

# Brain Opera

## Exploring Surveillance in 360-degree Immersive Theatre

Ellen Pearlman

**N**oor: *A Brain Opera* is the first full opera where a performer, wearing a wireless EEG headset, triggers videos, a sonic environment, and a libretto with her brainwaves. The brainwaves are also displayed in live-time as the performer interacts with audience members within the confines of a 360-degree immersive theatre, and a dramatic story is narrated between the performer and me. *Noor* had its world premiere at ISEA 2016 Hong Kong (International Society for Electronic Art) on May 18, 2016. As I conceived and directed the work, its theme was loosely framed around the following metaphorical question: Is there a place in human consciousness where surveillance cannot go? Through images, sonic environment, pre-recorded libretto, and spoken narrative, the opera presented the true story of the life of Noor Inayat Khan, a Sufi Muslim Princess and covert British operative inside Nazi-occupied France, who was murdered at Dachau. It touched upon issues of memory, faith, and the locus of self in light of increasingly invasive and sophisticated surveillance technologies. The performance also worked with the bodies of both the performer and participants by creating a responsive feedback loop in which the performer's interactions with the audience—through movement, gaze, touch, and speech—visibly changed the performer's brainwaves.

*Noor: A Brain Opera* explores the life of a young woman, Noor Inayat Khan, whose father Hazarat Inayat Khan brought Sufism to the West early in the twentieth century. Noor, born in Moscow of an American mother and Indian father, grew up in a peaceful household outside of Paris. When she was thirteen her father suddenly passed away while on a pilgrimage in India, leaving Noor and her mother in charge of her younger siblings. World War II broke out and the family moved to England for safety. Unable to stand idly by as the war unfolded, Noor as a young adult entered British secret intelligence training as a covert wireless

operator. After some months, she was parachuted into Nazi-occupied France to track the movements of the Nazis in Paris. At one point, she was the only communications link back to the Allies. Living between a number of safe houses, Noor was betrayed and arrested three times (escaping each time) before finally being sent to Dachau, where she was shot and executed. During her imprisonment, Noor never divulged any information concerning her training or collaborators. This fact provided an underlying theme in my work, one which directly related to my questions about the relationship between surveillance and human consciousness, especially human biometric indicators—most notably the human brain.

The opera was in development for two years. Once I developed a working proof of my concept that brainwaves could indeed trigger visuals, sound, and speech, I contacted a Max/MSP programmer in New York, Tommy Martinez, who developed a patch to trigger different brainwave patterns according to four different mental states. I then enlisted sonic artist Taras Mashtalir, and librettist and electronic poet Natali Fedorova, both from St. Petersburg, Russia, to begin composing a score and a background libretto. The performance text would be based on both a biography of Noor, titled *Spy Princess*, as well as the film *Enemy of the Reich*, which was about her life. Saba Arat, a musician from Istanbul who lives in Hong Kong, was the performer. Technical director William Wong and choreographer David Leung were also Hong Kong-based. The process of making this brain opera focused initially on the story, and how to suggest the main character's interior mental states, as well as on the coding of the technical implementations. Collaborations often took place between New York, St. Petersburg, and Hong Kong using a combination of Skype and Team Viewer, which allowed different programmers to take control of the computer screen in Hong Kong and debug recalcitrant software code.

The sonic score, the pre-recorded libretto, and the videos were contained inside four electronic databanks that corresponded to the emotions of excitement, interest, meditation, and frustration. These databanks would be triggered according to pre-set thresholds that were calibrated during rehearsals with the performer. For example, the databases of meditation, when triggered by Saba's brainwaves once her specific threshold state was attained, would produce harmonious sounding music. The libretto would intone the ninety-nine names of God in English (translated from Arabic), and the videos would display tranquil types of images. The sequencing of these sounds, visuals, and pre-recorded words would fire randomly from within each individual repository, but only when the pre-determined threshold of the measurement of a particular emotion was reached. The threshold had to be attained or else the emotional state would potentially trigger all the time. Databanks corresponding to the emotion of excitement would

produce short, choppy sounds—libretto phrases that evoked videos of extreme movement—with the other emotions of interest and frustration following similar, but distinct trajectories. The databank would only trigger when a high level of emotion was detected.

As an interactive brain opera, *Noor* took advantage of the recent emergence of consumer-based EEG brainwave headsets and various other devices capable of interacting with and augmenting new technologies. It was developed using an Emotiv headset, a model I selected because it allows access to more mental states and has greater stability than other similar consumer headset models. This meant that while wearing an Emotiv brainwave headset, a performer was able to trigger videos, a sonic environment, and a pre-recorded spoken libretto according to each emotional category—the states most readily available at this time using these technologies. During the event, the performer's brainwaves were displayed in live time as part of a five-screen immersive theatrical experience. Different graphical and colored representations of these states would arise and fade out as per the levels of emotional intensity of the performer.

The opera was an emotionally powerful and immersive experience for the performer, crew, and observers. The story and interaction took place over approximately a twenty-minute period. Wearing a brainwave headset for longer than this was not feasible for a performer, due to both the pressure from the headset on her head and the closeness of its Bluetooth wireless signals to her brain. The experience began as soon as the audience walked into the darkened theatre. The performer and I had a spotlight on us, and a small pedestal held the laptop computer I used to monitor the correct placement of the Emotiv headset sensors. I placed the brainwave headset onto the performer's head as she sat on a stool. In this way, the audience became part of the set-up process. The spectators were given a brief introduction as well as instructions about what the five screens and sounds represented. I explained that they would see colored bubbles on one screen and that the colors reflected different emotional states, which would be activated at various times throughout the performance. The colors and their corresponding emotions were as follows:

Pink = interest  
Yellow = excitement  
Turquoise = meditation  
Red = frustration

The videos corresponding to those emotions would, at various times, be launched on one of the four screens, with different images fading in and out, depending on the intensity of the performer's emotional state. The sonic environment and the

pre-recorded words of the libretto, which also corresponded to emotion, would be triggered simultaneously by the performer's brainwaves. I would explain that the performer was free to respond through her words and actions. Once the explanation had been given to the audience, the spotlight was shut off and the performance began.

The audience did not always understand that they were free to walk around the theatre, but once the performer approached a participant to interact with her through gaze, speech, or touch, they began to move more fluidly throughout the space. At that point, the sonic environment would change, as would the display color of the brainwave-generated graphics, as well as the various videos projected onto the walls of the 360 degree-theatre. The audience's behavior affected the performer's brainwaves as well, such that there existed a continual feedback loop: story-performer-audience-story-performer-audience.

The question of how to represent the interior workings of someone's brain guided our work. My approach was to use actual video images I had collected over the years, as well as to incorporate whisper-like words of association, live narration, and a themed sonic environment. Humans are hard-wired to understand stories, and I wanted drama and narration to prevail in such a highly technical environment. I was not particularly interested in using generative graphics, except to represent the four different brain states in real-time.

On the technical side, I used multiple types and configurations of hardware and software that interacted and responded in ways they were not necessarily built for. This included taking electrical EEG signals, extracting them from Saba's brain through the Emotiv headset, and sending them via Bluetooth to a number of other software programs. The EEG signals' numeric values were extracted from those software programs and sent wirelessly over a network to other software programs that could interpret and modulate the EEG signals. Those same signal values were transformed through yet another software program and sent to another computer where they were split between video display programs and custom-built audio software. This was done to ensure that the sonic environment, the pre-recorded libretto, and the videos would trigger simultaneously, as issues of timing and control were critical. Customized software launched the visuals and sounds from the four separate databanks. Finally, the audio and spoken-word librettos were sent out to sound speakers mounted inside in the theatre. The four videos and generative graphics representing Saba's live-time brainwaves were sent through a specialized professional theatrical video software program that was custom calibrated to display the video images on the fifteen-foot high curved walls that comprised the theatre.



Top: Saba Arat with Emotiv headset placed on her head in front of audience by Ellen Pearlman. Photo: Vincent Mak. Middle: Test rehearsal with audience in 360-degree theatre. Images of interest (left) and excitement (right) display on curved 15-foot walls. Sonic artist Taras Mashtalir does sound check on the left, Saba Arat moves among the audience on the right. Photo: Ellen Pearlman. Bottom: Saba Arat interacts with choreographer David Leung as images of excitement appear behind on 15-foot tall screen. Photo: Vincent Mak.

During the final month before the brain opera's premiere, there were approximately three to four audience previews with selective volunteer audience members. I solicited feedback from the spectators about their experience of the opera. What became apparent in our exchanges was that they did not understand the connections between the performer's brainwaves, the images, sounds, libretto, and the life of Noor Inayat Khan. The pre-recorded libretto was not strong enough to convey the story line. It was more effective as a supplement. This meant that Saba Arat and I had to work out a spontaneous narrative to guide the audience into the dramatic story of the opera. We discovered that a back-and-forth dialogue helped the subsequent test audiences make connections between the subjective experience of the performer, story, visuals, sonic environment, libretto, and their own experiences with the spectacle. Audience interaction with and in response to the central performer changed as they became enmeshed in both the story and the immersive context.

I learned through my work that audiences were drawn in by unexpected twists in conflict and when the boundaries between the real and the unreal unraveled—when outer perceptions and inner realities became temporarily suspended. According to director John McGrath, author of *Loving Big Brother: Surveillance Culture and Performance Space*, once spatial experience has been appropriated, there is an anticipation of suspense, the suspense of not knowing how one will act. In this moment of unknowing there is the possibility of agency within the space. At this decisive point, information can be translated into abstract data and re-assembled as decontextualized “data doubles” or “data flows,” from which further information can be extracted. Surveillance in this context—a brainwave projected live in a theatre—is used as a cultural practice where the understanding of its aims is part of its structure. It allows popular culture, media, art, and narrative to offer unique insights into cultural surveillance practices.

This approach allowed me to explore with subtlety whether there is a place in human consciousness that surveillance cannot enter. I wanted the audience to experience the sense of surveillance by instilling in its members a feeling of empathy for the main character, rather than being directly surveilled themselves. The sense of having the artwork be open to interpretation, instead of directing the audience in an overt and potentially didactic experience, was an important element of the performance.

The premiere of *Noor: A Brain Opera* proposes a new, content-rich environment for creative practitioners to explore. Although the first use of EEG sensors and the brain by artists took place in 1965, with a concert by Alvin Lucier, *Music for Solo Performer*, and has been used by various artists since then, the availability of

consumer-grade EEG sensors has made the brain a new instrument for all different types of performative interactions.<sup>1</sup> These new forms are still awaiting discovery.

## NOTES

1. Many people think that Todd Machover premiered the first brain opera in 1996 at Ars Electronica in Linz, Austria, however this is incorrect. There was no BCI (Brain Computer Interface) in use, and the so-called opera was concerned with site-specific installations involving various interactive haptic sensors.

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