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Audience gaze while appreciating a multipart musical performance

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ABSTRACT

Visual information has been observed to be crucial for audience members during musical performances. The present study used an eye tracker to investigate audience members' gazes while appreciating an audiovisual musical ensemble performance, based on evidence of the dominance of musical part in auditory attention when listening to multipart music that contains different melody lines and the joint-attention theory of gaze. We presented singing performances, by a female duo. The main findings were as follows: (1) the melody part (soprano) attracted more visual attention than the accompaniment part (alto) throughout the piece, (2) joint attention emerged when the singers shifted their gazes toward their co-performer, suggesting that inter-performer gazing interactions that play a spotlight role mediated performer-audience visual interaction, and (3) musical part (melody or accompaniment) strongly influenced the total duration of gazes among audiences, while the spotlight effect of gaze was limited to just after the singers' gaze shifts.

1. Introduction

What do audiences look at when they watch and listen to an ensemble music performance? Many studies have explored what factors attract visual attention, when they attract the attention, and how (reviewed in Carrasco, 2011). In particular, gaze has been observed as an indicator of visual attention. However, the gaze of the audience of a musical performance remains unclear even though visual information has a great impact on an audience appreciating an audiovisually presented musical performance (e.g., Platz & Kopiez, 2012). Investigations of gaze in various situations thus contribute to a holistic understanding of human behavior.

Taking into account auditory attention, while appreciating audio-visually presented music, a complicated audience gaze is likely to emerge. This assumption is supported by findings that visual attention interacts with auditory attention. For example, in brain activity, the circuit related to auditory attention is linked with the circuit related to vision (Winkowski & Knudsen, 2006). In Driver and Spence's review of crossmodal attention, auditory stimuli affect visual attention, while visual stimuli do not influence auditory attention (Driver & Spence, 1998). These findings suggest that visual attention is associated with the cognition of musical sound.

In the present study, we particularly focused on the gaze of the audience while the audience is appreciating an ensemble performance in order to explore the psychological process of music appreciation as audiovisual experience. An ensemble

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performance involves multiple musical parts and performers that can potentially divide or integrate the audience's attentions, as well as inter-performer interaction cues (reviewed in Keller, 2014) that could influence performer-audience visual interactions. Despite such intriguing aspects, fundamental perspectives on audience gaze are insufficient. What attracts the gaze of an audience during the appreciation of a musical performance? Do audiences evenly look at the whole of an ensemble, or do they look at specific performers? If so, why? To find out, we explored gazing behavior during ensemble music appreciation.

First, in accordance with the dominance of a musical part in auditory attention when listening to multipart music that contains different melody lines, we hypothesize that auditory attention, depending on the musical part (melody or accompaniment, namely soprano or alto in the present study), influences visual attention. Soprano is the highest female voice (Jander, 1980), while alto is lower than soprano. Ensemble performance often involves multipart that could potentially yield a bias of auditory attention. For example, prior studies have shown a higher-pitched effect, in which higher voices attracted listeners' attention in multipart music (e.g. Fujioka, Trainor, Ross, Kakigi, & Pantev, 2005). Nevertheless, in audiovisual music appreciation, no study has examined whether such auditory attention corresponds to visual attention.

Second, we hypothesized that inter-performer gazing affects an audience's visual attention. In accordance with the joint-attention theory, we highlighted, in particular, one potential function of the gaze as spotlight, as suggested by Kawase's study (Kawase, 2009a), in which a singer in a pop band directed her gaze toward a co-performer who played a solo part. Since previous studies have mostly focused on performer-audience visual interactions in solo performances, this hypothesis regarding ensemble performances differs from available findings. In light of the reciprocal interaction model including performer-audience communication flows during musical performances (Hargreaves, MacDonald, & Miell, 2005; Kawase et al., 2007), gaze interactions between performers (Davidson, 2005; Kawase, 2009a; Kawase, 2014a; Kawase, 2014b; Moran, 2010) can influence audiences' visual attention.

This hypothesis is also supported by the joint attention theory that revealed that a person's visual cue can attract other person's visual attention (e.g. Baron-Cohen, 1995; Frischen, Bayliss, & Tipper, 2007). If this theory is applicable to musical performances, gazing interactions between performers could influence the visual attention of audiences. Data of audiences' gazes during musical performances could shed light on additional aspects of joint attention.

Third, in the context of audiovisual interactions during multimodal music appreciation (e.g. Platz & Kopiez, 2012), it would be beneficial to investigate how audio and visual attention are associated with each other. We hypothesized that certain audiovisual interactions alter the audience's gaze. Therefore, we investigated how the audience's visual attention reacted when auditory attention (e.g. dominance of a musical part) and visual attention (joint attention between the performer and the audience) simultaneously emerge. Given that ensemble musical performance potentially causes attention allocation in both auditory (multipart) and visual (multi-party) aspects, this attempt could lead to an understanding of attention in simulated multimodal situations in the real world.

To investigate these issues, we used eye tracking to analyze audience members' gaze when watching an actual performance by a singing duo. Given that multipart music is often played in an ensemble, and that gaze between performers naturally emerges in music performance, our attempt would be in agreement with ecological validity. Factors that support our hypotheses are reviewed below.

1.1. Auditory attention in multipart music

Prior studies have explored how listeners recognize each melody in multipart music. In terms of auditory attention, higher-pitched parts have been observed to attract more listeners' attention. Gregory's (1990) study of melody recognition in multipart music found that participants could recognize each melody in multipart music with significant accuracy and that factors such as the relationships and distances between keys and pitches affected recognition; specifically, higher melodies were better recognized than lower ones when there were significant gaps in pitch between melodies. With respect to the relationship of melody and accompaniment part, Uhlig, Fairhurst, and Keller (2013) examined the influence of structural and temporal aspects on auditory attention in multipart music and showed that the melody part was perceived as leading compared to accompaniment part. Furthermore, cognition research has elucidated high-voice superiority in polyphonic music, meaning that listeners pay more attention to higher pitches (Fujioka et al., 2005; Trainor, Marie, Bruce, & Bidelman, 2014), even among very young (three-month-old) children (Marie & Trainor, 2014). By demonstrating the model, Trainor et al. (2014) suggested that such high voice superiority was derived from characteristics of the auditory nervous system.

Other studies have explored how ensemble performers integrate multipart melodies by measuring behavioral (Bigand, McAdams, & Forêt, 2000) and brain activity (Ragert, Fairhurst, & Keller, 2014). Although these findings yield important perspectives on perceptions of multipart music, it remains unclear how musical parts (melody and accompaniment) affect the visual attention of audiences during ensemble performances. Thus, the present study examined the influence of musical parts on the gaze of audience members.

1.2. Joint attention as one of the functions of gazing in everyday communication

Joint attention represents the sharing of attention among other person(s) in communication when the other person(s) are referring to something. This function's tendancy to alter attentions has been investigated in daily communication