2013-NP-164828) to the first author. We thank Isabelle Préfontaine for her assistance with data collection and the École de l'Étincelle for their collaboration. Ethical approval for this project was given by the Comité d'éthique de la recherche des arts et sciences de l'Université de Montréal.

Correspondence concerning this article should be addressed to Marc J. Lanovaz, École de Psychoéducation, Université de Montréal, C.P. 6128, succursale Centre-Ville, Montreal, QC, Canada, H3C 3J7. Email: marc.lanovaz@umontreal.ca

The final, definitive version of this paper has been published in *Psychology of Music*, 45/3, May 2017 published by SAGE Publishing, All rights reserved.
<https://doi.org/10.1177/0305735616657408>

Abstract

Prior research has shown that background music may be effective at reducing problem behaviors maintained by non-social (sensory) reinforcement in children with autism spectrum disorders (ASD). However, no study has examined the effects of background music on socially-reinforced problem behaviors, which are also common in this population. Thus, the purpose of our study was to extend previous research by examining the effects of background music on engagement in problem behaviors maintained by social reinforcement in children with ASD. Following a music preference assessment and a functional analysis, we used an alternating-treatment design to examine the effects of background music on problem behaviors in three children with ASD. Background music produced clear reductions in problem behaviors for one participant and marginal reductions in a second participant. Albeit preliminarily, our results indicate that background music may reduce engagement in problem behaviors maintained by access to other socially-mediated reinforcers.

Keywords: autism, music, problem behavior, social reinforcement

Effects of Background Music on Socially Reinforced Problem Behaviors
in Children With Autism Spectrum Disorders

One of the fastest growing populations of children with special needs are those diagnosed with autism spectrum disorders (ASD), which now represent more than 1% of school-aged children (Blumberg et al., 2013; Ouellette-Kuntz et al., 2014). In addition to experiencing difficulties with social communication and presenting atypical repetitive behaviors, children with ASD tend to engage in higher levels of problem behaviors than children with other developmental disabilities (e.g., Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Hartley, Sikora, & McCoy, 2008). This issue is a significant concern for practitioners and researchers as problem behaviors may interfere with the children's participation in learning and social activities (Lanovaz, Robertson, Soerono, & Watkins, 2013; Matson, Hess, & Mahan, 2013).

A handful of researchers have examined the effects of background music on engagement in repetitive problem behaviors maintained by non-social (sensory) reinforcement in children and adolescents with ASD and other developmental disabilities (e.g., Desrochers, Oshlag, & Kennelly, 2014; Lanovaz, Rapp, & Ferguson, 2012; Saylor, Sidener, Reeve, Fetherston, & Progar, 2012). For example, Lanovaz et al. (2012) and Saylor et al. (2012) showed that background (noncontingent) music reduced various forms of repetitive vocalizations (e.g., grunting, humming, repeating acontextual words, squealing, whining) in children with ASD and the latter study also indicated that children may prefer music over other forms of auditory stimulation. The songs included classical music, children's music and pop music, and were selected based on parental reports or preference assessments. In these studies, background music

was considered a function-based intervention because the auditory stimulation produced by music substituted for (or matched) the stimulation generated by vocalizations.

However, none of the previous studies have examined the effects of background music on problem behaviors maintained by social reinforcement such as attention or access to preferred items and activities. Given that most problem behaviors in individuals with developmental disabilities are maintained by social reinforcement and that the effects of treatments often differ across functions (Beavers, Hanley, & Lerman, 2013), examining the effects of background music on socially-mediated problem behaviors appears important. Albeit music would not be function-based in these cases, its ease of delivery may make it suitable for contexts wherein a parent or educator is unavailable to intervene directly. Thus, the purpose of our study was to extend previous research by examining the effects of background music on engagement in problem behaviors maintained by social reinforcement in three children with ASD. By conducting single-case experiments, we could test our novel intervention in a small sample while still maintaining strong internal validity (Horner et al., 2005). As such, the results should inform the relevance and design of future larger trials on using background music with this population.

Method

Participants, Settings, Data Collection, and Interobserver Agreement

Three boys attending a specialized school for children with ASD participated in the current study. The students were referred to the research team by their educators because each engaged in problem behaviors that were potentially maintained by social reinforcement and the student:staff ratio prevented the implementation of more time-consuming interventions. Tony and Arthur were 6 and 7 years old, respectively, and did not have any formal means of communication. Tony mainly engaged in scratching and pinching others whereas Arthur

exhibited throwing objects and screaming. Luke was 6 years old and communicated using a pictorial system. He engaged in pinching, kicking, hitting, and biting himself and others.

We defined problem behaviors as any behavior directed towards oneself or others that could potentially produce physical damage or that was disruptive for others (i.e., scratching, pinching, throwing, screaming, hitting, biting, and kicking). Each child's classroom was divided into multiple areas (e.g., group teaching area, leisure area, independent work area). We conducted the sessions in the leisure area as each teacher reported that the target behaviors were most problematic during free time. For each child, we recorded all sessions on video and subsequently measured the frequency of their targeted forms of problem behaviors. To measure interobserver agreement (IOA), a second observer recorded the frequency of problem behaviors for at least 33% of sessions for each participant using the block-by-block method with 10-s intervals. Mean IOAs were 98% (range: 90%-100%) for Tony, 97% (range: 93%-100%) for Arthur, and 96% (range: 92%-100%) for Luke.

Procedures

Music preference assessment. Prior to the treatment assessment, we conducted a modified paired-choice preference assessment to identify the preferred songs subsequently used as background music (Lanovaz et al., 2012). Specifically, we assessed preference for five age-appropriate songs for each participant, which were selected based on both teacher and parental reports of child preference. During the assessment, we presented songs in pairs. During each trial, we placed two external speakers in front of the child. Each speaker was associated with one of the two songs of the pair being assessed. At the beginning of the trial, we prompted the child to touch one speaker and played the associated song for 30 s. The song only played from the speaker that the child touched. Then, we repeated the same procedure with the other speaker and

played the second song for 30 s. Finally, we removed the child's hands from the desk and asked him to touch the speaker associated with song he wanted to listen to. When the child selected a speaker, we played the associated song for an additional 30 s and recorded his choice on a data collection sheet. If he did not choose a song, we immediately repeated the procedures once with the same pair. Failure to choose a speaker on the second trial resulted in the trainer recording no choice for the pair. Each song was presented with each other song twice in a random order and we counterbalanced the side on which we presented each song (i.e., left or right speaker) on the second trial. The most preferred song was the one selected the most often. Table 1 presents the songs assessed and identifies the most preferred songs used as background music for each participant.

Functional analysis. To confirm that the problem behaviors were maintained by social reinforcement, each child participated in a functional analysis with 5-min sessions in which we alternated a play condition with a test condition based on the hypothesized function of the problem behaviors (Iwata & Dozier, 2008). These hypotheses were developed by questioning the teachers about the stimuli and events correlated with the problem behaviors and by conducting observations in settings in which these behaviors were most likely to occur. The test comparison was a tangible condition for Tony and Luke, and an attention condition for Arthur. In the play condition, the child had access to toys and activities hypothesized to maintain the problem behaviors (i.e., movie turned on for Tony and an iPad for Luke) and the research assistant provided attention every 15 s, which was delayed for 5 s if problem behaviors occurred simultaneously. Otherwise, she provided no consequences for engagement in problem behaviors. In the tangible condition, Tony watched a movie and Luke played with an iPad for 1 min prior to the start of the session. Then, the research assistant removed the preferred activity and indicated

that the children could play with the other toys available. Contingent on problem behaviors, she provided the preferred activity for a 15-s period. The attention condition was identical to the play condition except that the research assistant provided attention (i.e., a brief verbal reprimand) contingent on problem behaviors (rather than on a noncontingent basis).

Treatment assessment. To examine the effects of background music on problem behaviors, we alternated a baseline condition with a background music condition within an alternating-treatment design. The baseline conditions for each participant were identical to the test condition of their functional analysis, but each session now lasted 10 min. The background music conditions were the same as baseline except that we played a preferred song in a loop continuously through external speakers (Tony and Luke) or headphones (Arthur) during the entire session. Given that Luke equally preferred two songs, we played the two songs in a sequence. In addition, Arthur also participated in a noncontingent attention condition, which was alternated with the previous conditions. During this condition, the research assistant provided attention every 15 s regardless of problem behaviors (as in the play condition of the functional analysis).

Results

Figure 1 presents the results of the functional analysis and treatment assessment for each participant. During the functional analysis, Tony engaged in higher rates of problem behavior (per min) during the tangible condition ($M = 1.2$) than during the play condition ($M = 0.2$). During the treatment assessment, rates of problem behavior remained lower in the background music sessions ($M = 0.5$) when compared to the baseline sessions ($M = 1.6$). For Arthur, we observed higher rates of problem behavior in the attention condition ($M = 2.3$) than in the play condition ($M = 0.7$) of his functional analysis. In general, Arthur engaged in lower rates of

problem behavior in the background music ($M = 0.2$) and noncontingent attention ($M = 0.4$) sessions in comparison to baseline ($M = 0.9$). Notably, rates of problem behavior remained at zero for the last five of six background music sessions whereas the behaviors continued to occur variably during baseline and to a lesser extent during noncontingent attention. Finally, Luke's functional analysis indicated that problem behaviors were more likely to occur in the tangible condition ($M = 2.2$) than in the play condition ($M = 0.1$). However, rates of problem behavior remained similar across baseline ($M = 2.9$) and background music ($M = 3.6$) sessions.

Discussion

Overall, providing access to background music produced clear reductions in socially reinforced problem behaviors for one participant (Tony) and marginal reductions in a second participant (Arthur). We observed these reductions even though social reinforcement remained available for engaging in problem behaviors. One potential behavioral mechanism that may explain these results is that background music may have functioned as an abolishing operation, which reduced the child's motivation to engage in the socially reinforced problem behaviors (Laraway, Snyckerski, Michael, & Poling, 2003). Given that the television also produced auditory stimulation, listening to music may have substituted for part of the stimulation generated by television for Tony. Music also reduced attention-maintained problem behaviors (Arthur), which suggests that music may also compete with other forms of reinforcement (see Leblanc, Patel, & Carr, 2000).

Our study extends the research literature on using background music to reduce problem behaviors in children with ASD and other developmental disabilities (e.g., Desrochers et al., 2014; Lanovaz et al., 2012; Saylor et al., 2012) by applying the treatment to behaviors with a social function. From a practical standpoint, using background music may be an interesting

option when it is not possible to use the stimulus maintaining the problem behaviors as part of the treatment. In our study, it was not possible for the teacher to provide attention or access to the reinforcers (e.g., television) during certain periods of time, which made it important to identify alternatives that did not involve the delivery of these stimuli as reinforcers. It should also be noted that music reduced engagement in problem behaviors despite being implemented without extinction; that is, the social reinforcers provided for engaging in problem behaviors remained available during background music. Therefore, the treatment may also be an option when implementing extinction in the environment is unfeasible.

Our results are limited in several manners and should be viewed as preliminary until replicated by other researchers. The procedures were implemented in a school setting, which may be stigmatizing for some children, but less so than engaging in problem behaviors. Our study should be replicated in other settings (e.g., home, community environment). Another limitation is that we used headphones to provide background music to Arthur, but we did not assess their effects in isolation; the headphones may thus have functioned as a confounding variable. We also did not measure appropriate behavior, generalization, maintenance, treatment integrity, or social validity. In the future, researchers should replicate our study with more participants while including these measures.

Furthermore, the intervention did not reduce problem behaviors for one participant. In this case, it may have been necessary to implement an extinction component simultaneously; researchers should examine whether combining background music with extinction reduces the latter's side-effects or produces more rapid reduction in problem behaviors. The results may also be limited insofar as we only assessed one function with each participant; it is possible that the problem behaviors had other social functions that we did not test within our functional analysis.

In the future, researchers and clinicians should consider teaching children to request music or providing music in the absence of problem behaviors (rather than on a noncontingent basis).

Examining the impact of background music on other populations (e.g., patients with dementia) may also be interesting avenues for further investigation.

Acknowledgments

We thank Isabelle Préfontaine for her assistance with data collection and the École de l'Étincelle for their collaboration.

Funding

The research project was supported in part by a grant from the Fonds de Recherche du Québec – Société et Culture (2013-NP-164828) to the first author.

Ethical Approval

Ethical approval for this project was given by the Comité d'éthique de la recherche des arts et sciences de l'Université de Montréal.

References

- Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty years of research on the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 46*, 1-21. doi: 10.1002/jaba.30
- Blumberg, S. J., Bramlett, M. D., Kogan, M. D., Schieve, L. A., Jones, J. R., & Lu, M. C. (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged US children: 2007 to 2011–2012. *National Health Statistics Reports, 65*, 1-11.
- Desrochers, M. N., Oshlag, R., & Kennelly, A. M. (2014). Using background music to reduce problem behavior during assessment with an adolescent who is blind with multiple disabilities. *Journal of Visual Impairment & Blindness, 108*, 61-64.
- Dominick, K. C., Davis, N. O., Lainhart, J., Tager-Flusberg, H., & Folstein, S. (2007). Atypical behaviors in children with autism and children with a history of language impairment. *Research in Developmental Disabilities, 28*, 145-162. doi: 10.1016/j.ridd.2006.02.003
- Hartley, S. L., Sikora, D. M., & McCoy, R. (2008). Prevalence and risk factors of maladaptive behaviour in young children with autistic disorder. *Journal of Intellectual Disability Research, 52*, 819-829. doi: 10.1111/j.1365-2788.2008.01065.x
- Horner, R. H., Carr, E. G., Halle, J., Mcgee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179. doi: 10.1177/001440290507100203
- Iwata, B. A., & Dozier, C. L. (2008). Clinical application of functional analysis methodology. *Behavior Analysis in Practice, 1*, 3-9.

- Lanovaz, M. J., Rapp, J. T., & Ferguson, S. (2012). The utility of assessing musical preference before implementation of noncontingent music to reduce vocal stereotypy. *Journal of Applied Behavior Analysis, 45*, 845-851. doi: 10.1901/jaba.2012.45-845
- Lanovaz, M. J., Robertson, K., Soerono, K., & Watkins, N. (2013). Effects of reducing stereotypy on other behaviors: A systematic review. *Research in Autism Spectrum Disorders, 7*, 1234-1243. doi: 10.1016/j.rasd.2013.07.009
- Laraway, S., Snyckerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36*, 407-414. doi: 10.1901/jaba.2003.36-407
- LeBlanc, L. A., Patel, M. R., & Carr, J. E. (2000). Recent advances in the assessment of aberrant behavior maintained by automatic reinforcement in individuals with developmental disabilities. *Journal of Behavior Therapy & Experimental Psychiatry, 31*, 137-154. doi: 10.1016/S0005-7916(00)00017-3
- Matson, J. L., Hess, J. A., & Mahan, S. (2013). Moderating effects of challenging behaviors and communication deficits on social skills in children diagnosed with an autism spectrum disorder. *Research in Autism Spectrum Disorders, 7*, 23-28. doi: 10.1016/j.rasd.2012.07.002
- Ouellette-Kuntz, H., Coo, H., Lam, M., Breitenbach, M. M., Hennessey, P. E., Jackman, P. D., ... & Chung, A. M. (2014). The changing prevalence of autism in three regions of Canada. *Journal of Autism and Developmental Disorders, 44*, 120-136. doi: 10.1007/s10803-013-1856-1

Saylor, S., Sidener, T. M., Reeve, S. A., Fetherston, A., & Progar, P. R. (2012). Effects of three types of noncontingent auditory stimulation on vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 45*, 185-190. 10.1901/jaba.2012.45-185

Table 1. Songs included in the music preference assessment for each participant

Participant	Song	
	Title	Artist, composer, or album
Tony	Caillou Theme	Caillou
	Le Beau Petit Bonhomme	Carmen Campagne
	Le Poussin Piou	Morgana Giovannetti
	Love Theme	Philippe Rombi
	Arrival of the Queen of Sheba	Handel
Arthur	1, 2, 3, ... Soleil!	Bébé Lilly
	La jungle des animaux	Bébé Lilly
	Raspoutine	Bébé Lilly
	Funnybear (French version)	Gummybear
	Roar	Katy Perry
Luke	Five Little Monkey	Flickbox Kids Songs and Rhymes
	Head and Shoulders Knees and Toes	Super Simple Songs
	Jean Petit Danse	Martial
	Jingle Bells	Evergreen Christmas
	L'ABC des Fruits	Didier Lester

Note. Bold identifies the most preferred song(s) for each child.

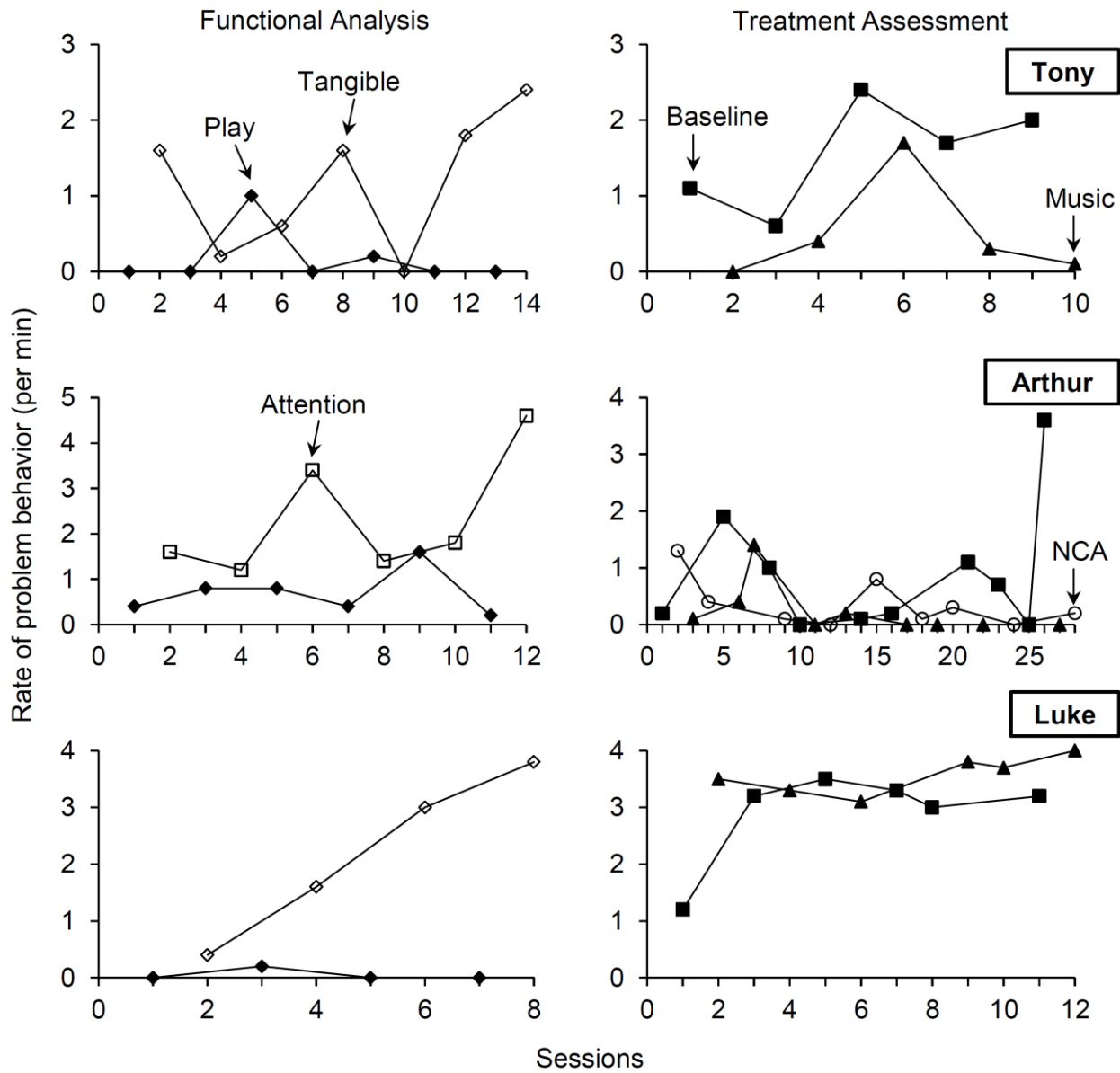


Figure 1. Rates of problem behavior during the functional analysis (left panels) and during baseline, background music, and noncontingent attention (NCA; Luke only) sessions (right panels) for Tony, Arthur, and Luke.