[Journal of Music Theory Pedagogy](https://digitalcollections.lipscomb.edu/jmtp)

Volume 5 | Article 1

1-1-1991

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INTRODUCTION

I was recently asked to present a seminar on a topic of my choice, but with the following proviso: the topic must be theoretical, and sufficiently provocative to inspire lively debate. Well, could there be any doubt—what more controversial topic to choose than solmization? Musicians have been unable to agree on this subject for six hundred years; it ought to spark quite a discussion, I thought—and it did.

Among theory teachers there is disagreement, sometimes antagonistic, about the value of solmization within the ear-training curriculum, particularly about which system to use. Most agree that the teaching of solmization is beneficial, but when it comes to the selection of one system, we hear little consensus and much opinion. Everybody has a preference and everybody wants to pump his preference into heads of students who are often passed from teacher to teacher—system to system—until perplexed beyond repair. Sightsinging manuals, other than presenting a cursory explanation of each system, usually advocate no one system, deferring instead to the teacher.

PURPOSE

Upon what basis do theory professionals choose a system? Typically, they resort to one of the following arguments to buttress a predisposition for one system over another. The first argument is Newtonian: "I was taught this system, and I don't have time to learn something else" (i.e., a body at rest tends to stay at rest). The second argument is geographical: "the system I use is taught in Europe, therefore it is superior." (This truth is considered self-evident—so evident, in fact, that it matters not whether the vaunted system is truly superior, only that the right people believe it to be so.) The third argument gives expression to the instincts of the herd: "All great performers use such-and-such" (sort of like "All great conductors are men"). Even if such a claim were true, it would prove nothing.[1]

The selection of a method ought to be justified by its potential as a pedagogical resource, not in terms of what or where the teachers were taught. Judicious application of a system presumes a high regard for contexts, purposes, and outcomes, not sacred cows. The right solutions require that we ask the right questions—questions like: what does each system help students to learn and how? how is each system easy to use; how is it difficult? what rudiments does each system *not* teach, and why? in what setting might one system out-perform the others?

In training the ear we desire to promote musicianship throughout the music curriculum. But because the teaching of solmization happens within the context of the theory curriculum we especially desire to nurture an aspect of musicianship that is within the particular domain of theory—that is, analysis. Too often ear training is considered an adjunct of performance, its curriculum created within the arena of interdepartmental turf warfare. As a matter of fact, there are those within every department who would content themselves with an ear-training strategy intended only to produce facile readers. From the theorist's point of view, the purpose of ear training is broader—to produce musicians who can perceive, understand, and analyze music with utmost intelligence and skill.

In what forum are these issues most likely to be resolved? Ultimately, the answers must come from experimentation and research. Through research we know a great deal about how the ear perceives the elements of sound. Scientific inquiry into the nature of acoustical phenomena can be traced in this century most notably through Seashore, back to Helmholtz, Rameau and a host of composers, scientists, and pseudo-scientists to antiquity. But researchers have not yet tackled the problem identified in this proposal, that problem being, "what are the comparative values of pedagogical resources within each solmization system?". The perceptual, co-variable, and cross-disciplinary connotations of such a study are daunting, to say the least—which is not to say that it cannot be done, but to suggest why it has not been done.

Lack of hard data notwithstanding, there remains the avenue of philosophical argumentation (as we have seen, when it comes to this subject a smidgen of logic cannot hurt). A systematic and rational comparison of the theoretical resources of solmization systems can serve, in the absence of definitive experimental data, at least to steer us in the right direction. This paper is such a comparison. Consider the method to be dialectical and speculative, in the main—that is, it is primarily a comparison of theorems and not a comparison of experimental results. If anyone can be forgiven for this, it is theorists—those who delight in navigating the uncharted oceans of hypothesis. It falls to future research to decide whether this theory has spied the new world, or sailed over the edge.

SOLMIZATION SYSTEMS

ASSUMPTIONS

The efficacy of solmization as a teaching device is historically established. There are reasons why musicians have been using vocables since classical antiquity, and reasons why many systems have evolved. (For those reasons, whatever they be, we ought to credit some good to each system.) Having hedged somewhat, I hasten to confess that this paper is an attempt to persuade and to convince; it is a flotilla of arguments for one system—"do-tonic" movable "do"—which means that readers are invited to roll out the big guns and decide for themselves which arguments truly float.

It is herein hypothesized that solmization works because it associates phonemes with various musical constructs that, with repetition, enable students to audiate sound from sight, and perceive sound to sight.[2] Syllables give names to structures that would otherwise have no names. In the context of the ear-training curriculum the ideal solmization system ought to provide the following resources:

1. Analytical orientation: In accord with the primary goal of music theory, the ideal solmization system will contribute to the analytical vocabulary and percepts of the student. Syllables ought to convey meaning in terms of musical structure, and the user must have perceived the structural function of a pitch, through analysis, before naming that pitch.

2. Aural orientation: The ideal solmization system will facilitate the recognition of musical structures and their transfer to written symbols. Students are better served when they learn first to recognize sounds, then the symbols, and not the reverse. The ideal solmization system will be oriented toward the ear, not toward the eye, causing students to become absorbed first with sounds, second with symbols.

3. Consistency: The ideal solmization system will be consistent in its phonemic association of musical structures with syllables. Pitch (frequency) is not a musical structure. Pitch is an *aural* structure, the production of which is necessarily part of making music, but pitch itself is not music. Rather, pitch is an attribute of sound. To be musical, pitches must first have been organized into contextual configurations, such as tonic, dominant, leading-tone, etc.

4. Singability: Since one of the goals of solmization is to improve sightsinging, it stands to reason that the ideal system should be singable. A singable system will be mono-syllabic, so as not to destroy rhythmic

relationships. A singable system will use a variety of beginning consonants and sustaining vowels, so as not to be boring and provide for distinct phonemes and articulations. A singable system will not be cluttered with diphthongs and ending consonants.

5. Stylistic flexibility: The ideal solmization system will lend itself not only to the singing of simple diatonic music, but also to modulating, chromatic, and atonal music.

FIXED "DO" SYSTEMS

The first solmization systems were based on a movable concept.[3] The Greeks devised a system that, allowing for differences in ancient and modern diatonicism, is remarkably similar to our movable "do." Twenty centuries later, Guido's hexachord (ut, re, mi, fa, sol, la) put "ut" upon C, F, or G—representing the tonic. The purpose of the medieval hexachord was to consistently identify the semitone by the syllables "mi fa," which meant that "ut" would move within the context of a single scale, and would not always represent the tonic. Seventeenth-century musicians, seeking to accommodate the increasing prominence of the leading tone, modified the Guidonian syllables, adding "si" for the seventh scale degree, and "do" which came to represent the tonic.

During the *bel canto* period, singers adopted the syllables of solmization and used them to construct vocal exercises—called *vocalizzo*, or *solfeggio*—in which the syllables served to aid the singer in uniting vowels and consonants. This led to the consistent association of certain syllables with fixed registers and has evolved into the system of fixed"do." The fixed system is used in much of the world as the only method for naming pitches; alternatively, we name pitches by using letters: "A, B, C," etc. (So, Americans, who tend to be unnerved by European musicians who can spit forth strings of syllables, shouldn't be. Most Americans can do the same thing with letters.)

Seven-syllable fixed "do" (with chromatic inflections)

The south-European fixed "do" system uses seven syllables (do, re, mi, fa, sol, la, si) to represent the natural pitches C to B, and all chromatic inflections. Thus A-flat, A-sharp, and A-natural are all solfèged "la." This method provides no phonemic distinction between the pitches of any scale (major, minor, or modal) beginning on A-flat, A-sharp, or A-natural; twenty-one diatonic scales can be solfèged by the sequence "la, ti, do, re, mi, fa, sol." Indeed, a chromatic scale on "A" would use nearly the same sequence.

While the seven-syllable fixed "do" system offers certain advantages (e.g., it has the fewest syllables to learn), it is defective in this respect: all major, minor, and modal scales, starting on a given pitch, use the same series of syllables. Conversely, diatonic scales of the same class, starting on different pitches, would use a different series of syllables. The anomaly applies to intervals too; a m3 might be called "do-mi," or "re-fa," or "mi-sol," or "fa-la," or "sol-ti," or "la-do," or "ti-re," while the same combinations might be used to name a M3, d3, or an A3. Paradoxically, in seven-syllable fixed "do," it is customary for identical structures to be given identical names, the process of differentiation depending entirely upon notation instead of sound.

As a consequence, seven-syllable fixed "do" is a language of pitch "regions," therefore a language that is impotent when describing tonal structures, or conditioning the ear to discern those structures. A pedagogy based on seven-syllable fixed "do" offers no unique advantage over a pedagogy that simply trains students to sing the letter names they already know. Seven-syllable fixed "do" is minimally helpful as a pitch naming scheme, and tonally ambiguous. With the abandonment of diatony it becomes necessary to use a twelve-syllable system that accounts for the fully chromatic tendencies of modern music.

Chromatic fixed "do" (with solfeggio syllables)

In chromatic fixed "do," sharped pitches are named by changing vowels to "i," and flatted pitches by changing vowels to "e" (with the exception of "re," which becomes "ra"). A chromatic scale on "C" would be sung: (ascending) "do, di, re, ri, mi, fa, fi, sol, si, la, li, ti, do," (or descending) "do, ti, te, la, le, sol, se, fa, mi, me, re, ra, do." Because each of the twelve chromatic scale degrees has its own syllable, chromatic fixed "do" is sometimes called "twelve-syllable fixed do," but this is a misnomer. Twenty-one syllables are actually required to negotiate every possible flat, natural, or sharp permutation on the keyboard, after which the system has still to account for double sharps or flats.

If the purpose of a chromatic syllable arrangement is to provide a name for all chromatic situations, the system has imperfections. How does the singer navigate through enharmonic alterations like E-sharp, B-sharp, C-flat, and F-flat, not to mention double sharps and flats? While C-flat and F-flat could be called "de" and "fe," the system is pushed to the brink of absurdity in its attempts to name the others.

Chromatic fixed "A" (with alphabetical names)

The third type of fixed "do" solmization dispenses with the traditional *solfeggio* syllables in favor of letter names. Thus a D-Major scale would be sung: "D, E, F-sharp, G, A, B, C-sharp, D." The advantage of this system is that North American students already know the letter names of pitches; if one must teach a fixed system in this country, alphabetical fixed "do" is an attractive compromise. This system improves over twelve-syllable fixed "do" by providing names for double sharps and double flats. The disadvantages are four: 1) chromatic alterations are bi-syllabic; 2) vowel resources are meager and they include diphthongs; 3) the phoneme for "F" ends in a consonant; and 4) students who do not use syllables may have difficulty communicating with the rest of the world that does.

Fixed "do" as a resource for training the ear

Consider what fixed systems do, and do not do, well. Chromatic fixed "do" can account for chromatic pitches within the rubric of monosyllables.[4] Furthermore, it is argued that fixed "do," more than any other system, is at home with atonal or modulating music, where the imposition of an artificial tonality or the continual movement of "do" may be unnecessary or counterproductive. It is on this round that the advocates of fixed "do" connect their case most convincingly. Movable "do" is indeed slower when applied to tonal modulations (with atonal music this is debatable). But one must parry with two arguments. Does the average musician encounter a sufficient proportion of atonal music in a lifetime to warrant the exclusive use of fixed "do?" Should not a student proficient in movable "do," which trains one to fix "do" anywhere one chooses, be able to constrain "do" to the pitch "C" in situations where atonal considerations require it?

Many musicians believe that fixed "do" facilitates the development of a strong sense of absolute—some use the word "perfect"—pitch. It is argued that singers, especially, can be trained to use fixed "do" like a vocal fingering chart in which placements, registers, and pitches are associated with corresponding syllables. The tacit implication is that it is essential for singers to acquire a sense of absolute pitch if they are to become competent readers, and that the best way to develop that sense is through Pavlovian repetition of syllables.

These beliefs seem plausible to most people, and are seldom disputed, in spite of the fact that no one has proven that practitioners of fixed "do" really do acquire a stronger sense of absolute pitch, or that an acute perception of specific frequencies really does make one a more musical reader.[5] Conceding the disputed outcome temporarily, we should at least challenge its underlying premise—is it indeed necessary for musicians to attain absolute pitch before they can become good readers? If so, is the practice of fixed "do" the best way to attain it? Not knowing the answer we can only surmise that absolute pitch is helpful, most people would agree, but essential?—most people would probably not.

Defects of fixed "do" as a resource for training the ear

Critics of fixed "do" raise three objections. The first is based on a historical interpretation of the word "solmization." The second objection is based on the technical difficulties of twelve-syllable fixed "do" in tonal music. The third objection concerns the paucity of meaning that fixed systems carry with respect to analytical processes.

Consider the following interpretation of what it means to "solfège." Musicians, until the eighteenth century, were used to designating scale degrees by syllable; syllables were therefore movable, and carried structural meaning. It was the singers of the *bel canto* age who attached a second function to syllables, as vocalizations. Until recently, musicians have recognized a distinction between *solmization*, which has meant the use of syllables to name scale degrees, and *solfeggio*, which has meant the use of syllables to perfect vocalization. In *solmization*, syllables were employed to teach musical structure, whereby the student learned to read and write. In *solfeggio*, syllables were employed to teach vocal placement, whereby the student learned singing technique. In *solmization* the musician recognized the musical function of a pitch before giving it a name, and the syllable was a byproduct of analysis. In *solfeggio* the singer named a pitch without considering its function, and the syllable became the agent of vocal technique.

This distinction has been maintained in reference works until recently. The operative definition in the important dictionaries, prior to 1980, is that solmization is a method of identifying pitches by *scale degree*.[6] One might argue, therefore, the historicity of a point of view that regards fixed "do" as *solfeggio* (a scheme for naming frequencies), and not as *solmization* properly understood. Admittedly it uses solmization syllables, but not according to historical usage—that is, to identify pitches by scale degree. The syllables of fixed "do" describe frequencies and notational positions, but not functions.

If the historian has an interest in maintaining the distinction between *solmization* and *solfeggio*, so has the theorist. As a system for naming pitches, fixed "do" is wanting. Seven-syllable fixed "do" is simplistic, ambiguous, and inaccurate. By contrast, the "twelve-syllable" system is more precise, but, with its twenty-one syllables, the most complicated solmization system imaginable. The student who wishes to solfège even simple diatonic music in all keys must know all twenty-one syllables. In the United States, at least, fixed "do" is alien and heuristic insofar as it requires students to substitute an old-world lexicon of pitch names for names they already know.

The most serious objection to fixed "do" is that it does not identify pitches by tonal function, therefore it cannot reinforce the perceptual structures of tonality, neither can it be used as a language to describe tonal structures. Mentioned earlier, this criticism bears repetition inasmuch as it is the essence of the argument against the use of fixed "do" in the context of theory pedagogy. For the ear-training specialist, whose task is to conceptualize musical structures aurally, and to train students to hear differences in structures, it is advantageous to name the structures themselves, not merely the pitches used to write them.

One might argue that pitch notation is irrelevant to music, which necessarily exists prior to, and independent from, printed marks. Notations are symbols for sounds; they do not disclose the function of those sounds—that is done through analysis. Musical function is ultimately defined by sound itself and captured cognitively by means of analytical and aesthetic processes that have nothing to do with notational symbols. When a student learns to recognize and name sounds by ear, he moves closer to a mastery of symbols, *ergo* the reduction of sound to symbol (writing music) and production of symbol to sound (reading music). Reading and writing are recursive processes that require an ability to perceive and name sounds and symbols both, but sounds first.

By perceiving and naming the sounds of music, not the symbols, we do more than perceive and name frequencies; we perceive and name musical style itself, a creature that cannot be caged by scratchings on a piece of staff paper. Contrary to the way we often use the word, "music" cannot be seen, it can only be heard. The conventional symbols of pitch, rhythm, meter, dynamic, articulation, and timbre, are, at best, approximations of what happens in a musical performance. Whether the process is reading symbols to sound, or writing sound to symbols, both depend on the perceiving and the naming of musical structures, and both are surely enhanced by analysis but hindered by unthinking recitation of pitch notation.

A matter of aesthetic awareness

Is aesthetic response based primarily on the perception of pitch, or the perception of tonal relationships? There is no way we can practically separate the two, but we can theorize distinctions nonetheless, distinctions that are germane to this proposal. The perception of frequency is a sentient power that enhances the aesthetic experience physiologically and only to a degree that is sensual or pleasant to the ear. Perception of frequency alone is therefore sensory, sensual, acoustical, and aesthetically incomplete. By contrast, complete aesthetic perception is cognitive, and affective, and dependent on the processing of sensory data—processing that is intellectual, emotional, analytical, and much more sophisticated than acoustical perception.

The type of listening that is purely pitch perceptive (if that were possible) would be primarily acoustical. And the type of listening that is purely relationship perceptive would be primarily aesthetic according to this view. Actually, both processes are essential to aesthetic perception; the first is the faculty of the ear to perceive and to differentiate sounds, but the second, being the learned ability to assign musical significance to those sounds, is more inherently musical, therefore aesthetic. True aesthetic perception requires an awareness of the syntactic rules of pitch formation, rules that are defined by musical styles and musical works of art. Were it possible to be cognizant of pitches only, without cognizance of pitch relationships, such a mode of listening would be non-aesthetic.

For the sake of argument, let's presume momentarily that the syllables of fixed "do" name frequencies, but the syllables of movable "do" name tonal functions. We must then ask which type of perception (frequency, or tonal function?) is more important to hear, therefore more important to teach. While the fixed "do" musician's perfect recognition of pitch may promote the perception of frequency, one must question the degree to which it promotes the perception of musical structure, therefore equipping the musician to process sounds aesthetically. Is not the perfect processing of musical structure a skill more informative than the perfect perception of pitch, and therefore a more useful step toward the goal of truly proficient reading and writing?

If one considers frequency an attribute worth naming with a high degree of specificity, then fixed "do" is an exercise not wasted. To be sure, the perception of frequency is essential to the perception of music. But naming frequencies?—even the precise naming, contributes little to the cognition of musical structure; to wit, most animals respond to frequency more acutely than humans, but animals (so far as we know) do not perceive music aesthetically. If, on the other hand, one considers musical structure worth naming to a high degree of specificity, then fixed "do" is an exercise in futility. Fixed "do" cannot do it.

A matter of nature or nurture

The perception of pitch and perception of musical structure are interdependent processes, both important to the musician, and both matters relating to the fields of theoretical psychology and aesthetics. But this proposal is pedagogical, and concerned not so much with the issue of nature, as with nurture. To what extent is the teaching of each process possible?

On the motor side, teachers naturally desire to cultivate and monitor the maturation of hearing within students. But data show that hearing development, if not musical aptitude itself, is nothing more than biological maturation, or nature. Gordon concluded that by the age of nine a child's developmental aptitude for music is normally fixed, and that what follows is a process of achievement.[7] Seashore showed that the physiological boundaries of the ear increase neither with training, nor with age.[8] Hearing, like seeing, has matured in most people by the age of six. Seashore found that practice may improve a person's ability to recognize the musical operations of pitches, but not to modify the capacity of the ear to hear them better.

Is it possible for the average student to acquire perfect pitch, as some musicians claim? The research does not support such a claim.[9] Correctly understood, perfect pitch is more than an ability to name any key struck on the keyboard, but an ability to differentiate, and quantify, deviations in pitch as small as one cent.[10] Thus defined, absolute pitch is extremely rare, not limited to individuals with musical training, and probably inherited. What often passes for perfect, or absolute, pitch is an acute sense of relative pitch, that involves the comparison of pitches to one or two frequencies consistently and reliably recalled. Upon this basis it is safe to say that absolute pitch cannot be taught or learned, but that relative pitch can be.

So called "ear training" is really a process of training the mind, not the ear. If the physiological limits of the ear are fixed by age six, and musical aptitude by age nine, they are of secondary concern to the ear-training specialist. The primary concern is with developing the mind, that which has continual potential for musical growth, and that which yields the greatest educational return. The goal of the music educator is to take what nature has given, the ability to recognize and produce deviations in pitch, and to nurture sympathetic mental responses to that which is aesthetically satisfying.

While some students can acquire a sense of absolute pitch, few do. We cannot assume, and neither should we expect, that every student will. As Seashore wrote: "fortunes have been spent and thousands of young lives have been made wretched by application of the theory that the sense of pitch can be improved with training. It is the cause of the outstanding tragedy in musical education."[11] Instead of relying on a technique predicated upon a skill attainable by the minority, we should rely on a technique that develops skills attainable by the majority. Returning to an earlier question—is the precise recognition and naming of frequencies a trick worth teaching? True, a sense of absolute pitch can be taught to some musicians, but does it deserve a priority status in the ear-training curriculum? I think not. We don't listen to music that way—"ah! I hear an "A," now a "B," now a "C-sharp!"—neither should we train the ear that way.

A matter of musicianship

If we don't listen to music that way, neither do we play music that way (at least not after the fifth grade). Musicianship requires a great deal more that putting the right fingers over the right holes and blowing. Returning to the problem of perceiving and naming symbols, what advantage is there to the student blessed with perfect pitch, who can peruse a score, see the symbol for A-440, and name it "la" in a fixed system? Having done this does not necessarily mean that he can produce the frequency "A" in a manner that is musically informed, even if he is able to produce the pitch in the relative range of 440 hz. To produce a musical pitch he must first have recognized the function of that pitch in the aesthetic scheme of things and then have interpreted the pitch accordingly. Having recognized the function, why not give the function a name? If sightsinging and dictation are the activities teachers use to assess the degree to which a student is apprehending musical structure, so can be the naming of those structures in movable syllables.

The definitive test of the efficacy of any solmization system must be a measure of what it brings to the listening experience. To what extent does fixed "do" inform a musician who is listening—without score—the musician whose only connection with music is sound itself. To what extent does fixed "do" clarify, illuminate, and intensify the listening experience? To what extent is fixed "do" an analytical resource for the listening musician?

How many musicians proficient in fixed "do" use the system at all when listening to music? How many fixed "do" musicians are able to use the system when taking dictation? Unless the musician has perfect pitch, the answer to all of the above is "None, or not at all."

Fixed "do" is a language that names the symbols for frequencies, but does not name the tonal assemblies they represent. Calling a pitch "la" in fixed "do" yields no clue as to how it might be functioning within its musical setting. The system of fixed "do" is purely nominal, notational, and visual; it names pitches, but is deaf to their tonal meanings and functional contexts. Fixed "do" proceeds from written symbols to musical production, but cannot reverse direction unless the user has perfect pitch. As a consequence, fixed "do" is of no help in the dictation process. In the theory classroom, fixed "do" is a language that sees, but does not hear, and absolutely does not analyze.

MOVABLE "DO" SYSTEMS

Number singing, movable "one"

Having considered the "pros and cons" of fixed-pitch systems, we now consider movable systems. If historic solmization is a method of identifying pitches by scale degree, then its most practical variation would be to have students identify scale degrees by number, forgetting *solfeggio* syllables altogether. In number solmization the tonic is identified by the number "one" regardless of mode. The first advantage to this system is that students are not required to learn *solfeggio* syllables—sufficient reason for some people to adopt the system pronto. A second advantage is that it brings a greater degree of consistency in the naming of some musical structures. For example, the tonic and dominant are always sung "one" and "five," regardless of the key or mode.

On the negative side, solmization by number provides for no phonemic distinctions between modal scale degrees (super-tonic, mediant, submediant, and leading-tone), which are called by the same names in minor or major, even though aurally distinct. The number system is incapable of modal differentiation, all modes are sung "one, two, three, four, five, six, seven." In this respect number solmization resembles seven-syllable fixed "do." The inability of both systems to distinguish phonemically between a major and minor seventh, or a major and minor scale, or a major and minor triad, is a serious flaw.[12]

"La-minor" movable "do"

The "la-minor" system, strongly promoted in music education today, is descended from the English system of tonic sol-fa, developed in the mid-nineteenth century by Sarah Glover and John Curwen, and adopted by the Germans as "Tonika-do." "La-minor" is the system advocated by Kodály. In "la-minor" the tonic of a major scale is called "do," but the tonic of a minor scale is called "la." Each mode requires a different syllable to represent the tonic.

Two advantages over other systems are worthy of immediate recognition. First, sophisticated theoretical knowledge is not needed to solfège "la-minor" at sight, explaining why the system is advocated by teachers of young students. Beginning singers, liberated from the constraints of notation, are free to solfège what they hear before having learned its visual cognates. This advantage applies to all movable systems, and is as it should be. Second, in the "la-minor" system alone, the singer who has progressed to the reading stage, and who can identify the tonic pitch (major) of each signature, calling that pitch "do," can sing any of the seven modes associated with that signature. The young singer need learn only seven syllables to sing diatonic music in any mode.

Because the pitches of all keys sharing the same signature also share the same syllables, "la-minor" is sometimes called "key- signature" movable "do." By this we recognize that the "la-minor" system operates on the relative relationship between modes, allowing singers to move unencumbered from major to the relative minor without having to incorporate syllabic modifications that account for a new tonal center. Modulations that do not involve a change of signature are negotiated simply, without the student knowing that a modulation has happened. Modulations to other key signatures require the shift of "do" to a new pitch.

What is presented here as an advantage to young students may be viewed as a defect by the college theory teacher, who must insist that students be cognizant of modulations from major to relative minor. From the theorist's perspective, "la-minor" insinuates a dependence on the major to define the minor, as if to suggest that minor cannot exist independently of its relative. This is a simple objection: that a student might begin to consider a minor scale as a major scale, only starting on the sixth scale degree, whereas in reality that which exists in the pure minor ought to be appreciable in its own right without analogy to the major.

According to "la-minor," half-steps in all modes are defined and named by their relationship to the relative Ionian mode. Thus "mi-fa," and "ti-do" are always semitones, regardless of the mode, but located on different scale degrees in each mode. In this regard "la-minor" is similar to

Guido's "ut, re, mi" scale. While both methods of identifying semitones in diatonic systems are uncomplicated, both methods, as a consequence of their simplicity, tend to neglect the aural and notational differences between modes. By inference, they tend to portray all modes as infratypes of Ionian, diminishing the significance of modal variation to the degree that other scale degrees are implied to behave as tonic.

A grasp of the relative relationship between a scale and its relatives sharing the same signature is necessary if one is to identify structural links between sections of a work, but when it comes to aural perception of functional harmony, a more useful comparison is found in the relationship between a major scale and its parallel minor. With so many aural structures belonging both to major and to minor, it is instructive to bring shared features together, *calling them by the same names.* As for the differences, we know that when functional harmonies become more complex, homogeneous major and minor tonalities tend to vanish, while androgynous tonalities, having characteristics both major and minor, tend to appear.

It is in this context of secondary chromatic relationships and modal borrowings, that the deficiencies of "la-minor" manifest themselves most clearly. "La-minor" gives seven meanings to each *solfeggio* syllable: "ti" could be the leading tone of a major scale, the super-tonic of an Aeolian mode, or the dominant of a Phrygian scale, etc. Structures that are the same in each mode, like the tonic, dominant, and leading tones, ought to be called by the same names. But according to the "la-minor" system, the leading tone in Ionian is called "ti"; in Aeolian it is called "si"; in Dorian it is called "di"; in Phrygian it is called "ri"; in Mixolydian it is called "fi." Mercurial phonemic relationships tend to confuse static musical relationships that inhabit every mode. Thus, while "la-minor," *vis a vis* fixed "do," names musical structures more consistently, it is nevertheless erratic in its naming from one mode to the next.

"Do-tonic" movable "do"

The only way to identify musical structures consistently, from one mode to the next and from one key to the next, is to name the tonic "do" regardless of the mode or key. "Do-tonic" accounts for lowered second, third, sixth, and seventh scale degrees by calling them "ra, me, le," and "te" respectively. The raised fourth degree of the Lydian mode is called "fi." Like twelve-syllable fixed "do," the "do-tonic" system has the capacity to negotiate chromatic configurations, but unlike fixed "do," it accounts for double sharps and flats, while at the same time identifying the structural meaning of every pitch that has a structural function. The syllables "di, ra, ri, me, fi, le," and "te" will get a function through just about any chromatic situation, secondary or borrowed.

In contrast, with "la-minor," which is happy in the company of its relative scales, the "do-tonic" system is happier with parallel relationships, and is therefore better suited to teach the aural particulars of major and minor. Unlike "la-minor" system where "mi-fa," and "ti-do" were always half steps (but located on different scale degrees), the "do-tonic" system provides different phonemes for half-steps that necessarily occur at different places in each mode. Students are not confused, therefore, by having to make comparisons with Ionian when singing non-Ionian modes.

Consider how students are taught to recognize key and mode in written theory. Whereas the key is essentially defined by the location of the tonic pitch, mode is defined by the number of accidentals in the signature. A change of tonic, with the signature remaining unchanged, effects a change of key and mode. Conversely, a change of signature, with the tonic remaining unchanged, effects only a change of mode. The "la-minor" system is equivocal when it comes to maintaining this key/mode relationship. In "la-minor," a change of tonic (signature remaining unchanged) does *not* require the renaming of the tonic pitch; conversely, a change of signature (tonic remaining unchanged) *does* require the renaming of the tonic pitch. Both processes may involve modulation or modal mutation. Thus the "la-minor" system admits a curious inconsistency where some modulations and mutations require renaming of the tonic, but other modulations and mutations do not.

By contrast, in the "do-tonic" system, the tonic is always called "do," regardless of where the tonic pitch is or the number of sharps or flats in its signature. Because in "do-tonic" solmization, structures that are the same in each mode are always called by the same name when in the same places, it presents the ideal vocabulary for teaching functional harmony and melody. The "do-tonic" system facilitates the teaching of aural skills because it names structures the way students hear them. This is extremely important, because in musical performance the size of an interval is defined by its tonal context.

To be sure, the "do-tonic" system imposes its own challenges. Students must learn five new syllables to negotiate modes other than Ionian (in "la-minor" these syllables were only necessary for chromatic alteration). Like "la-minor," the "do-tonic" system is fully functional for singing students in the absence of the printed page. Unlike "la-minor," "do-tonic" requires that reading students be able to interpret set-up information to correctly identify the pitch that is tonic, in order to call it "do," in all modes. This requires theoretical acumen beyond the level of beginning students.

If the "do-tonic" system has a greater affinity for the notation of music than does its variant "la-minor," what proves to be a disadvantage from the sightsinger's perspective is an advantage to the student who is taking dictation. In the case of the former, one must use notational cognates to name structures before they are heard, but in the latter, one can name structures as they are heard, before reference to notation whatsoever. It is for this reason that the "do-tonic" system is superior to other systems for the promotion of writing ability while the "la-minor" system may excel in the promotion of reading ability (at least for younger students).

Every movable system must find ways to overcome the impediment of tonal modulation, this being the most frequent criticism of such systems. What about modulation? If one takes the view that the purpose of syllables is to teach a student to read a modulation passage quickly, then movable "do" may be inferior in the short run. To sing a modulating melody, the student must first analyze the melody to determine what syllables to apply in each key. The analyzing takes time, therefore the reading is slower. If one takes the view, however, that the purpose of syllables is to help students to analyze, then movable "do" is superior in the long run. Teaching students how to locate the point of modulation, apply the appropriate pivoting syllables, and continue in the new key, is precisely analogous to the way we teach modulations in written theory. It is appropriate to apply the same technique in ear-training.

Is movable "do" unsuitable for singing modulations? To the contrary. In terms of analysis, movable "do" finds in modulation another opportunity to use the system to great pedagogical advantage. Whereas the "la-minor" system is unaware of modulations when they are between relatives, fixed "do" begs the question altogether. The practitioner of "do-tonic" solmization, in wrestling with the difficulties of naming modulatory functions, is in fact learning how modulations work. So, while it is admittedly possible for students to read modulations more quickly in fixed "do," one must doubt the degree to which fixed "do" aids understanding the structural dynamics of modulation—indeed, to what extent fixed "do" contributes to an awareness that modulations have, in fact, even occurred.

How the "do-tonic" system accommodates interval nuance

It is a cliché, but true nevertheless, that when it comes to reading notes, what you see is not always what you get. The actual frequency of written pitches (therefore melodies, intervals, and chords) in all contexts, tonal or atonal, are interactive and relative. The tempered scale, to which we have become accustomed in theoretical terms, is an expedient compromise for the sake of the keyboard. It is a great credit to the musical mind that it tolerates the tempered scale at all. In truth, most musicians have never performed, and never will perform, within the constraints of equal temperament. Accomplished wind players, string players, and singers routinely give color to pitches by raising or lowering them. This process is governed in tonal music by the mental and physical attributes of tonality, and in atonal music by the pitches that immediately surround the pitch in question.

This fact, long recognized by musicians, was established in the 1930s by the seminal research of Seashore and colleagues at the State University of Iowa, and has not been disputed since. For example, in a comparison of eleven performances of a Kreutzer violin *Etude*, Greene found significant and predictable deviations from the tempered scale in intervals of the second, and third.[13] All seconds and thirds, regardless of melodic direction, tended to be smaller than their tempered counterparts, with the exception of the M2 which tended to be larger. Fourths were more true to the tempered scale than were seconds and thirds. Seashore's comparison of vocal performance, two years earlier, had yielded similar results, leading him to conclude that musicians do not perform conventional tempered intervals but take license with pitch formations for the sake of artistic nuance. "Beauty," he wrote, "lies in artistic deviation from the rigid . . . ."[14]

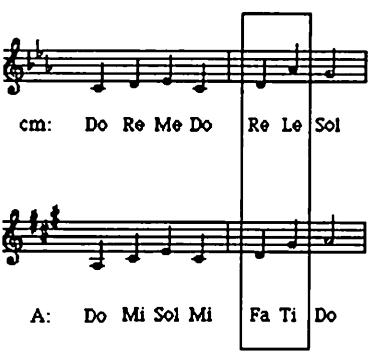
> "Things are not what they seem." The ratio of 1:1 between the physical fact, such as frequency, and the mental fact, pitch, is not always exact. Thus 440 does not mean always the same pitch. The pitch would vary in predictable ways with differences in intensity, duration, and harmonic constitution of the tone, that is, with amplitude, duration, and form of the sound wave. In a predictable way, we speak of the deviation as a normal illusion. An illusion is said to be normal when all persons under similar circumstances tend to get the same result. It is called illusion because the perception does not correspond to the physical object to which it refers.[15]

Seashore's normal illusions have two types of pitch manifestations relevant to this proposal: first as the physical alteration of frequencies, second as the mental alteration of perceptions. As an example of the first, "A" is not always the same frequency, rather, "A" when it functions as leading tone in the key of B-flat would be predicted to be a different frequency than "A" as it functions as dominant in D Major, or the third scale degree in f-sharp minor, or the root of a French-sixth chord in c-sharp minor, or the flat second scale degree of a Neapolitan sixth chord in g-sharp minor.

In view of the tendency of pitches of mutate when exposed to other pitches, how is it that movable "do" provides a superior resource to the teacher? Whereas the system of fixed "do" would call said pitch "la," in each of the aforementioned contexts, the "do-tonic" system would call it "ti, sol, me, le," and "ra" respectively, more accurately representing the various functions of the pitch in its various contexts, if not more accurately representing the pitch (frequency) itself.

To the person who may be skeptical that pitches can and should have nuance of frequency, sing the two melodies in the following example. The tritones "re-le" and "fa-ti," if well sung, are predicted to be unequal in terms of acoustical formulae, in spite of the fact that they are—by enharmonic equivalent—identical.

Figure 1: Normal illusion of nuanced frequency in a tonal context.

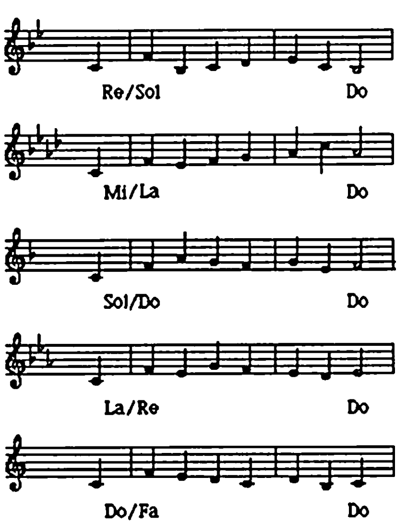


Play the tonic pitch, solfège the first line, then play A-flat on the piano. The piano A-flat sounds sharp (assuming that the piano is "in tune"). Now do the same for the second line, then play G-sharp. The piano G-sharp sounds flat; yet, when played on the keyboard, the intervals are identical. When sung, however, the tritones are not only acoustically dissimilar, but also difficult to recognize as the same class of interval at all.[16] The well-trained musician will sense that "le" compresses its interval by tendency toward "sol," and that "ti" stretches toward "do." In reality these are not identical frequencies, nor are they identical intervals. Each tritone is unique because frequencies and intervals are perceived and performed differently—depending on the context.

Studies that take technological pains to prove the extent or the relevance of pitch nuance are grasping for that which is profoundly obvious. Enharmonic equivalencies, theoretically undifferentiated by the tempered tuning system, are practically differentiated by the sensitive musician, and never more so than in the performance of chromatic inflections, secondary inflections, borrowed inflections, and enharmonic pivots. Similar exercises would likely indicate that the rule of pitch nuance operates within harmonic and melodic constructions of virtually every kind. Pitch nuance is shaped by the fabric of tonality. It is this tonal nuance that is so successfully articulated, and consistently articulated in the "do-tonic" system.

A second of Seashore's normal illusions is the phenomenon in which intervals are perceived to be different when they are really the same. Acoustically static intervals are often confused by students when they appear in their various tonal contexts. Seashore identified the P4 as an interval that is not normally subject to nuance of augmentation or diminution. This does not mean that the P4 is immune from normal illusion. The following exercise illustrates that truth. Each melody is in a different key, each melody begins with the same interval. Or is it really the same interval? Granted, each melody does begin with a P4, but do they really sound the same? Perhaps these fourths are acoustically dissimilar, their frequency ratios being altered by tonality, but that is not the point. Assuming that each fourth is perfectly identical we cannot escape the "illusion" that each fourth *sounds* different, not at first, but after the tonal center has become apparent.

Figure 2: Normal illusion of pitch perception in a tonal context.



The message of the foregoing illustrations is that the various species of intervals are neither monolithic by construction nor by perception. Otherwise identical intervals may sound dissimilar, perhaps even be acoustically dissimilar, depending upon tonal context. This is disturbing to the student who has been trained to think of reading as a process of concatenating intervals. Having learned one interval in one context, they are often baffled when the same interval presents itself in a different context.[17] Because intervals sound different in various contexts, the ideal solmization system will give an interval a different name for each context. "Do-tonic" solmization accounts for pitch nuance in a way that fixed "do" can not.

Not only should the ideal solmization system give intervals different names in different contexts, it must give identical contexts the same name regardless of the mode. Such a degree of consistency can only be accomplished by means of a "do-tonic" system. The "la-minor" system fails in that it would call the P4 between 5 and 1 "sol-do" in major keys, "mi-la" in minor keys, and a host of other names in other contexts. Most musicians concur, the P4 between 5 and 1 sounds the same regardless of the mode; it is logical, therefore, to name the interval consistently. If you call an interval "mi-la" (thinking 5 to 1 in a minor key) the student trained in "la-minor" might easily confuse this with 3-6 in a major key.

SUMMARY

Fixed "do" systems—whether seven-syllable with chromatic inflection, truly chromatic, or alphabetical—are nominal in that they identify frequencies and pitches without distinguishing tonal features or scale degrees. Fixed "do" systems depend on notation, and proceed first from notation to sound. Casual listeners, without a score, cannot use fixed "do" to empower the listening process (that is, unless they have perfect pitch, and then they don't need syllables).

The advocates of fixed "do" argue that it helps to develop perfect pitch. While this may be possible, one might counter with easier ways to develop perfect pitch, ways that do not require memorization of new pitch names (e.g., singing letters of the alphabet, or simply carrying around a tuning fork). Be that as it may, the advocates of fixed "do" are taking a gamble; their students may or may not develop perfect pitch (few do), and until they do, the system accrues no benefit in terms of understanding tonality.

The advocates of fixed "do" are troubled by the limitations of movable "do" systems as applied in atonal contexts. Admittedly, application of movable "do" to atonal and modulating music slows the reading down.

The objection deserves a serious answer. First, but not to belittle the presumed ascendency of atonal music, the average musician performs vastly more tonal music than atonal. Second, the student trained in movable "do" has the option of ignoring tonal associations, thinking in the key of C, and making the system "fixed." By contrast, the student of fixed "do" has no such option. Third, the objection that movable "do" is slower than fixed "do" in modulation represents a misunderstanding of the theorist's purpose for using syllables. Movable "do" is necessarily slower because the student must analyze before naming, precisely what the theory teacher expects—and desires to promote.

The fundamental purpose of ear training is not to produce readers, nor is it to produce musicians who can take dictation (although it does both). The strategic purpose of ear training is to train the mind to hear music completely. It so happens that the best way for the theory teacher to evaluate what the mind is hearing is to have the student read symbols to sounds, and write sounds to symbols. The well-planned theory curriculum will not neglect the tactical goals of sightsinging and dictation, because these are the two environments that best train the mind and demonstrate the trained mind. Movable systems work in both environments, but fixed systems do not.

Movable "do" liberates the user from the printed page. Musicians trained in movable "do" use the system to intensify the listening (therefore aesthetic) experience by clarifying tonal relationships and providing a language to describe those relationships. For theory students, movable "do" pays a copious dividend in improved dictation skills, the student is able to name what he hears before he writes its pitch.

Of the various movable systems, the "do-tonic" offers the most pedagogical resources and best exemplifies the ideal solmization criteria as proposed at the beginning of this paper: 1) "do-tonic" solmization helps develop analytical skills; 2) "do-tonic" solmization is oriented toward the ear; 3) "do-tonic" solmization stands alone for its consistent naming of musical structures; 4) "do-tonic" solmization is singable; 5) "do-tonic" solmization lends itself not only to the singing of simple diatonic music, but also to modulating and atonal music; and 6) the "do-tonic" system has historical precedence that stretches to antiquity.

Having indicated a preference for the "do-tonic" system of solmization, I recognize that a practical pedagogy requires the discrete and systematic acquisition of skills, and that involves the use of other systems. The first step in this process requires students to solfège tonal music in the key of C, diatonic fixed "do," first using numbers. The second step involves teaching the primary syllable names and applying them still in the key of C. The third step requires students to move "do" to other tonal centers. The fourth step requires complete mastery of the "do-tonic" system in all diatonic keys and the syllables used in all modes. The fifth step familiarizes students with the chromatic inflections of secondary, borrowed, and altered sonorities. The sixth step introduces the concept of pivot function in modulating music, which is beautifully illustrated in movable "do." And the seventh step refixes "do" on the pitch C and introduces the remaining chromatic alterations that will be encountered in atonal music.

NOTES

1Given the lack of empirical data, it should come as no surprise that the apostles of each system fall, sooner or later, upon their anecdotal swords. Having heard that fools tread where angels fear to follow, this writer rushes to the fray with a fourth argument—pedagogical. There should be enough material here for every reader to find something to disagree with.

2Audiate is a neologism coined by Edwin Gordon, which he defines as follows: "Audiation takes place when one hears music silently, that is, when the sound is not physically present. One may audiate in recalling music or in composing music. In contrast, aural perception takes place when one hears music when the sound is physically present." Edwin E. Gordon, *The Nature, Description, Measurement, and Evaluation of Music Aptitudes* (Chicago: G.I.A. Publications, 1986), 13.

3It would be provident no doubt to spare the reader descriptions of each solmization system, descriptions that can be found in *Groves, Harvard,* or other sources. It seems likely, however, that not every reader will know all about every system (or study *Groves*). So, for the sake of those who do not, the descriptions have been included, and for the sake of those who do, the descriptions have been kept short.

4For example, fixed "do" uses "le" instead of "A-flat." (two syllables), or in French "la bémol" (three syllables). For sightsinging purposes any solmization system has a rhythmic advantage over naming pitches by letter names.

5"More musical reader" because it shall be demonstrated that a "musical" performance requires deliberate alterations of frequency (nuance) in response to other frequencies and tonal contexts.

[6]All editions of *Grove's Dictionary*, until 1980, defined "solmization" not only in terms of syllables applied to scale degrees, but also to tonal functions. Thus defined, solmization is the practice of using syllables to name scale degrees. The *New Grove Dictionary* (1980) broadened the definition of solmization to include syllables used to name pitches and intervals. Definitions in the *Harvard Dictionary* mirror *Grove* before 1980, and like the *New Grove*, the *New Harvard Dictionary* (1986) redefines solmization as the designation of pitches by syllable. The change of definition represents current usage. The change has the potential to confuse an important distinction that until recently was vigorously maintained.

[7]Edwin E Gordon, *The Nature, Description, Measurement, and Evaluation of Music Aptitudes* (Chicago: G.I.A. Publications, 1986), 9.

[8]Carl E. Seashore, *Psychology of Music* (New York: McGraw-Hill, 1938), 58.

[9]Most how-to-learn perfect pitch strategies are based on a fitfully tortured analogy between the perception of pitch, and the perception of color. It is a wrongful analogy that has no scientific or logical basis.

[10]Seashore stipulates that the test for absolute pitch must be carried out immediately after the person awakes, before any other sounds have been heard. Carl E. Seashore, *Psychology of Music* (New York: McGraw-Hill, 1938), 62.

[11]Carl E. Seashore, *Psychology of Music* (New York: McGraw-Hill, 1938), 58.

[12]Lesser criticisms include: the number "seven" is bi-syllabic, the number "one" sports the ugliest vowel in the English language, while "one, five, six," and "seven" all end in consonants.

[13]The analyzed passage was comprised entirely of seconds, thirds, and fourths. Paul C. Greene, "Violin performance with reference to tempered, natural and Pythagorean intonation," *Iowa State Musician* IV (1937): 232-251.

[14]Harold G. Seashore, "An objective analysis of artistic singing," *Iowa State Musician* IV (1935): 12-157.

[15]Carl E. Seashore, *Psychology of Music* (New York: McGraw-Hill, 1938), 63.

[16]Nuanced temperament, as exemplified in this problem, is perhaps the ultimate goal of musicianship training—a powerful argument for doing sightsinging and dictation away from the keyboard.

[17]I have observed that students who are able to identify non-contextual P4s consistently, will often mistake the contextual P4 from "mi" down to "ti" for a tritone.