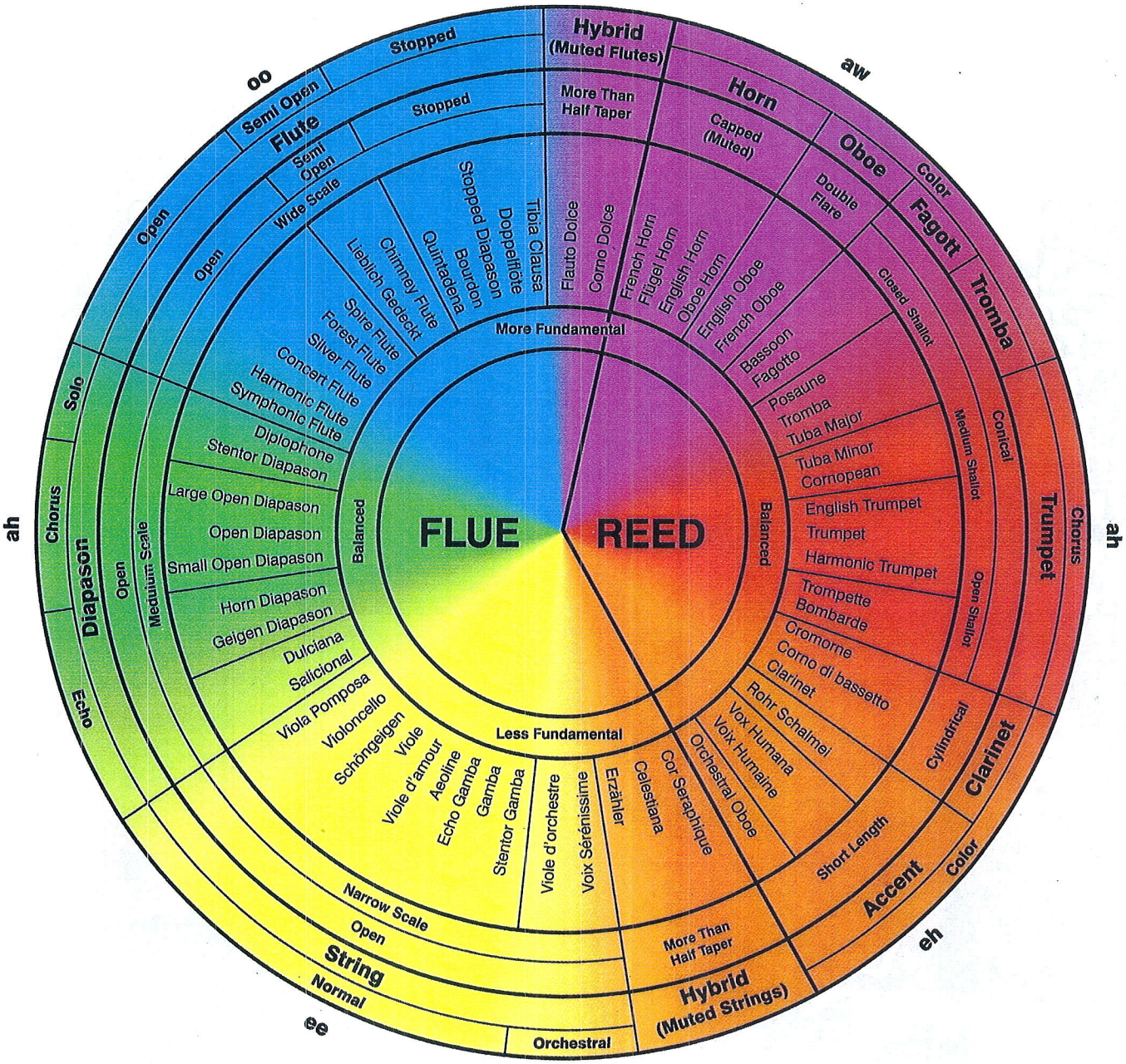
$3.75

SCHOENSTEIN
PIPE ORGAN TONAL COLOR WHEEL



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READING THE COLOR WHEEL

The color wheel is divided into four main rings, as delineated by the five bold circles. The four rings are most clearly seen just to the right of the twelve o'clock position on the wheel. In other areas of the wheel, the outer two rings are often subdivided. The following text describes the content of the wheel, starting at its perimeter and working inward toward the core.

VOWEL SOUNDS

Describing organ tone in words is difficult and often misleading. Bright, dark, rich, warm, brilliant, wooly and sweet are just a few of the common attempts to picture organ tone. Saying that a stop sounds like an oboe, for example, doesn't help much either. Is it an oboe in a French band or in an English orchestra? Six of the most basic vowel tones are shown at the outer edge of the wheel to introduce a more accurate system of description. There are dozens, if not hundreds, of minute variations in vowel sound, any of which might be employed to illustrate the kind of organ tone one is either hearing or wishes to hear. Consonants may be used as well to describe the percussive onset of some tones.

FIRST (OUTER) RING

The outer ring of the wheel indicates twelve major categories of organ tone. The number of categories could be decreased to six by reducing the reed family to chorus reeds and color reeds and by combining the two hybrid groups into one. Conversely the number of categories could be increased to seventeen, thus revealing more detail, by dividing the flute family into open, semi-open and stopped flutes; the diapason family into chorus, solo and echo diapasons; the string family into normal and orchestral strings.

SECOND RING

The second ring describes the elements of pipe construction that contribute most to the distinctive character of each group. Among flues, the most important determinant is the scale—a pipe's diameter relative to speaking length. Next in importance are the treatment of the top end of the pipe (open, semi-open, stopped) and the shape of the pipe body (parallel or tapered). Among flutes, tone quality is so greatly affected by the opening at the top that they are divided into three distinct tonal groups based on this characteristic alone. The strongly tapered (muted) flue pipes are called hybrids because they have an unusual tone that is difficult to place squarely in the flute or string category. This elusive quality is part of their charm. (Mildly tapered construction also affects tone, but this and myriad other more subtle construction features cannot be shown with clarity on the color wheel.)

In the reed family, the shape and length of the resonator, as well as the shape and opening of the shallot (the organ's equivalent of a mouthpiece) are the most important among many variables. Scale, of course, also plays an important role; however, there are great variations in scale within each reed group—not a continuum as found in flues (string to diapason to flute.)

THIRD RING

The third ring gives specific examples of 8-foot stops of various dynamic levels in each tonal category, using nomenclature found in Schoenstein organs. Dozens, if not hundreds, of other names would serve just as well. One example is the term "principal," which is synonymous with "diapason." Some names are unique to Schoenstein organs, but in those cases, stops with more common names, which are in the same category, are also included for clarity—for example Viole d'orchestre, which is in the same class as Voix Sérénissime.

FOURTH RING

The essence of tone color is harmonic structure—the relative strength of a tone's harmonic components. The most elementary description of tone color derives from the balance between a tone's first harmonic or fundamental frequency, and all its upper harmonics or overtones, considered as a group. Tones with what we may consider a "normal" balance (between the fundamental and all upper harmonics) are capable of producing what is called "chorus tone" in the organ. These are the trumpets and diapasons at the right and left sides of the ring respectively. At the bottom of the ring are stops with less fundamental

in relation to upper harmonics, with a tone often described as "bright." At the top are stops with more fundamental in comparison to upper harmonics, sometimes called "dark." Although it is not possible to include in this highly simplified presentation, a detailed analysis of each stop would reveal widely varying proportions between the fundamental and the various upper harmonics from one stop to the next around the wheel. Thus, some stops can be described and recognized by the prominence of certain harmonics. A keen ear can detect if a stop has, for example, a prominent third harmonic (an octave plus a perfect fifth above the fundamental). Two groups of stops—the clarinet and stopped flute families—emphasize all the odd-numbered harmonics. Note that these are roughly opposite one another on the color wheel. The two hybrid groups emphasize the fifth, sixth and seventh harmonics, giving them their mysterious quality.

FLUE AND REED

The inner core of the wheel divides all organ tone into two categories based on the method of tone production—flue or reed. Flue pipes generate tone by wind blowing across the lip of the pipe, which causes the column of air inside the pipe to vibrate. A flue pipe generates its tone very much like a simple whistle or the flute of the orchestra. Reed pipes generate tone with a thin, brass tongue (reed) vibrating against a small, open-faced, hollow tube (shallot). The resulting tone is then amplified and modified by a resonator (often conical in shape), which comprises the top portion of the pipe. A reed pipe generates its tone much like the clarinet of the orchestra.

LOUDNESS AND PITCH

Loudness and pitch affect our perception of tonal color. Extremes of either can obscure tonal color or create what appear to be variations. For example, a diapason voiced loudly can become stringy and the same pipe voiced softly can seem fluty. Many tone colors when voiced softly can take on a "gray" or nearly neutral tone, which can be very valuable, especially for accompaniment. Around the tonal color wheel, stops that are normally loudly voiced may appear next to ones that are usually soft. Relationships are based entirely on tone quality, irrespective of loudness.

Many stops lose their distinctive color as they approach the top of their pitch range; the same is true of some stops toward the bottom of the compass. The color wheel considers stops as they sound in the mid-range of the manual keyboard.

USING THE COLOR WHEEL

Diapason, flute, string, and reed are just about as useful in describing organ tone as are sweet, sour, bitter, and salty in describing food flavors. A simple system is better than no system, but as a tool for description or analysis of tonal design or registration, the standard "four families of tone" is limited and misleading. It certainly doesn't create much enthusiasm for the nearly limitless subtle variety of tone colors that can be produced by the pipe organ. Take the reeds for example. One may well wonder how it is possible to put a Trumpet, a Clarinet and a Vox Humana into the same category. What about open flutes and stopped flutes? What about different scales of strings: one that might have the bite of a reed and another almost diapason-like breadth? These questions prompted a search for a way to categorize the vast array of organ tones in a more systematic way.

Music has always been related to color, and musicians often describe not only timbre but also tonality in terms of color. Organ consoles sometimes have red color engraving on reed stop knobs; some French Romantic organs use different colors for each of the major tonal families. A color wheel, therefore, seems to be an appropriate way to present the families of organ stops, showing how they are related in a continuum, depending on their harmonic content and thus the vowel sound they produce. It is very interesting to see how the relationships among visual colors (primary, secondary, etc.) correspond to the relationships among tone colors.

PRIMARY COLORS

The primary colors (red, blue and yellow) cannot be made by combining other colors; they are unique. The primary tone colors of the organ are flute, string and trumpet. They, too, are unique. The most striking example of a secondary color that may be synthesized by combining primary colors is the diapason, which can be imitated, if not replaced, by combining a flute and a string. We see this often on small instruments where the Swell uses a flute and a string as the foundation of the division. How can the diapason be omitted from the list of primary colors when it is universally recognized as the most important stop of the organ? An analogy is that green may be the most important color in a forest painting, but that does not make it a primary color.

THE DIAPASON

Diapason tone is unique to the organ. It is the signature sound, well known to even the most casual listener. The terms "diapason" and "principal" are synonymous, but at Schoenstein we reserve "principal" for the 4-foot member of this tonal family, which is used to set pitch for tuning. Diapason is the tone color that sets the organ apart from other instruments and therefore is the most important of all flue stops. Diapason tone is poised at the mid-point between pure string and pure flute tone. This is the characteristic that also makes it one of the most difficult stops to design and voice perfectly. If the scale is a bit too wide, the stop will tend toward the flute character. If it is a bit too narrow, it will tend toward the string character. Given the influence of the acoustic into which the organ plays, achieving this perfect balance is one of the most challenging aspects of the organ builder's art. This explains why diapason tone has differed so much among various builders and national traditions over the centuries. The sound of the diapason and the emphasis placed on diapason tone is what most commonly defines a personal or national style of organ building—and what most often invites criticism.

THE ORGAN'S TWO PILLARS OF TONE

If the diapason is the monarch of the flues, certainly the trumpet is the emperor of the reeds. It is the dominant sound of the reed family and the only primary "inimitable" reed tone; it cannot be synthesized by combining two other reed stops. What makes the diapason and the trumpet the pillars upon which the structure of an organ is built is their unique ability to create a true chorus effect. The term "chorus" is often used loosely, by applying it to a group of stops of different pitches that are in the same tonal family. Sometimes a group of flutes at 16′, 8′, 4′, $2^2/_3$′ and 2′ is called a chorus. This is not correct. That same group of pitches in the diapason family, however, could be called a chorus, following this definition: a chorus is a group of stops of the same tone color, sounding at different pitches of the harmonic series, that has both strong fundamental and brilliant overtones and is commonly played together **in chordal texture**. A chorus is possible only when the various pitches can interlock with each other and fuse to make a single blended block of sound. This fusing requires production of the most natural singing vowel tone, the "ah." The tone must have a balance of fundamental and overtones such that the overtones of a lower pitch interlock with the fundamental and overtones of each successively higher pitch.

Certainly stops from other tonal families can be combined in this way, but such an ensemble is not normally used in chordal texture. For example, the grouping of flutes mentioned above is most effectively used in playing a single melodic line. An ensemble of strings or specialty color reeds can produce interesting special effects, but their lack of fundamental precludes sustained use as a chorus.

The two pillars of organ tone, capable of producing a chorus, are the tonal backbone of the organ. One or the other, or most often both together, are necessary to give the organ's full ensemble its sense of grandeur and magnificent power. Often in the Anglo-American tradition, one division of an instrument (commonly the Great) has a diapason chorus as its primary focus while another division (usually the Swell) has trumpets as its power center. The full Great will have a diapason color with some trumpet accent. The full Swell will consist of trumpet 16′, 8′ and 4′ plus a mixture to add a diapason accent. In the full organ ensemble, with all divisions coupled together, the diapasons and trumpets may be of equal power, or one may slightly dominate the other depending on the acoustical and musical circumstances, but the diapason chorus and trumpet chorus are the essential elements of organ architecture on which the rest of the structure depends. The term "quasi-chorus" may be applied to several tonal groups. These include stops that can produce a chorus-like effect for limited use. For example, an ensemble of echo diapasons (dulcianas and salicionals) can produce a sound like a diapason chorus heard at a distance, a most useful

timbre in choir accompaniment. Reeds of the tromba family can make a fine multi-pitch ensemble effect, but their emphasis on the fundamental doesn't permit the kind of balance and blend found in the trumpet chorus. Exactly the opposite imbalance–emphasis on overtones–limits the usefulness of ensembles built on fagott tone. A mixed group of color reeds such as a Clarinet at 16-foot pitch, Flügel Horn at 8-foot pitch and Rohr Schalmei at 4-foot pitch can yield a chorus-like effect on the Choir manual. Also, a stop of this type can be used as a substitute 16-foot voice to give a lighter effect to a trumpet chorus.

DESIGN AND REGISTRATION

The main purpose of the color wheel is to provide some practical help in both organ registration and tonal design. Here are just two points relative to registration that the wheel helps illustrate. The Diapason is a closer relative of the Harmonic Flute than is the Bourdon. Therefore in playing one of the beautiful Harmonic Flute solos in the French Romantic repertoire on an organ without one, it might be wiser to substitute a broad-scale diapason, rather than a stopped flute with its emphasis on off-unison overtones and consequent "hollow" tone color. On the other hand, a stopped flute serves as a nice substitute for a Clarinet, especially if augmented with flute-toned mutations reinforcing the off-unison overtones, since the Clarinet shares a similar harmonic make-up. Thus, looking at tones near one another or opposite one another on the color wheel provides insight as to how tones may be combined or substituted.

Thinking of tone colors in this format helps in deciding which stops to include in an organ design. For example, note the close relationship of the Flauto Dolce, Corno Dolce, French Horn and Flügel Horn. Each one of these stops exhibits a mysterious, muted quality. If that effect is desired, the color wheel shows choices that might be overlooked if these stops were not arranged together based on tonal quality. In a small symphonic organ we often include the Corno Dolce or Flügel Horn where the more specialized Flauto Dolce and French Horn are not practical. Thus an important effect is included by substituting these stops for a soft string and an Oboe. A Swell division should have flute, string and diapason tone at 8-foot pitch. Where there is space for only two 8-foot stops, the color wheel illustrates interesting possibilities to provide diapason quality: one combines two primary colors–a flute and a string; the other selects, in addition to a flute, a tone on the border between string and diapason tone–a Salicional or a Viola Pomposa–thus providing an alternate foundation not dependent on the flute, but light enough to be effective in string passages.

In a large instrument, where an important effect is a crescendo using only string stops to develop a build-up of tone, the difference between the hybrid muted flutes and the hybrid muted strings becomes important. Many people think of these as one tonal category, but their musical effect is quite different and must be taken into account. If a build-up is to be of pure string tone throughout, the starting point must be in the muted strings. On the other hand, if the desired effect is to start with a dark, mysterious tone color, gradually infusing it with the light of string tone as the build-up develops, then it is best to start with muted flutes.

If a very colorful tone with edge is required, it may be obtained with either an Orchestral Oboe or a Viole d'orchestre. The question becomes, which is more valuable in the tonal structure? Their close relationship, as shown on the wheel, presents the interesting option of substituting string tone for reed tone or vice versa.

The color wheel helps in making choices among flutes and color reeds for maximum variety and tonal interest. If an organ has only two flutes, one should be stopped or semi-open and the other open. If two color reeds are desired, one should be from the upper part of the wheel and one from the lower part for maximum tonal differentiation. An Oboe and Clarinet offer more variety than an Oboe and an English Horn.

In choosing the type of heroic reed to include on a larger instrument, a proper match with the room acoustic and musical needs is best made from a careful analysis of the various stop options, ranging from Bombarde to Harmonic Trumpet to Tuba Minor and Tuba Major. These stops graduate from light fundamental and strong overtones to heavier fundamental and weaker overtones.

One should not infer that the color wheel can be used as a pattern for the design of a particular organ. A well planned stop list does not have to include stops from every one of the tone wheel categories. There are no established proportions among tonal elements. The design of an organ depends on acoustical and musical requirements–not on a formula. The color wheel reveals possibilities for creative design through a systematic approach for placing tones in categories and illustrating their relationships.

NOMENCLATURE ODDITIES

Pipe organ nomenclature can certainly be confusing. This is especially true of names that we know from the symphony orchestra. For example, the French horn in the symphony orchestra offers a wide variety of tone colors, ranging from the brilliant hunting horn effect to dark and covered melodic beauty, depending on many factors, including the position of the hand in the bell and the angle of the bell. The French Horn of the organ imitates the dark and mellow moods of the orchestra's French horn, but the role played by the heroic character of the orchestral French horn is taken by the organ's Tuba Minor, which is a member of the trumpet family.

The tuba we most often hear in the symphony orchestra is the bass tuba. We forget that there is a whole family of tubas, and that the Tuba Major we hear in the organ, a member of the organ's tromba family, is like the tenor tuba or one of the treble Sax horns of the orchestra or band. The trombone leads to the opposite misunderstanding. In the organ, the name Trombone is usually reserved for a deep bass reed, whereas in the orchestra, the trombone we hear most often is the tenor trombone.

Oboe is another confusing organ name. The Orchestral Oboe sounds very little like the oboe of the symphony orchestra despite its name. The French Oboe or Hautbois is probably most like the orchestral instrument. The English Oboe and the capped Oboe Horn are only distant sonic relatives of the orchestral double reed instrument. Bassoon tone of the orchestra is seldom captured in the organ. The organ Bassoon is usually more closely related to brass tone than to woodwind tone. The English Horn is more successful, but the Saxophone is a stop that has been attempted many times without much success.

Everyone knows that the Vox Humana sounds nothing like a human voice. If the Vox Humana does have a vocal sound, it is the sound of a large choir of voices heard from a great distance. It is, of course, a choir with a somewhat unfashionable vibrato!

The stops that sound most like their orchestral counterparts are the open flutes. These have a quality similar to the traverse flute of the orchestra. Other successful parallels to orchestral sound are the Clarinet, the Trumpet and the narrow scale strings. On the other hand, there are stops developed over the centuries of organ evolution that we continue to call by names that we know are far off the mark, such as the Stopped Diapason, which is a flute.

Sometimes one name is used to describe two or more different tone qualities. For example, a Gemshorn can be slightly tapered and a member of the diapason family or strongly tapered and a member of the hybrid (muted string) category, sounding much like an Erzähler. For this reason the Gemshorn does not appear on the color wheel.

Remember, too, that the name of a stop may not indicate its proper tonal family relationship. Each builder has a system of nomenclature, and often names are assigned to stops at the request of a client or organist. The ear is the only reliable guide to assigning a stop to one of the color wheel categories.

The color wheel is an attempt to show the ever-changing and delightful kaleidoscope of musical beauty and drama that the thoughtfully designed organ is capable of producing. Perhaps it may open new avenues of thought about organ registration and design.

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