nologies with classic analog systems and tools. The book and DVD-ROM package uses detailed illustrations, screen shots, and audio and video examples. For information: <www.halleonardbooks.com>.

The Mormon Tabernacle Choir and Orchestra at Temple Square has released *Bravo! The #1 Albums* (Mormon Tabernacle Choir®, $39.98), a multi-disc CD set of three albums that topped the Billboard® music charts. *Bravo!* features 53 selections from the choir's repertoire—including some of the choir's most beloved and requested songs—and provides more than four hours of listening. The collection comprises a trio of albums: *Come, Thou Fount of Every Blessing*, *Men of the Mormon Tabernacle Choir*, and *Heavensong*.

Also included is the exclusive bonus disc, *Music from 9/11: Rising Above*, offered in CD format for the first time, and only available in the *Bravo!* collection. Recorded live on 9/11/11 in Salt Lake City for national broadcast, *Music from 9/11: Rising Above* features the popular stirring music performed on that "Music and the Spoken Word" broadcast as a tribute to the American spirit rising above adversity.

The Mormon Tabernacle Choir has recorded nearly 200 albums over the past 100 years, with five gold records, two platinum records, and a Grammy. The latest recording, *Glory!*, marks the 40th project to come out on the choir's independently owned recording label.

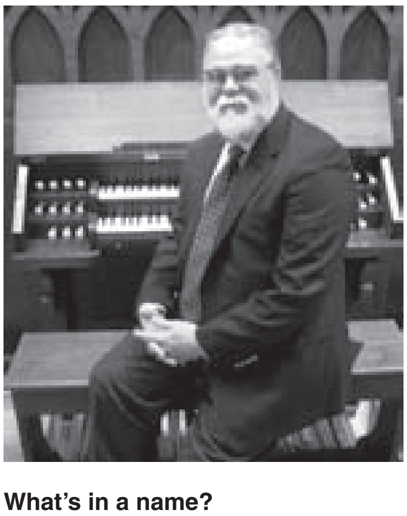
The choir's weekly "Music and the Spoken Word" program is the world's longest-running continuous network broadcast, and airs on more than 2,000 TV, radio, and cable stations across the country. The weekly broadcast was inducted into the National Radio Hall of Fame in November 2010. The choir also celebrated its 100th anniversary of recordings in 2010, a record unmatched by any another American recording artist. For information: <MormonTabernacleChoir.org>.

The firm of **Michael Proscia Organbuilder, Inc.**, Bowdon, Georgia, announces a commission from the First United Methodist Church, Roanoke, Alabama, to re-engineer and enlarge their circa-1920 Pilcher organ. When installed, the casework ran the full width of the 35-foot-wide balcony, and, with the façade pipes, completely obstructed from view the large stained glass window immediately behind the organ. The cornerstone of the church is dated 1902; since that time, the elements have taken their toll on the wood and metal support structures of the window. Contraction and expansion of the lead elements that bind the glass together have deteriorated, separating from the glass, and have allowed rain water to enter, damaging lathe and plaster work applied to the interior walls of the sanctuary, particularly inside the swell box. Repair of the window can take place only if the organ is removed, allowing access to the window.

The organ will be re-engineered (divided) to allow the window to be seen and the "prepared for" stops (and others) to be installed. In 1976, the Greenwood Company of Charlotte, North Carolina, rebuilt the instrument. Their work included silencing the many speaking pipes in the façade, replacement of the (presumably) tubular-pneumatic console with an all-electric console (prepared for additions), replacement of the tubular chests with electro-pneumatic chests, and an electro-mechanical relay. Proscia will return the speaking façade pipes to their original intent after they have been stripped of gold-colored spray paint, and repaired as required; then, new gold lacquer will be applied. Rededication is scheduled for later this year or early 2013. For information: <www.prosciaorgans.com>.

In the wind . . .

by John Bishop



What's in a name?

Did you ever meet someone named Smith? Ever wonder where that name came from? Ever wonder why Smith is such a common name? Your friend John Smith is descended from a blacksmith, or maybe a silversmith. Smith is a common name because centuries ago, a much higher percentage of the population was involved in actually making stuff by hand. How about Cooper? They made barrels. How about Sawyer, Taylor, Shoemaker, Brewer, or Cook? Come to think of it, my name is Bishop—but I know it's not relevant.

Just like those common surnames, lots of functions and devices in our world have names that are descriptive, and I think many of us seldom stop to notice how accurate those names are.

Likewise, I know that lots of people take for granted how something works. You flick a switch and a light comes on. Don't bother me with stories about fuel sources, generating plants, transformers, distribution systems, self-burnishing contacts, correct choice of wire gauges, or tungsten filaments.

The long and short of it

After graduating from Oberlin, we lived in an old four-bedroom farmhouse in the farmlands a couple miles out of town. It was a lovely place if a little ramshackle. The rent was $225 a month, and there was a natural gas well on the property—foreshadowing the controversial fracking going on now in that area. The electrical system in the house was just terrible, and all the lights and outlets in the kitchen, utility room, and dining room were on one circuit. I was cooking dinner one night when the lights went out. There was toddler Michael, sitting on the dining room floor, a startled look on his face, a black mark on the wall around an electrical outlet, and a pair of scissors on the floor. He looked at me and said, "hurtchoo."

What was it he did that caused the lights to go out? I know, I know, he stuck the scissors in the outlet. (Today, responsible parents put little plastic pluggy things into the outlets so that can't happen. In those days, we did have seatbelts in our cars, but not those pluggy things.) What he actually did was shorten an electrical circuit. He tried to use the scissors as an appliance. We're used to operating devices that are designed to consume electricity, whether it's a motor we use to make daiquiris, a heating device we use to melt cheese on a piece of bread, or a light bulb that illuminates our world. Each of those items "burns" electricity to do its job.

The wiring in your house is all in circuits. Each circuit originates at an electrical panel, goes to whatever appliances it's supposed to run, fuels them, and returns to the source, which is protected by a circuit breaker that shuts off the circuit if something goes wrong. (Our house in Oberlin had fuses, which have the same function as a circuit-breaker.) If something happens to connect the outgoing and incoming sides of the electrical circuit before it gets to the appliance, the result is a "short circuit." Michael's pair of scissors was not designed to perform a function when fed with electricity. All it could do was make a big spark. He "shorted out" the circuit. We laugh now, but bad things could have happened.

A couple more simple points. That circuit breaker I mentioned is designed to break the circuit (turn it off) when it's overloaded by a short circuit, or by the attempt to run too much power through the circuit by plugging in a vacuum cleaner in addition to a space heater. Too much power and the wires heat up. If there's no safety system, they start a fire. The old-time fuses have a piece of wire in them engineered to carry only a certain amount of power. When that was exceeded, the wire burned safely inside the little glass enclosure.

And many of the circuits in our houses are actually left open in the form of outlets. A ceiling lamp is a closed circuit, but an outlet doesn't become a complete circuit until we plug something in—not a pair of scissors, but something that includes an appliance that consumes electricity.

Water towers

Keep the pressure on

Water towers are architectural icons and infrastructure workhorses on Manhattan Island. Every building more than eighty feet high needs one, and there are a lot of buildings more than eighty feet high in Manhattan. We can see thirteen water towers from our apartment in lower Manhattan. They are necessary here because there are simply too many faucets and toilets for the municipal water provider to be able to supply pressure hundreds of feet in the air to thousands of buildings. So a building has a tank on the roof and a pumping station in the basement. Filling the tanks works something like a toilet bowl. Water is pumped into the tank. When it's full, a ball-cock valve operated by a float turns off the pump. As water is used, the float goes down with the water level and turns on the pump to maintain the proper level.

The water tower on an average apartment building holds around 10,000 gallons, and the pumps are capable of filling a tank in two or three hours. Larger buildings have huge internal tanks mounted high inside. The Empire State Building, which is 1,250 feet tall, has water tanks every twenty floors. Buildings that size use as much as 40,000 gallons per hour.

I imagined that the source of the water pressure from a rooftop tank would be the weight of the water as affected by gravity, and I read that in a couple news stories, but I read on a "science-fact" website that it actually comes from hydrostatic pressure, which is a factor of elevation. The higher in the air the tank is located, the greater the pressure. Shameless and unscientific rounding off of numbers I found at <www.howstuffworks.com> shows that every foot of elevation produces about .45 PSI (pounds per square inch) of pressure. A tank that's a hundred feet up produces about 45 PSI, which is the kind of pressure we're used to when we open a spigot to take a shower or wash the dishes.

There is one way that the weight of water plays a role in this system. The tanks are built like old-fashioned barrels (built by coopers) with wooden staves held in place by iron hoops. The hoops are closer together at the bottom of a tank, and spaced increasingly further apart toward the top. The graduated spacing is similar on all the tanks, which makes me think there's a mathematical ratio involved, something like Pythagoras's overtone series. That provides extra strength down low to contain the great weight of water at the bottom of the tank. Water weighs about 8.35 pounds per gallon, and when you stack it up in a tank, the weight is concentrated toward the bottom. A 10,000-gallon tank holds more than forty tons of water!

There are two companies in New York City that still build water tanks: the Rosenwach Tank Company, and Isseks Brothers, both located in Brooklyn. Rosenwach builds between two and three hundred tanks each year. The tanks must be serviced annually to remove sediments from the water, and they usually last about forty years, though the Rosenwach website (www.rosenwachtank.com) says that some tanks made of redwood are still in service after ninety years. Wood is considered the best material because it is hoisted to lofty roofs relatively easily—it would cost a fortune to lift a 10,000-gallon steel tank to the roof of a twenty-story building—and because it has terrific built-in insulation qualities. Imagine if your source of cold water was a metal tank on a sunny roof. The wood is not treated with any paint or preservatives so as not to taint the water. Rosenwach uses so much lumber that they have a sawmill located in the heart of Brooklyn.

Wind regulators

The principle I described of graduating the spacing of the hoops around a water tank appears in many other ordinary facets of our life. Long runs of pipes for fire-suppression sprinkler systems are visible in the fellowship halls of many church buildings. Notice how they're larger in diameter at the end where the water originates than at the end of the run. This accounts for the ever-smaller demand for the volume of water as you pass each sprinkler head, and maintains the appropriate amount of pressure for the last sprinkler in the line.

This exact principle exists in pipe organs that have multiple wind regulators (reservoirs). The windline is largest in diameter where it enters the organ from the blower room, and the diameter decreases as you pass the regulators, ensuring that the wind pressure is adequate at the end of a long run.

We can compare the wind system of a large pipe organ with the water system in Manhattan. A rooftop water tank is both a reservoir and a pressure regulator, kept full and ready for use by a pump, and equipped with a valve that fills the reservoir as water is used. An organ regulator is kept full of air by a pump (the blower), regulates the pressure through the use of weights or springs, and has a

Water tower

valve that keeps it full as pressure is used. The valve is typically a curtain valve that works something like a window shade, connected to the top of the regulator with string or chain that runs across a system of pulleys. In a water system, pressure and volume is used when we fill a teakettle. In a pipe organ, pressure and volume is used when we play a hymn.

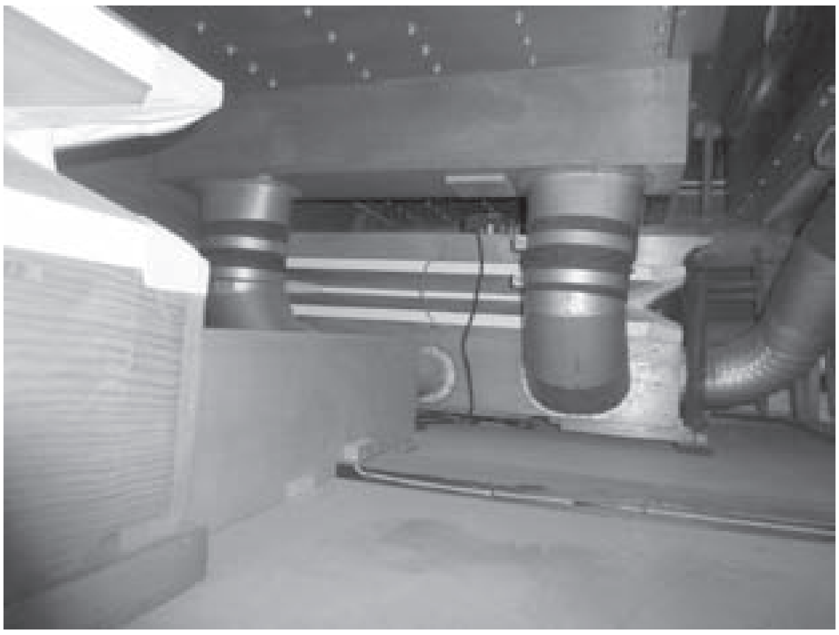
Electricity in pipe organs

You walk into the chancel, change your shoes, open your briefcase, put something up on the music rack, slide onto the bench, and turn on the organ. What's happening? You have started a big electric motor, and if your organ has electric action, you've also turned on a rectifier. The motor turns a fan (the organ blower), which blows air through the organ's windlines to the reservoirs, which inflate to a controlled height, and create stored wind pressure. Until you play a note, the organ is idling, sitting still at a constant pressure.

Did he say rectifier? What's a rectifier? What needs to be rectified? Is there something wrong? We use electricity in two basic forms, AC (alternating current) and DC (direct current). Electricity is polarized—one side is positive (+), the other is negative (–). In direct current, the polarization is constant—positive is always positive, negative is always negative. In alternating current, the sides alternate, swapping positive and negative back and forth at a rapid rate. We refer to 60-cycle current because standard AC power swaps sides 60 times a second. Fluorescent light tubes emit a 60-cycle hum.

Our household (and church-hold) electricity is AC power at 120 volts (volts is a measure of power), but pipe organ actions are designed to operate on DC power at around twelve volts. A rectifier is an appliance that converts 120VAC to 12VDC, rectifying the discrepancy. (While the voltage of house current is standardized, the DC voltage in pipe organs varies, usually between 12 and 16 VDC.) How does it work? A rectifier contains a transformer—an appliance that transforms AC power to DC power.

George Westinghouse and Thomas Edison were both pioneers of the industrial and residential use of electricity, and both are credited with the invention of many related devices and processes. They both found financial backers who supported the construction of neighborhood-wide systems to light houses—J.P. Morgan's house on Madison Avenue in New York was the first to be illuminated by Edison. Edison was a DC man, and Westinghouse focused on AC power. Neither was willing, or perhaps able, to promote both. As the public was learning to accept the concept of having this mysterious power in their homes, there was a debate comparing the relative safety of the two systems, and Westinghouse and Edison each went to great lengths to try to discredit the work of the other by publicizing levels of danger. When the first electric chair to be used for executions



Wind regulator

of prisoners was built using DC power, Westinghouse and AC power gained traction in the public eye. If DC could kill people, we don't want it in our houses. It was political. Today, when we hear of a construction worker getting electrocuted, it's proven to us that AC power can kill, too. Michael was lucky.

Pipe organ wind

When I talk about pipe organ wind, I keep mentioning reservoirs and regulators. Don't I really mean bellows? Like the short circuit, and the circuit breaker, I suggest we use the name that best describes what the thing is actually doing. A bellows produces a flow of air. A blacksmith uses a bellows to blow on the fire in his forge just as we use a bellows at our living room fireplace.

A reservoir is a storage device. A rooftop water tower is a reservoir. In modern pipe organs, the bellows have been replaced with electric blowers, so what we might call a bellows under the windchest of the organ is actually a reservoir. But the reservoir also regulates the wind pressure. We use weights or spring tension to create the pressure. The more weight or the heavier the springs, the higher the pressure. But in order to create pressure, we also have to limit how far the thing can open—that's another function of the curtain valve. The organbuilder sets it so the valve is closed when the reservoir is open far enough. Otherwise it would inflate until it burst, which is the air pressure equivalent of a short circuit. So the balancing of weights, springs, and limit of travel determines the wind pressure. And, the curtain valve I mentioned earlier opens to allow more air in as you consume air by playing. So I think the most accurate term to describe that unit is "regulator." Reservoir is correct, but incomplete. The rooftop water tank is also a regulator, though the regulation of pressure happens automatically as a function of physics—remember that hydrostatic pressure. *Hydro* means water, *static* means "lacking in movement." You get pressure regulation without doing anything!

Stop and think about it

Many of the common names for organ stops are descriptive, even definitive. "Prestant" comes from the Latin, *prestare*, which means "to stand before." So a Prestant, by definition, is an organ stop that stands in the façade. Many organs have misnamed Prestants. A Chimney Flute is a capped pipe (usually metal) that has a little chimney sticking up from the cap. The purpose of the chimney is to emphasize the third overtone (2⅔′ pitch). That's why a Chimney Flute is brighter than a Gedeckt.

I don't need to say much about Clarinets, Oboes, Trumpets, or Flutes. But a Harmonic Flute is special because the pipes are twice as long as Principal pipes, and the characteristic hole halfway up the resonator breaks the internal sound wave in half, so the double length produces normal pitch, but with a much richer harmonic structure.

Diapason is a mysterious word, until you look it up. I found two good applicable definitions: "a rich, full outpouring of sound," and "a fixed standard of pitch." Go to <www.diapason-italia.com> and you find an Italian manufacturer of high-quality audio speakers—"a rich, full outpouring of sound."

Quint = fifth. A 2⅔′ Quint speaks the second overtone above fundamental pitch—one octave plus a fifth. A Quintadena emphasizes that overtone—that's why it's brighter than a Bourdon.

Tierce = third. A 1⅗′ Tierce speaks the fourth overtone—two octaves plus a third.

A Resultant is a tricky one. Turns out that if you play 16′ and 10⅔′ pitch together, your mind's ear is tricked into thinking that you're hearing 32′ pitch, because 16′ and 10⅔′ are the first two overtones of 32′. The result is that you imagine you're hearing a 32′ stop. Hah! Fooled you!

By the way, why does blowing on a fire make the fire bigger? Simple. Fire uses oxygen as fuel. Throwing a blanket over a fire cuts off the oxygen supply, as does the acolyte's candle-snuffer. Blow air on a fire and you increase the oxygen supply. Poof! S'mores, anyone? ■

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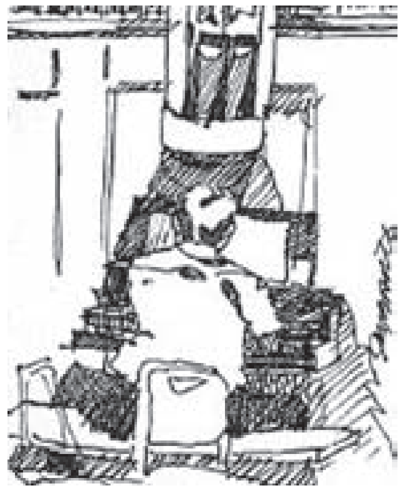
On Teaching
by Gavin Black



Recitals—Examples

Last month I laid out some ideas about recital planning, especially how teachers can help students think about recital planning. This month, in a column with a somewhat unusual and more personal format, I will give two examples of programs of my own from the last several years—one harpsichord and one organ—and discuss some of the thinking behind the programming choices in each one. Along the way I will add a few more general ideas to the discussion as well. Nothing that I write here is meant to serve as an exact template, of course, for what anyone else—student or experienced performer—will or should do. But I hope that it will be interesting as a set of examples to think about.

The first program that I want to look at is a harpsichord recital that I gave in the exact same form about a dozen times during the 2011–2012 season:

Toccata in D Minor, BWV 913, Johann Sebastian Bach (1685–1750)

Suite in E Minor, Johann Jacob Froberger (1616–1667): *Allemande–Gigue–Courante–Sarabande*

Biblical Sonata No. 6–"The Death and Burial of Jacob," Johann Kuhnau (1660–1722):

I. The sadness of the sons of Jacob, assisting at the bed of their dying father, relieved a little bit by the paternal benediction
II. Thinking about the consequences of this death
III. The voyage from Egypt to the land of Canaan
IV. The burial of Israel, and the bitter lament of those assembled
V. The consoled spirits of the survivors

Intermission

Sonata in G Major, George Frideric Handel (1685–1759)

Thirty-two variations on "La Capricciosa," Dieterich Buxtehude (c.1637–1707)

Double-manual harpsichord in the German style, Keith Hill, 1978

The first thing to notice about this program is the last thing listed, that is, the instrument. In planning performances that season, I wanted to use this particular harpsichord. It happens to be my own first harpsichord, acquired in June 1978. I hadn't used it for recitals since about the late 1990s, and I wanted to renew my own awareness of its possibilities. Also, it is a magnificent-sounding instrument, and I felt that audiences would get a lot out of hearing it—and that it had been too long.

In this case, the instrument then determined at least some of the boundaries of the programming choices. Especially since I was in part showcasing the instrument, I wanted all the repertoire to fit the style of the sound closely. It is probably true that any harpsichord piece from the earliest beginnings in the fifteenth century through Haydn could be played on this harpsichord and sound good. However, Germanic music from the mid-to-late-seventeenth century through roughly the end of the time of Bach is the music that fits it the very best.

The pieces that I started with in planning the specifics of the program were those by Kuhnau and Buxtehude. These are both fairly long works, and each is of great intensity: similar in artistic stature, and indeed in mood and style, to the great late works of Beethoven. Both are pieces that I have been playing for a long time, but have not included in recitals for a decade or so. Each of them is also a piece after which it is difficult—for a while—to focus on listening to anything else. (This is in a sense a *goal* rather than a fact, since in order for it to apply, the pieces must, of course, be played effectively.) This is the beauty of the intermission: it allows two such pieces to be included in a program without compromising the audience's ability to listen to the rest of what is on offer.

I chose to put the Buxtehude at the very end and the Kuhnau at the end of the first half for two reasons: first, the Buxtehude is longer; second, the particular kind of intensity that is projected by the Kuhnau is—as the subject matter suggests—somewhat "down" in mood. The Kuhnau certainly *could* be an ending piece, but the Buxtehude seemed like a more exhilarating one.

To be honest, the specific reason that I decided to open the program with this