

When the water returns: Context

each of these piece titles
should be in italics
(throughout the
chapters, too)

When I first visited Luanda in 2005/6, the water supply was much poorer than in 2008/9. On our first visit to the Bairro Popular the water did not run every day and, when it did, it reliably ran out by dinner time. By 2008/9 the water in the neighborhood was on most of the time. It ran amply most mornings and more weakly toward the end of the day; it was hit or miss whether it would be on in the middle of the night, but it ran more often than not ¹. Of the two homes we occupied in the neighborhood, the first had a tap connected to the public service and no water tank. The kitchen was the only room with running water, so water needed in the bathroom, for example, was carried in buckets from the kitchen. There was usually 2-4 gallons standing in the bathroom used for flushing the toilet and hand washing. We kept 50 gallons of reserve water in the kitchen in a large plastic trash can and 20 more gallons in small water containers in the hallway adjacent to the kitchen. Whenever possible we filled large bowls with water from the sink for use if the water went off. We boiled tap water for drinking which we kept in recycled 1.5 liter water bottles. We occasionally purchased water in 300 ml and 1.5 liter bottles for

convenience. When the water was off, we purchased drinking water rather than boiling our reserves.

Our second home had the advantage of a 200 gallon, in-ground water tank but the water lines for passing the city's water directly into the house were broken. This meant that water delivered throughout the house came from the tank which we monitored and filled manually ~~from~~ with a hose connected to a tap in the enclosed parking area at front of the house. Used carefully we could get at least a week of water out of the tank, but we checked and refilled it twice daily to keep it topped off. We were unsure about ~~when~~ the condition of the tank and when it had last been cleaned so ^{we} carried water from the tap ~~from~~ in the front to the kitchen at the back for cooking and boiling to drink. The situation was more comfortable because ^{the} amount of water we had on hand at any one time ^{was} greater at this property and because the pump attached to the tank fed water to the kitchen, the primary bathroom, and to a laundry area and secondary bathroom in the small, enclosed outdoor space at the back of the home. The flaw in the system was that the pump was electric and we had no working generator. When the power was out we would fill buckets at the hose in front and carry it throughout the house as needed. This wasn't a problem for short outages but became the most tiring part during the few multiple-day power outages we experienced during our time at the property.

Despite the inconveniences of each system, both are quite posh. Many of my neighbors were without a working tap in their home at all. At the second property, many ^{the} of neighbors got their water from a single tap located in the kitchen of one house and carried it down or across the street. Even that situation is one of relative convenience as

compared to the homes in the adjacent peri-urban neighborhoods, just a few blocks further from the city center. There, water is obtained from long overdue and relatively new taps installed with the help and advocacy of NGOs, from private water tanker trucks that carry water to central points in the neighborhoods to vend, or from shockingly dirty, small waterways which have effectively become sewer systems.

In general, the closer you get to Cidade Baixa in the city center the better water and power function, but your individual water situation varies greatly with your wealth. Throughout the city there are better-kept or even new apartment complexes and large homes with water and electricity systems that seem to function independently from public services. These tightly intermingled with rundown buildings, improvised housing, and small slums without any public services. Even when the middle and lower class have access to public services, the city's wealthy residents are unlikely to notice for a period of days if the water and electrical grid cease to function unless they go out of their way to pay attention.

Despite an ability to purchase drinking water around the corner from each of our homes and despite an ability to pay for one of private tankers ^{the} ^{to} make a delivery at our home in the event of a city-wide shortage, I spent the bulk of my 13-month stay very preoccupied with the status of the taps. I checked the water a number of times each day and was compulsive about keeping available containers constantly full. I generally attributed my impulse to keep our water topped off to the pressure and responsibility I felt in caring for a two year old that had no choice about moving to Angola and could have just as well passed his time in relative safety and security of the global north.

I can remember two times during our long stay that the water was out for an extended period. The first time, we were living in the second house and the water was out for 10 days. The outage had been planned as part of work on one of the main water lines that fed the city. Water was out throughout the whole of the city for the duration. The outage was announced in the government's newspaper and on state radio just prior to the outage. I first learned of it from David's nanny on the day it was scheduled to go out when she heard it announced on the radio. She stayed to watch David for me while I stored as much water as possible and then left early to go home and prepare as she could (there was not water in the house where she lived -- I believe it came from a neighbor's house). Because the water was out, we arranged with our friends to go on a camping trip to a beach outside the city, preserving what we had in the house for the time we were away. When we returned to the city after our camping trip the electricity went out for three days. Without light or water for more than a day, life was relatively frustrating. With careful management our water supplies were still strong after eight days, but I had nonetheless made arrangements to move to a friend's house in the main city where they had a generator and a much larger water tank if the outage went on much longer. On day ten the water returned weakly as everyone's water ran more or less constantly to refill their tanks. It ran out after a few hours and was off overnight but it returned the next day and service returned to normal.

The second long outage was unannounced, lasted seven days, and was local to our neighborhood. It came after we had moved back in with our friends in the first house -- with four adults in the home and a much smaller reserve the second outage was more

stressful. We stretched our approximately 70 gallons of reserve for three or four days before our friend took the gerry cans with him to work and returned that evening with them and two extra filled with water. The water returned in the middle of the afternoon on the seventh day; at the time we had about 10 gallons of water remaining. The recording for "When the water returns" was made as I filled our water containers at the end of this second outage. *Hal.*[↑]

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When the water returns: Sound Description

Though three of the four dissertation compositions spatialize audio over multichannel sound systems, "When the water returns" is focused more specifically on the experience of the spatialization than the others. The piece features two distinct types of sonic content delivered over two separate spatialization systems. The first, and more direct one, is a sound recording of the onerous process of refilling a home's water vessels after they've been drawn down by a week-long water outage. These sounds are played and moved through a set of eight speakers position^{ed}_^ at the rear of the concert stage, as far forward and away from the audience as possible. The second is a set of synthesized, bell-like sounds ("pings") generated and triggered by a spectral analysis of the sound recording. The sonic goal of the piece is to experience how the placement of the bell-like

sounds affects our sense of the location of the recorded sounds.

The 12-minute recording used in the piece was created in the small kitchen at Arthur and Jojannake's ^{house} [IMAGES]. ^{After the extended outage, the water} ~~The water had been off for a number of days and~~ happened to come back in the middle of the afternoon, which is the hottest and quietest portion of the day; the street outside had little traffic and neighbors were relatively quiet at the time I recorded, though a variety of other environmental sounds are audible in the recording. I was at home writing at the computer, ^{my son} David was napping, ^{my wife} and Rebecca was reading when the water announced its return by jump ^{ing} and spitting from the open tap in the kitchen -- the air in the lines rattling the pipes attached to the kitchen wall. I moved quickly to get buckets in place to catch what I could in case the flow was short-lived (on occasion the water returns only momentarily before going off again). Once the first buckets were in place and it appeared that the water was going to continue to run, I set up a recorder on the kitchen counter and started it.

In part, the structure of the overall piece is determined by the structure of the recording which can be heard as divided into two sections by the different sound produced in filling two different kinds of container. Until 8:38 in the piece, the sound is of two ten-quart plastic pails being filled and poured alternately into a large 50 gallon plastic trashcan. From 9:00-11:00 we hear the sound of a five gallon gerry can being filled. The change ⁱⁿ the piece is marked by a brief period when the water is turned off. The different shape and thickness of the gerry ~~can~~ ^s produce a different sound and its larger size creates a much slower pace in the second section.

The version of the recording used in the piece is unedited except for an extremely

short fade on the beginning and end of the file. The piece begins quietly but abruptly with the sound of water rushing from the tap into a nearly-full bucket. The listener is dropped into the middle of the scene -- sound begins in the middle of an action of which the beginning is unheard. The piece starts with a flurry of activity that introduces the sound world heard in the long first section of the piece but eventually settles into a calmer section that gives the listener space to reflect on what they've heard in the opening moments. The first three seconds include the sound of extremely low frequency bumps and a large click -- sounds from my handling of the ^{recorder} recording after I turned it on and as I put it down on the counter. My voice is heard at 5 seconds as I poked my head into the next room to ask Rebecca if she would still be able to hear ^{the} David wake over the sound of the water. The voices are present to reinforce the sense of bodies in the space and to prevent the water as being heard, too much, as an independent object. The action and the sound are only relevant because of their relationship to human need; by including the sound of the voice I mean ^{to} contextualize the sound -- to have the water heard in relationship to human presence.

From 0:15-0:20 on the recording, I change the bucket for the first time. The sound of the water changes abruptly as I switch to a second bucket, swiftly moving the new bucket under the tap and the first out of the way with the sound of some spillover into the steel sink. There is the sound of several large bumps as I move the buckets around -- higher pitched sounds from the light, empty bucket and deeper thuds as I move the full bucket which weighs just over 20 pounds with two and a half gallons of water in it. There are also clicks as the metal and plastic swinging handles bump against the sides of the

buckets. At 0:23 we hear the sound of the full bucket being poured into the nearly-empty 50 gallon tank followed by the sound of the empty bucket being placed back by the sink, its handle again bumping against its side. At 0:40 seconds, Rebecca's voice is heard briefly, but otherwise from 0:30-1:10 the recording concentrates on the sound of the filling bucket, allow^{ing} the listener a moment of calm before the next section of the piece. It is in this stable moment that the pings^{synthesized} begin their gradual introduction -- in the dissertation performance the first synthesized sounds is heard at 0:31 with two more at 0:50 and then another at 1:10 as the action in the recording picks up again.

The sound of the recording at 1:10 begins to change as the water begins to spit and spurt -- the pressure is not constant and there is intermittently^{at} air in the lines, especially in the time right after the water returns to the house. The analysis system² uses transient detection to trigger synthesis events, so rougher sonic textures and percussive events are likely to produce pings. At 1:20 the buckets are switched again creating a brief flurry of activity before another stable section leading up to 1:57 when a ping is heard. The piece is stable again until 2:10 when the buckets are changed for a third time. With the recorded sound and the pattern of the bucket changing established, the pings begin^{to} grow progressively^{sp.} in density starting around 2:25, providing a new palette of sounds^{to} be heard in relationship to the sound of the water.

~~From 2:25~~ ^{After} when the pings are established, they remain until the end of the piece ^{at 2:25,} with varying density determined entirely by the analysis. As the soundfile plays it is being continuously analyzed both for transients and for the frequency and amplitude of the nine strongest partials. When transients are detected, the data for the partials are used

you don't explain what triggers the "pings". oh, I see!

but still, you need to explain your process. Very odd how you want to avoid any description of the technology

well, here's some. I should have waited.

Some screenshots would be good.

to set the frequencies and gains for a bank of bandpass filters with a very narrow bandwidth. An impulse is then generated randomly and sent through the filters. The output of the filter bank passes through an envelope stage that controls the onset and decay before being randomly assigned spatial coordinates and being sent to the speaker system surrounding the audience. As the piece progresses the pings become longer, smoother, and harmonically richer as the ~~the~~ onset and fade time increase and as the impulses used to activate the filter banks are made progressively longer and more complex. The focus remains on the lengthening pings for the long middle portion of the piece.

From 8:22-25 there ^{is} ~~are~~ a new, resonant percussive sound in the recording as ^{an} ~~a~~ empty gerry ^{can} is brought into the kitchen and set down along with a new kind of clicking sound from its cap being placed on the corner. At 8:38 the water turns off abruptly as the final bucket is removed from the sink and the gerry can is loudly arranged in the sink -- a series of low, pitched thuds. When the water comes back on, the sound texture is quite different. Not only is the gerry can larger than the buckets, its thinner plastic walls and smaller opening give it a more resonant and pitched sound. The ringing-sound created by the gerry can blends more seamlessly with ^{the} ~~the~~ pings than the previous water sound, making both sounds more difficult to localize.

With the gerry can in place, the physical action slows once again and the sound is concentrated on the sound of a single rising pitch in the recording as the container gets progressively more full. This pitch and its interaction with the now long, slow pings is the focus of the piece until 11:01 when the water is turned off for the final time.

With the water off, a variety of quiet percussive sounds are audible and are more readily detected by the transient analysis, giving rise to a burst of synthesized sound, creating the densest constellation of pings in the piece so far. These pings continue to the end at 12:13 against the soft sounds of my sandaled feet shuffling on the kitchen floor and small clicks and snaps as I clean up the space. As the final pings die away, their ends are stuttered as the noise floor established for the piece is crossed repeatedly and the audio flickers on and off. The audience is left listening for the long ends of the pings fading away into the quiet of the concert hall.

The volume threshold for the entire piece is set at the threshold of audibility. Played quietly, some of the low frequency and muffled sounds on the recording, many of which come from a spaces outside the kitchen where the recorder was placed, occasionally sound as if they're coming from a space adjacent to the concert hall itself and not from the recording. The low volume level of the piece was set to encourage this illusion. The low volume is also set to experience the effects ^{of} effortful listening and has been informed by the way I change my own listening when trying to localize quiet sounds.

The two spatialization systems in the piece operate independently. The system surrounding the audience is a straight forward implementation of the ambisonic externals for Max built by Philippe Kocker and Jan Schacher at the Institute for Computer Music and Sound Technology at the Zurich University of the Arts [<http://www.icst.net/research/downloads/ambisonics-externals-for-maxmsp/>]. When each ping is generated, it is assigned a random angle and radius with respect to the center of the listening space

before being distributed through the system. There is a maximum density of 32 pings which is only reached at the end of the piece when there are many pings and when the fade time for each sound is quite long.

The sound system used to reproduce the recording on the stage was originally created as an independent experiment with some of the principles of wave field synthesis (WFS) systems [CITE BAALMAN p. 11-12]. The system, provisionally called WfsFakie, is constructed on the idea that using an array of loudspeakers you can recreate a wave front by using each speaker to reproduce the signal as would be measured at the speaker's location. Based on the physical distance between a virtual source and each individual speaker, WfsFakie calculates and applies a unique delay, filter, amplitude, and reverb amount in reproducing the sound at each speaker. The system was initially built as an exercise to understand and internalize some of the principles of WFS systems, not as a complete reproduction of them, and has a number of limitations. For example, eight sources is too few for a complete effect over such a broad listening area and the large distance between each speaker in my system produces aliasing problems. A more complex system would also implement frequency-dependent filters (mine uses a simple lowpass filter to roll-off high frequencies based on distance), would calculate distance with greater precision, would account for phase, and would perhaps compensate for room acoustics. Despite its limitations, however, WfsFakie reproduces depth and position startlingly well. I found that the shimmery, metallic effect (sonic artifacts) produced by the system worked well with this recording in the context of the design of the piece. For "When the water returns" the original stereo file is summed to mono and assigned a

random position on a virtual sound stage behind the speaker array. Each time a transient is detected the system moves the mono source to a new random position over a randomly assigned period between zero and ten seconds. The movement produces an almost continuously changing texture in the recording playback as its perceived depth change^s

The movement and changing texture combined with the low playback volume contributes^s to difficulties a listener has in localizing the sound.

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When the water returns: Reflections

As with other pieces in this set^s the creation of intermediate works and sonic experiments formed a core part of the compositional process for "When the water returns". The piece "Your Participation Not Required (YPRN)", in collaboration with Harry Smoak, became the core space in which I developed the ideas and technologies used for the spatialization in "When the water returns". To date YPRN has been presented publicly twice, once at Concordia University's FOFA Gallery during Congress 2010 in Montreal, Canada and again at Pixilerations [v.7] in Providence, Rhode Island, USA.

For Pixilerations, Smoak and I described YPRN as an effort to "connect the movement of concert-goers with the ~~with the~~ 'live' architectural surround[?] of the Grant Recital Hall lobby, YPRN creates a temporary experimental space for engaging with color and acoustical phenomena while exploring the ambient environment of the evening's events." The sonic content included recordings of the original concert hall

this is missing a word or some punctuation →

space ~~during~~ ^{made} during previous public events and sine waves selected to activate the resonances of the room. YPNR's sound was distributed through an 8-channel speaker system that shifted between two primary states: in one each speaker acted as a voice that reproduced a single sine tone or a single channel of a recording originally made from the same position as the speaker. In the second state, each speaker reproduces a single band of the frequency spectrum during the playback of either a composite recording of the space or of a composite of the eight sine tone frequencies.

The sonic configuration was inspired by an idea that in one mode, the system filters a sound and the room mixes it, and in the second mode the system mixes the sound and the room filters it. The goal was to explore the impact of different styles of recording and reproduction on the experience of spatialization and audio immersion, and to try out different system states in an attempt to change a listeners ^{experience} experience of volume in the space. Changes in sound were choreographed with changes in color and quality of light as projected through custom LED instruments in exploration of the impact of each system on the other.

Not only did the variety of spatial recording and reproduction techniques used in YPNR become the technical basis for "When the water returns" ^{but} the project stoked questions about how sounds can be used ^{to} to fill a space with sound and how subsequent manipulations of that sound can change a listener's sense of space (for related

reference see Page 2 of Baalman, M. "On Wave Field Synthesis and electro-acoustic Music, with a particular focus on the reproduction of arbitrarily shaped sources." Berlin Institute of Technology, PhD Dissertation: 2007) ^{move to footnote}

My interest in the original recording used for "When the water returns" comes though the rhythms and pitches created by water as it is poured and fills a variety of containers, but I found the recording to be relatively one dimensional and wanted to find an alternate way to play the stereo recording that gave it a heightened sense of depth. The goal was, in short, to play a stereo recording but to have it feel as though the recording was being drawn into the hall. I meant to achieve this effect in two primary ways.

Whereas traditional spatialization techniques tend ^{to} concern themselves with the reproduction of accuracy as a means of reproducing depth of sonic experience, I wanted to experiment with contrasting techniques that might generate a sense of immersion through confusion or occlusion. To achieve this, the filters for a subtractive synthesis engine are tuned to the same frequencies as the strongest partials of the recording in the moment the pings are triggered. By filling the space above the audience with ^{tones} overlapping and interfering with the content of the sound recording, I hope to mask and confuse the location of the sound recording playback.

While the effect works for me, it is an open question as to whether or not it works for the audience. Upon hearing the piece, however, listeners report an experience of depth in the recording and a difficulty in determining precisely where the sounds come from. That said, I'm still don't understand precisely how or why this effect is achieved. I say this, in part, because of an experience I had early in testing of "Awakenings" when I played a version for a small audience in the tracking room of the Steinert Building on Brown's campus. Sitting in a room surrounded by eight highly-visible, full range speakers and two subwoofers, listeners reported hearing sounds from all sides of the room despite

the fact that, because of a playback error, the sound was coming exclusively from a single speaker in the front-center of the room. This indicates to me that under certain social and acoustic circumstances, being surrounded by speakers and having an expectation of surround sound may be enough to create an experience of ^{IMMERSIVE} ~~immersive~~ for listeners. In the case of my dissertation concert three of the four pieces (Including "When the water returns") play from speakers other than those located in the front of the hall. Here it seems especially likely that users will report hearing sounds from everywhere, whether or not they would be able to accurately report from which directions sounds emerge.

Whether the effect is generated because of listener expectations or because my particular treatment of sound in the piece, listeners have reported hearing the recorded sound as emanating from spaces other than that of the front speakers and have reported confusion about whether the sounds of the recording are occurring inside or outside of the concert hall.

Based on my own listening experiences, I also leverage the effects of a low listening volume to mask the location of the sound file playback. This piece, like the others in the set, is made with an interest in ^{listening} ~~listening~~. Here the specific interest is in the effect that loudness can have on our attention to the spatialization of sound. I have come to enjoy the experience of working to listen to quiet sounds, and this piece reflects that enjoyment. This practice began as I sat in the first house where we lived in Luanda and strained to hear the voices of my immediate neighbors. In listening to those quiet sounds, I found that I try hard to localize the sound in my effort to focus on it and hear it more clearly.

In setting a low volume for this piece, I require effort from the listener and hope to reward them with a temporarily changed listening state. As I see it, I ask the audience to attend in the public performance of this piece -- I ask of the audience extra effort in listening to be able to hear the quiet sounds and I ask them to be quiet themselves so their companions can hear better. I have occasionally been nervous about this piece ~~as being~~ ^{appearing} long, slow, and quiet -- all of which I fear risk audience interest -- but have been encouraged at two public performances of the piece and the degree to which the audience has been willing to adopt the desired attitude to hear ~~the piece~~ ^{it}.

I was initially encouraged to experiment in this vein by a story Alvin Lucier tells of Morton Feldman sitting down in the rear of a concert hall during a rehearsal of one of his quieter works and asking a musical director his opinion of the piece. The musical director said he liked it but thought it ^{too} quiet to hear. Mr. Feldman responded by saying that he thought it perfectly audible and that all the director had to do to hear the piece was to lean forward slightly in his seat. It is this subtle shift in attention, this leaning forward in an effort to hear, that I believe necessary to have the experience ^{of} "When the water returns" as I intend. Whereas in the Feldman case, however, the point of leaning forward is to hear the piece and in my case the point of the piece is leaning forward.

rewrite -
doesn't
make
sense

1. Water and rain remain huge problems in rural and urban Angola. See reporting such as: Redvers, L. "Water everywhere in Angola, but few places to drink". Mail & Guardian Online, 14 March 2011. <<http://mg.co.za/article/2011-03-14-water-everywhere-in-angola-but-few-places-to-drink/>>. and AFP. "Serious water shortage hits Luanda". AFP,

17 February 2012. <<http://www.google.com/hostednews/afp/article/ALeqM5hsTQqxRVTGTbWxTxIuEETiAaRZog>>. For an overview on the situation with water and sanitation see: U.S. Agency for International Development. "Angola: Water and Sanitation Profile". Summer 2008. <http://pdf.usaid.gov/pdf_docs/PNADO925.pdf>.

2. built around Tristan Jehan's pitch~ object, which itself is based on Miller Puckette's fiddle~ object.