

## **Emotional Synchrony between Performers and Audiences in live Concert and Theater**

### **Arts|Science Initiative 2014 Faculty Collaboration Grant**

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### **Introduction**

The overarching goal of our proposal is to better understand the mechanisms through which actors and musicians are able to induce strong emotional states in one another as well as audience members. There is general agreement between audience members and performers regarding the general quality of a given performance. Despite such agreement, there exists very little research into the mechanisms that allow performers, both actors and musicians, to engender specific emotions in others. Consequently, the means through which quality performances are able to induce strong emotions and transformational experiences in some audience members and not others is poorly understood. This proposal seeks to address this very issue through the utilization of expert improvisational actors at the Second City comedy club (Chicago, Illinois) and the world-class musicians from the Pacifica Quartet (now the Don-Randel Ensemble in Residence at the University of Chicago). As will be described in more detail below, we will utilize ultraportable physiological monitors to record variables associated with emotion expression and experience including heart rate, skin temperature and body movement. In order to evaluate aspects of physiological and emotional resonance, these devices will be worn by performers and select audience members during a live performance.

### **The relationship between emotion and physiological activity**

Since the work of the late 19<sup>th</sup> century philosopher and psychologist William James (James, 1884), the relationship between the experience of an emotion and its concomitant physiological responses has been a very active and recently burgeoning area of research (for review see Norman et al., 2014). Over a century after James' influential work, researchers continue to explore the precise relationship between physiological processes and the experience of specific emotions (e.g. joy, disgust, surprise) with increasingly advanced theoretical models, empirical approaches, and diagnostic technologies, such as EGG, fMRI, and physiological monitors. These developments have resulted in a much-refined and accurate ability to monitor relevant psychophysiological processes in real-time across multiple individuals with a minimally invasive protocol. Taking advantage of these developments and tools, and exploring them in expert performers serves as the foundation of the present project. Specifically, we propose to monitor well validated psychophysiological parameters in performers and audience members in actual live performances to understand the extent to which musical compositions or on-stage improvisations in experts are able to induce psychophysiological states associated with distinct emotions in audience members, and also test whether these states match subjective ratings recorded in audience members as well as actors and musicians. Additionally, this approach will allow for the evaluation of individual differences in psychophysiological resonance between performers and audience members as well as the extent to which this resonance is associated with reported emotion and evaluation of the respective performance.

### **Intellectual significance**

In addition to the novelty of approach used in this proposal, the primary intellectual significance of our approach will be a contribution to recently growing research in "Aesthetic

Science." Our project is aligned with a recent revival of empirical aesthetics, which was founded in the nineteenth century by Gustav Fechner (Fechner, 1876) in an attempt to bridge the gap between "top-down" philosophy and "bottom-up" science. Since then, "aesthetic science" has seen various periods of stagnation and growth (Shimamura & Palmer, 2012). An important recent milestone is the journal *Psychology of Aesthetics, Creativity and the Arts* which was founded by the American Psychological Association in 2006 and has become an important forum for a wide range of studies, including a 2013 issue on neuroaesthetics. Our proposed research develops a new approach to central concerns of aesthetic science, which has traditionally focused on studying aesthetic perception, understanding aesthetic judgment, and the impact of art on our emotions. As the development of new research paradigms requires both a sustained collaborative effort and ongoing support, our application of cutting-edge technology that is capable of measuring real-time emotion-sensitive psychophysiological processes in world-class performers and their audience members as well as the ability to integrate these data with an expert understanding of aesthetics, responds directly to the intellectual challenge of "insufficient interdisciplinary integration" in empirical aesthetics (Nadal & Skov, 2013). Moreover, our project will serve as a foundation for subsequent projects that seeks to connect the scientific study of emotions with the aesthetic appreciation and the widely reported, but little understood ability of some performers to induce strong emotions in audience members ostensibly based on some type of aesthetic appreciation. By integrating scientific innovation with outstanding musical and theatrical performances, such research has the potential to provide a novel approach to the study of real-world aesthetic experience and aesthetic judgment..

## Working methodologies

In order to monitor real time emotion-relevant psychophysiological processes we will have performers (musicians and actors) and a sample of audience members wear ultraportable bioharness devices (Equivalital Life Monitors, Cambridge, UK). These devices are made to be minimally invasive and can be worn underneath standard clothing without limiting any movement or being visible. The devices record a number of high quality bio-signals including an electrocardiogram (ECG) for monitoring heart rate and heart rate variability (HRV), infrared thermometers to measure surface skin temperature, respirometer to measure breathing rate and depth, and highly sensitive accelerometers for measuring subtle movements. These parameters have are widely used in laboratory settings to monitor emotion-specific physiological reactions (see Kreibig, 2010). For example, previous studies have demonstrated that the experience of elation is associated with decreased cardiovascular activity (Waldstein et al., 2000), while others have found the experience suspense to be related to increased respiration variability (Boiten, 1998). Moreover, the ability to use such variables to predict the experience of specific emotions has been demonstrated in laboratory experiments (Nyklíček, Thayer & Van Doornen, 1997; Thayer & Faith, 2001; Ellis & Thayer, 2010). Therefore, the our approach seeks to apply methods to monitor the experience of emotion in performers and audience members using that have been well validated but never explicitly utilized to monitor the emotional experience of real-world performances.

In addition to collecting high quality data, these devices are capable of synchronizing to allow for time-sensitive analyses to determine the extent to which emotion-specific physiological processes (i.e. responses associated with joy, or disgust) resonate across individuals. In other words, with the application of these devices (and software) one is able to measure the extent to

which a given emotion-related physiological state in the musicians (or actors) at time 1 is associated with an emotion-related physiological state in another individual (performer or audience member) at time 2.

With regards to gaining access to the performers, Berthold Hoeckner has contacted the Pacifica Quartet and they have expressed interest in collaborating with us in upcoming on-campus performances as part of the University of Chicago Presents Concert series.. Similarly, one of the research assistants on the project (Greg Poljacik) has maintained a working relationship with members of Second City and has approached them about participating in this project with positive results. Second City is world recognized for its sketch comedy and improv and has won numerous awards over its 50 year history. Numerous highly successful actors have worked at The Second City including Bill Murray, Steve Correll, & Tina Fey just to name a few. Second City puts on shows seven nights a week that consist of short scenes, songs, and improvised comedy sketches.

### **Procedure**

Both performance groups (actors & musicians) will be fitted with the ambulatory devices prior to their show. We will randomly request a 5 audience members from each show to also wear versions of the ambulatory device. We propose to collect data from at least 5 shows. Furthermore, we will provide the audience members with tablets where they will be asked to provide ratings of their current emotion at randomly selected intervals during the show based upon previously validated methodologies of rapidly measuring evaluative processes (Norman et al., 2011). Audience members and performers will be asked to provide brief ratings of the quality of the show at its conclusion. The primary research questions will be as follows: (1) Do the reported emotions during the show correspond to the same emotion-related psychophysiological

processes that have previously been demonstrated in the lab (2) Does the emotion-related physiological signals resonate from performers to audience members during the show, (3) Does the emotion-related physiological signals resonate across performers (i.e. similar signals between performers across time during the show) and (4) Does the rated quality of the performance correlate with the psychophysiological responses during the show in both actors and audience members.

### Proposed budget

We request primary funds to purchase 8 ambulatory units at a cost of \$1500 per unit for a total of \$12,000 (Equivital life monitors, Cambridge, UK). The necessary harnesses, recording software, analysis software and additional ambulatory units will be acquired through funds outside of this proposal. We request \$3,000 for payment of research participants.

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