

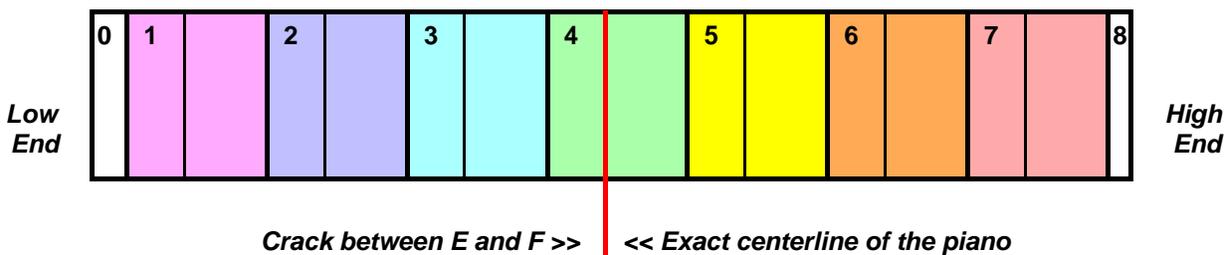
Why Key Maps for Piano Work So Well

KMA-05

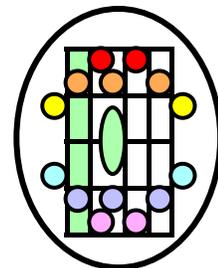


1. Notes move left and right in sync with finger movements and visually identify which keys to play. 2. Notes are drawn to scale for both PITCH and RHYTHM.

Based on a Piano Keyboard Labeled With The Rainbow Colors of the 7 Identical Octave Groups



From the Music Innovator's Workshop



Introduction and Overview

What is a Key Map?

A key map is music notation specifically designed for pianos and other keyboard instruments. Key maps are vertically oriented contour maps of the keyboard with notes that show the LOCATIONS of the keys that must be played to perform a musical composition. For rhythm, the physical length of each note is proportional to its length in beats, showing exactly how long to hold each musical sound.

Reading Pitch

Reading pitch on the maps is enabled by the fact that the keys of the keyboard form 7 identical 12-key visual patterns (C to B). We call these patterns of keys, Octave Groups. These octave group patterns of the keys provide the basic structure for each map. The octave groups are distinguished from each other by their locations from left to right, and by their colors on the maps. For beginners, colored labels are placed on the keyboard. The colors on the labels match the colors of the octave groups on the maps.

Reading Rhythm

Notes on key maps have vertical lengths that are proportional to their time durations in beats. Reading the rhythm is enabled by equally spaced thin horizontal lines that cross the staff at each BEAT, and by contrasting heavy lines that are equally spaced and cross the staff at the end of each MEASURE.

Basic Pitch Terminology

Most of the terminology of traditional notation is used for key maps. Traditional PITCH NAMES (A thru G) are used for the notes and keys. However, the black keys (and their notes) are given what we call "addresses" in addition to their traditional names. These addresses are the numbers 1, 2, 3, 4, and 5 beginning with C#/Db as key 1. The "octave groups" are numbered from 0 thru 8 in accordance with American Standard Pitch Notation (ASPN) terminology. (Middle C is the first note of Octave 4.)

Basic Rhythm Terminology

The terminology for rhythm on key maps is based on beats rather than on the whole note. (There are notes of - 1 beat, 2 beats, 4 beats, 6 beats, 1/2 beat, 1/3 beat, 3/4 beat, etc.) The number of beats of a note is determined by reading the beat lines crossing the staff at equal intervals.

Brother John

Here is a sample of a simple children's song on a key map. The vertical lines are the locations of the black keys. The notes with the pink fill are for the left hand. The heavy horizontal lines mark the measures; the light horizontal lines, the beats. (The space between two horizontal lines shows the length of a beat. The physical length of each note is proportional to its time in beats.)

Moderately #/b: None Beats: 4

Are
you
sleep-
ing,
Are
you
sleep-
ing,
Bro-
ther
John?

Bro-
ther
John?

Traditional Tune

Morn-
ing
bells
are
ring-
ing,
Morn-
ing
bells
are
ring-
ing.
Ding,
dong,
ding,

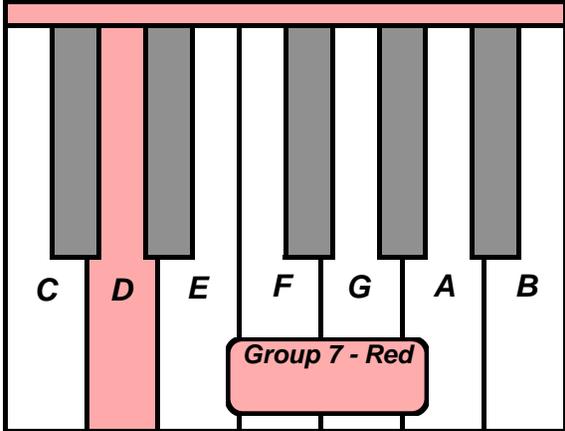
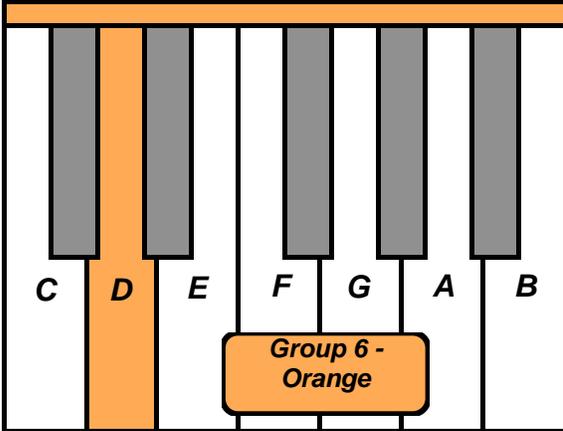
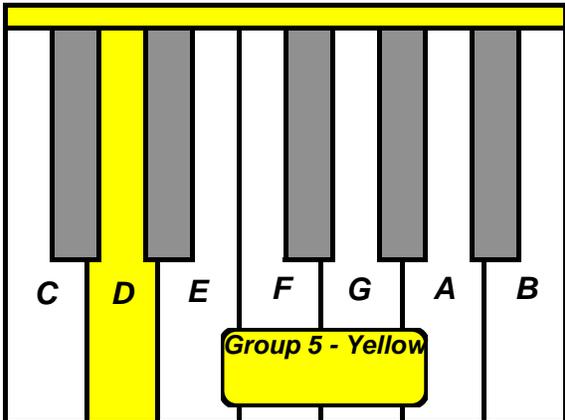
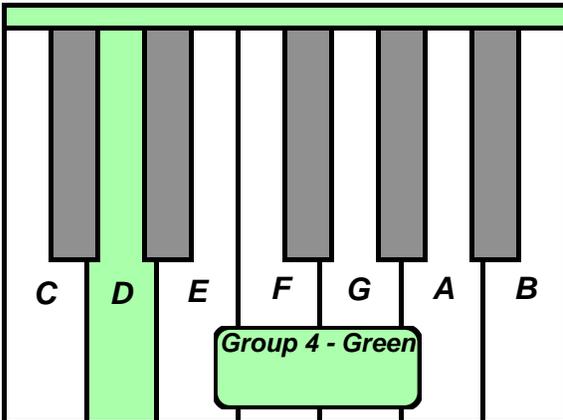
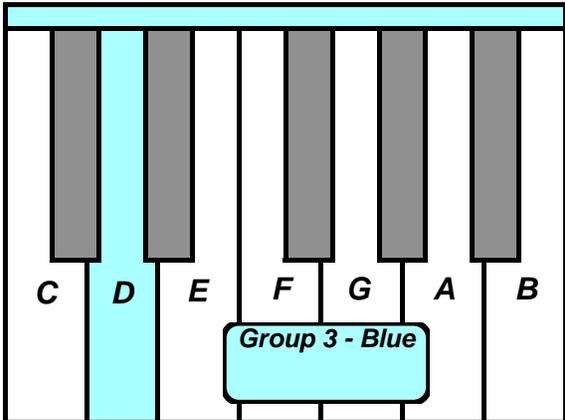
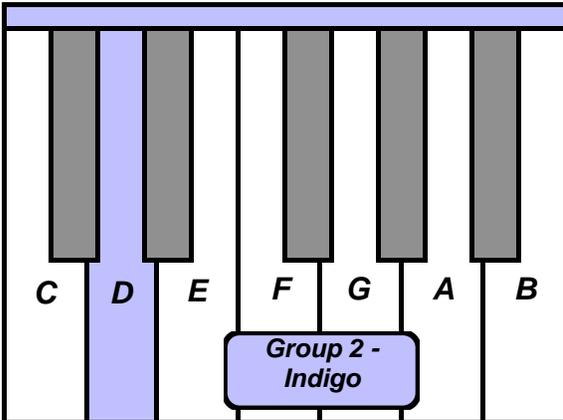
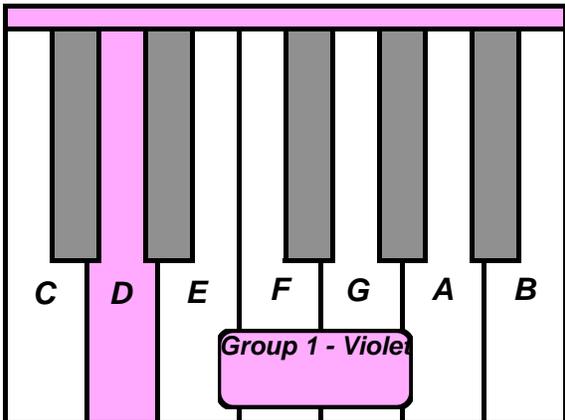
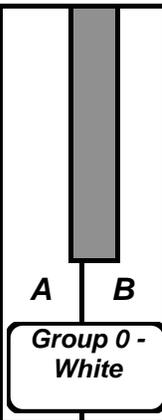
Ding,
dong,
ding.

What IS the Conceptual Basis for the Key Map Notation? Because creating and playing music is such an incredibly complex process, the notation must be based on a large number of concepts for it to work. These concepts will be explained in this unit. But to begin, there is one major concept that provides a basis for all of the other concepts that go into making a practical and effective notation. This is the incredibly effective design of the piano KEYBOARD - and the MATCHING DESIGN of the key maps.

The Design Genius of the Keyboard. There are 88 keys on the keyboard - spread out in front of the player. There were many design challenges, but the main one was how to design the keyboard so that individual keys could be found at the incredible speeds necessary for playing the most complicated and rapid music. The solution was to place all of the keys (except 4 at the ends) into 7 groups of octaves of 12 keys each. These groups were designed with IDENTICAL key configurations. Within each of these 7 groups there are 2 unmistakable patterns of black and white keys. The black keys are raised so that all of the keys can be located by touch as well as by sight. The design worked incredibly well! This is how players can find keys with lightning speeds - and this is also how players can read the matching key maps at the same lightning speeds.

The 7 Identical Octave Groups of the Keyboard

A piano has 7 complete octave groups. Other keyboards with fewer keys are grouped the same way, but they have fewer groups. Each octave group is color coded with one of the colors of the rainbow (in order), providing a distinctive sequential identity for each group.



H
i
g
h
e
s
t

C

K
e
y

The Awesome Keyboard

The piano keyboard (and other keyboards as well - especially the organ) provides a unique visual and tactual display of the full range of sound pitches used to create music in our culture.

Chromatic Scale

The keyboard arranges these sounds in half steps from low to high at the back side of the keyboard, where the black and white keys are mixed together.

C Major Scale

Across the front of the keyboard, the white keys are arranged to provide a C major scale across the entire usable sound spectrum.

The Magic of the Black Keys

*This is awesome: The keyboard has been designed so that any of its 88 keys can be found quickly (in a fraction of a second by skilled musicians) **BY TOUCH OR BY SIGHT!** This is made possible by the protruding black keys, arranged in 2's and 3's, across the entire keyboard. Any key can be identified and found, first by its general location, and then by touch.*

Conceptual Basis For the Pitch Notation

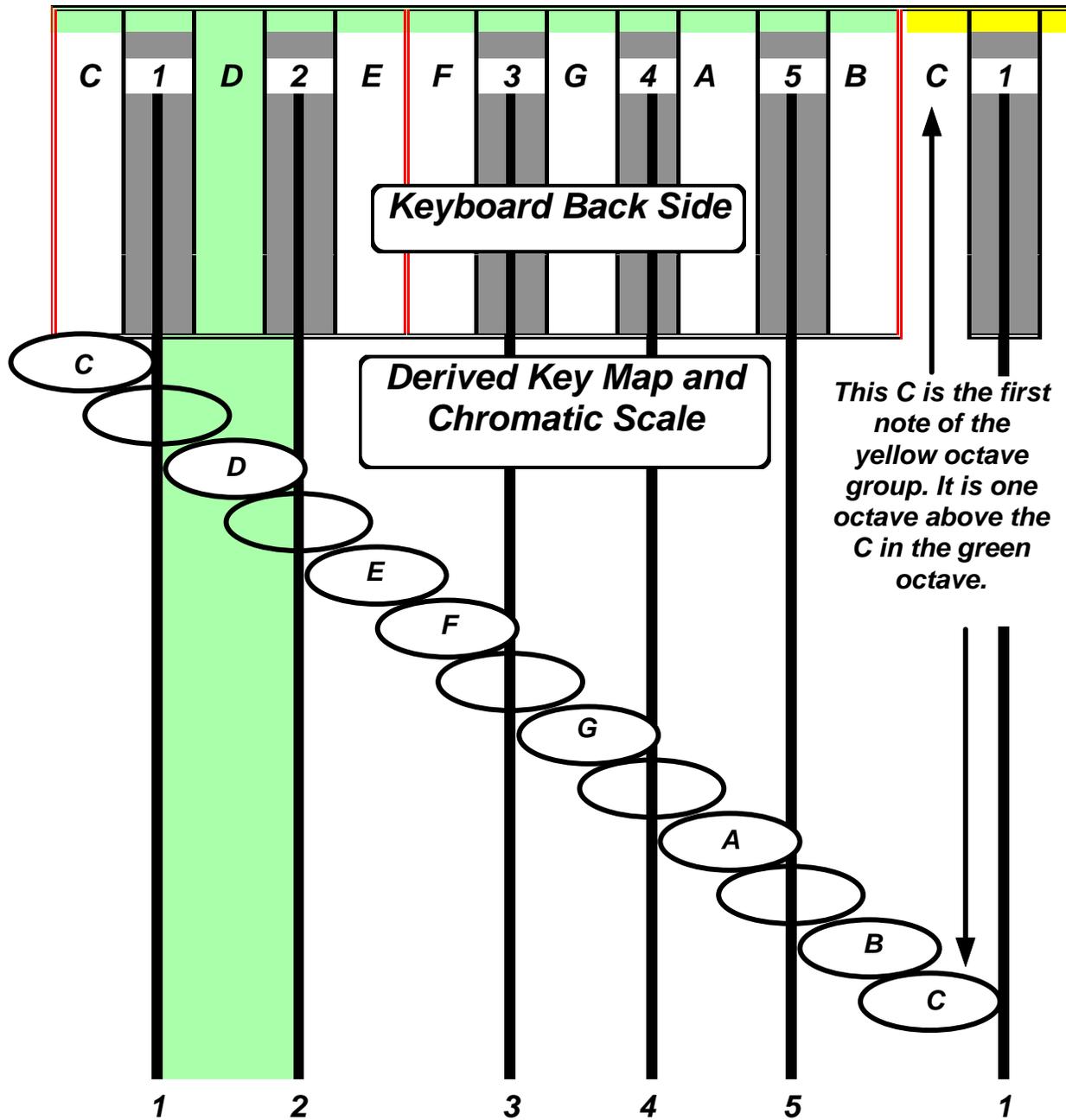
This arrangement of white and black keys along with the steady progression of the musical sounds in equal sized half steps from low to high makes the keyboard a perfect candidate for a graphic notation system that shows the location of each key (sound) on a diagram of the keyboard. This idea of notating the music on a diagram that shows which keys to play is the conceptual basis for the pitch notation.

Conceptual Basis For the Rhythm Notation

*Because the keys on the keyboard all represent equally spaced sound relationships (half step intervals), all notes in key maps also show equally spaced sound relationships. The result is that all intervals of a given size (in sound) are also the same size in the spacing of the notes. We call this **TruScaled**. It leads to the concept that the time lengths of notes be **TruScaled** as well. This results in graphically making the lengths of all notes in a composition proportional to the time in beats that they take. Thus, a 2-beat note is twice as long (graphically) as a 1-beat note.*

Derivation of the Key Map Staff

This diagram demonstrates how the horizontal spacing of the staff lines of key maps is derived from the spacing of the black keys on the keyboard. (A key map is a minaturized version of the lower part of this diagram.)



The Octave Group - A Basic and Important Organizing Concept for the Keyboard

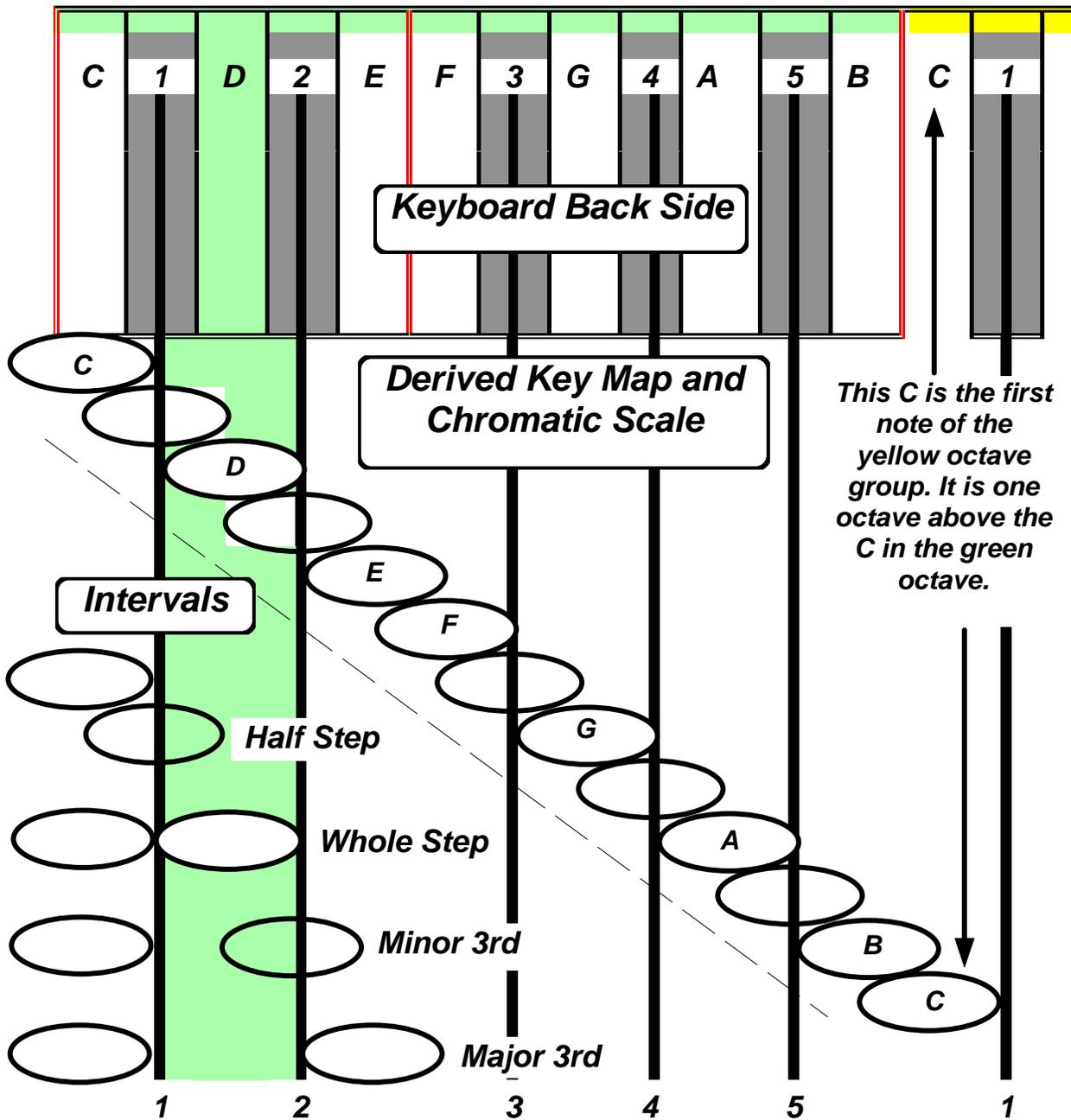
Identical 12 Notes in Each Octave Group. These octave groups are identical to each other and make it possible to use the same 12 notes for each identical group of keys. The notes in a group are distinguished from the notes in other groups by their locations and by color - as are the keys themselves. (The 7 groups are also numbered in the notation from 1 thru 7.)

The 7 Rainbow Colors. Each octave group is identified with one of the 7 colors of the rainbow (in the order that they appear in the color spectrum). These colors appear on the musical staff and, for beginners, they also appear on labels that are placed on the keyboard. Experienced players recognize these groups on the keyboard simply by their locations. Of course, the purpose of identifying the groups by their colors is to make it as easy as possible to find the groups on the keyboard that these colors stand for. To be clear, these colors are placed on the musical staff and on the keyboard, NOT on the notes.

The Sub-Groups of the Octave. Each octave group is made up of 2 sub-groups, the "low group" and the "high group". The low group is made up of the white keys C, D and E and the included black keys 1 and 2. The high group is made up of the other 7 keys of the octave group. These subgroups help the player clearly conceptualize the location of each key on the keyboard. This provides a basis for rapidly finding targeted keys.

Note Spacing Visualizing True Intervals

So that key map notes can show musical intervals accurately, the notes are always a whole step in width. Two notes with edges touching are a whole step apart. Two notes overlapping by half are a half step apart. All note intervals are proportional to the sound intervals that they represent. We call this *TruScaled*. The sequence of notes on this diagram forms a chromatic scale from the green C to the yellow C.

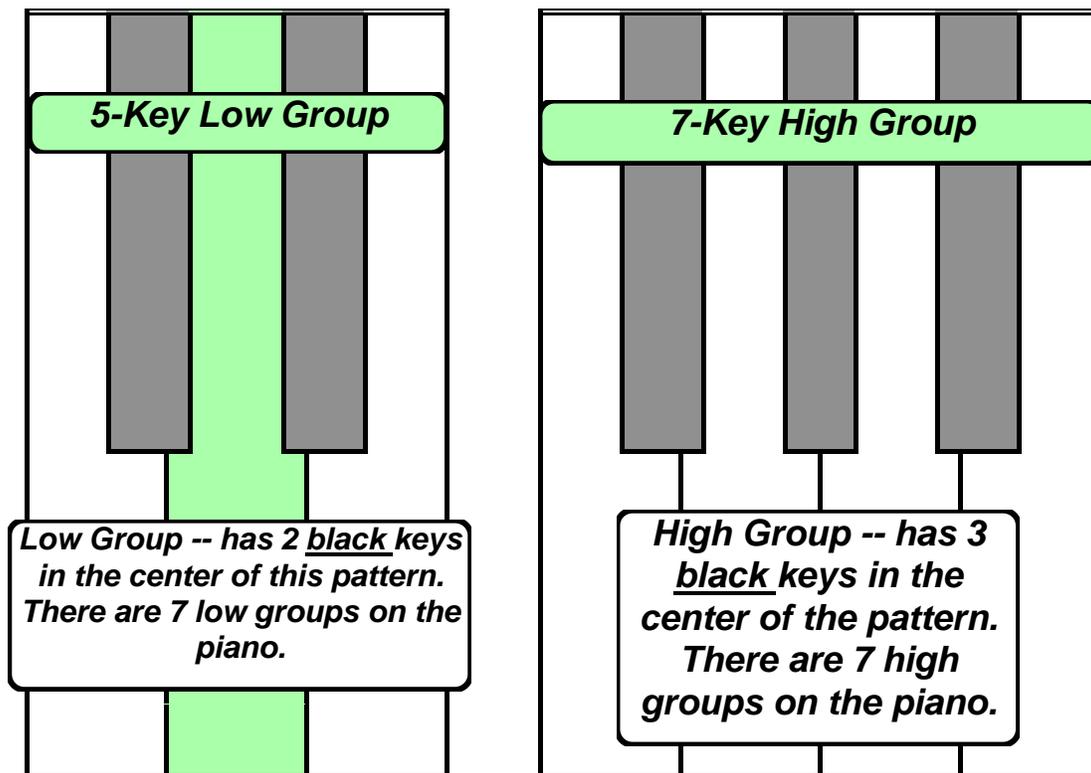


The Essential Roles of the 2 Subgroups of Each Octave Group

Each Octave Group contains 2 Subgroups: A 5-key Low Group and a 7-key High Group. Within each Octave Group, the Low Group has lower sounds than its High Group.

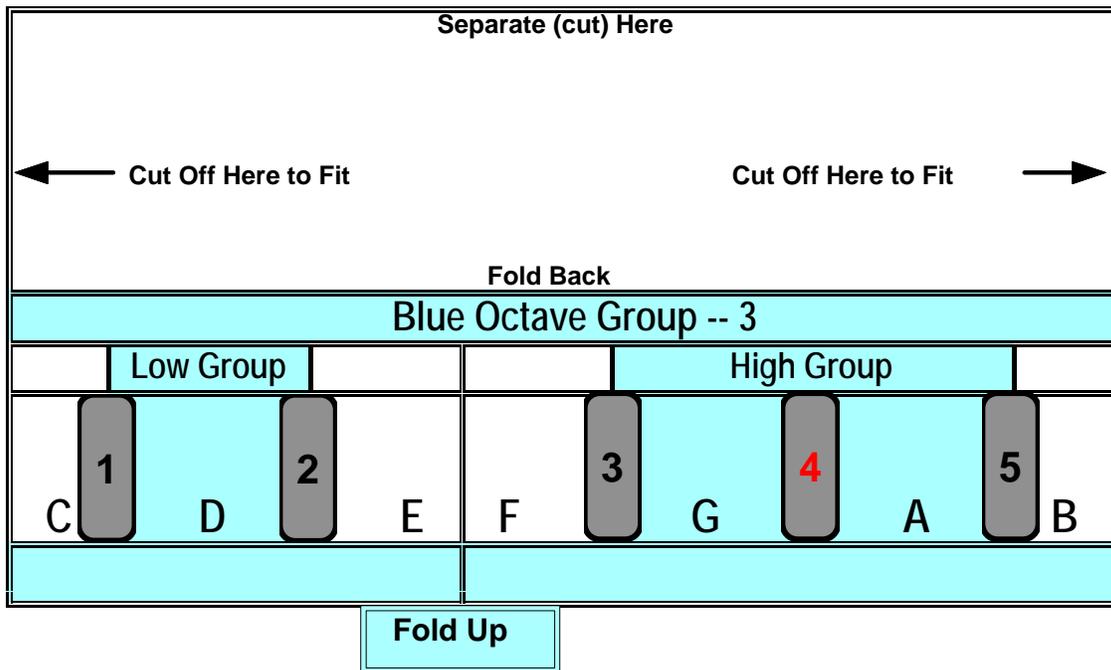
The most prominent visually identifiable keys on a musical keyboard are, of course, the black keys. They are visually (and tactually) the essential location markers for all of the keys on the keyboard.

Their essential role is carried out by their spacing (and standing out above the white keys). This spacing in groups of 2 and 3 marks, identifies and basically defines each octave group. These groups of 2 and 3 black keys make it possible to read the keyboard - and make it possible to read the key maps.

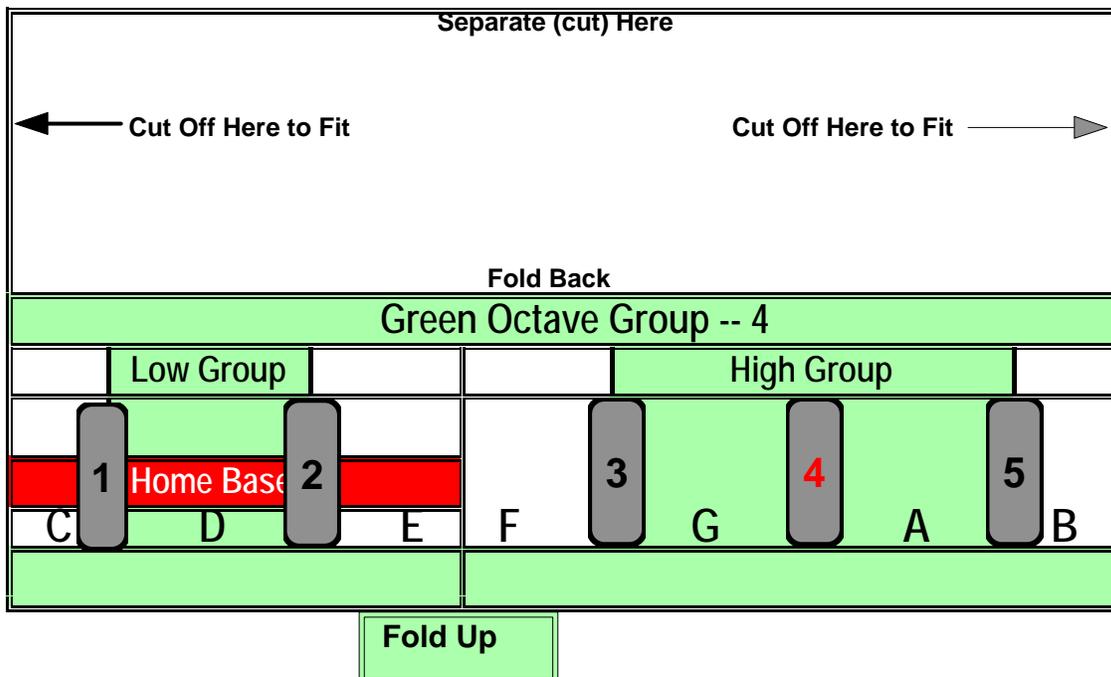


Octave Group Locator Labels. Here are samples of the 7 rainbow colored octave group labels that are designed for placing temporarily behind the black keys on the keyboard. These label the octave groups with the colors shown on the key diagrams and maps. The labels also show the names of the white keys. This way one can easily match the notes in a key map's blue octave group, for example, with the corresponding keys in the blue octave group on the keyboard. The labels can be left in place until no longer needed.

Sample



Sample



Conceptual Basis For the Vertical Staff

Unlike the horizontal staff in traditional notation, the key map notation staff must be oriented vertically so that the notes can move to the left and right in sync with the movements of the fingers on the keyboard. This one to one relationship between the moves of the fingers and notes is a much more intuitive movement than in traditional notation and clearly makes learning to read and play the notes less difficult.

The Vertical Staff as a Timeline

Another basic concept of the key map notation, illustrated below, is the use of the vertical staff as a timeline, providing the basis for the notation of rhythm.

Mary Had a Little Lamb - Keys of F and Gb

Sara Josepha Hale

Traditional tune

Version Played on Black Keys

Moderately *b: 1* Beats: 4

Moderately *b: 6* Beats: 4

(Basic RH Version)

Name

4	3
A	
G	
F	
G	
A	

Mary had a little lamb,
Little lamb,
little lamb,
Mary had a little lamb,
Its fleece was white as snow.
And

4	3

every where that Mary went,
Mary went,
Mary went,
And every where that Mary went,
the lamb was sure to go.

Address

4	3
5	
4	
3	
4	
5	

Mary had a little lamb,
Little lamb,
little lamb,
Mary had a little lamb,
Its fleece was white as snow.
And

Demo: Key Map With Notes For All 52 Piano White Keys

b/#: None Beats: 4

Concept: When it is desirable to clarify which hand to play notes with, the notes for the LEFT hand are shaded with a pink color.

This page demonstrates the full extent of the key map staff. The full staff is too wide to be practical for general use. Fortunately, the full staff is almost never needed. Piano music rarely extends for more than 3 or 4 octaves.

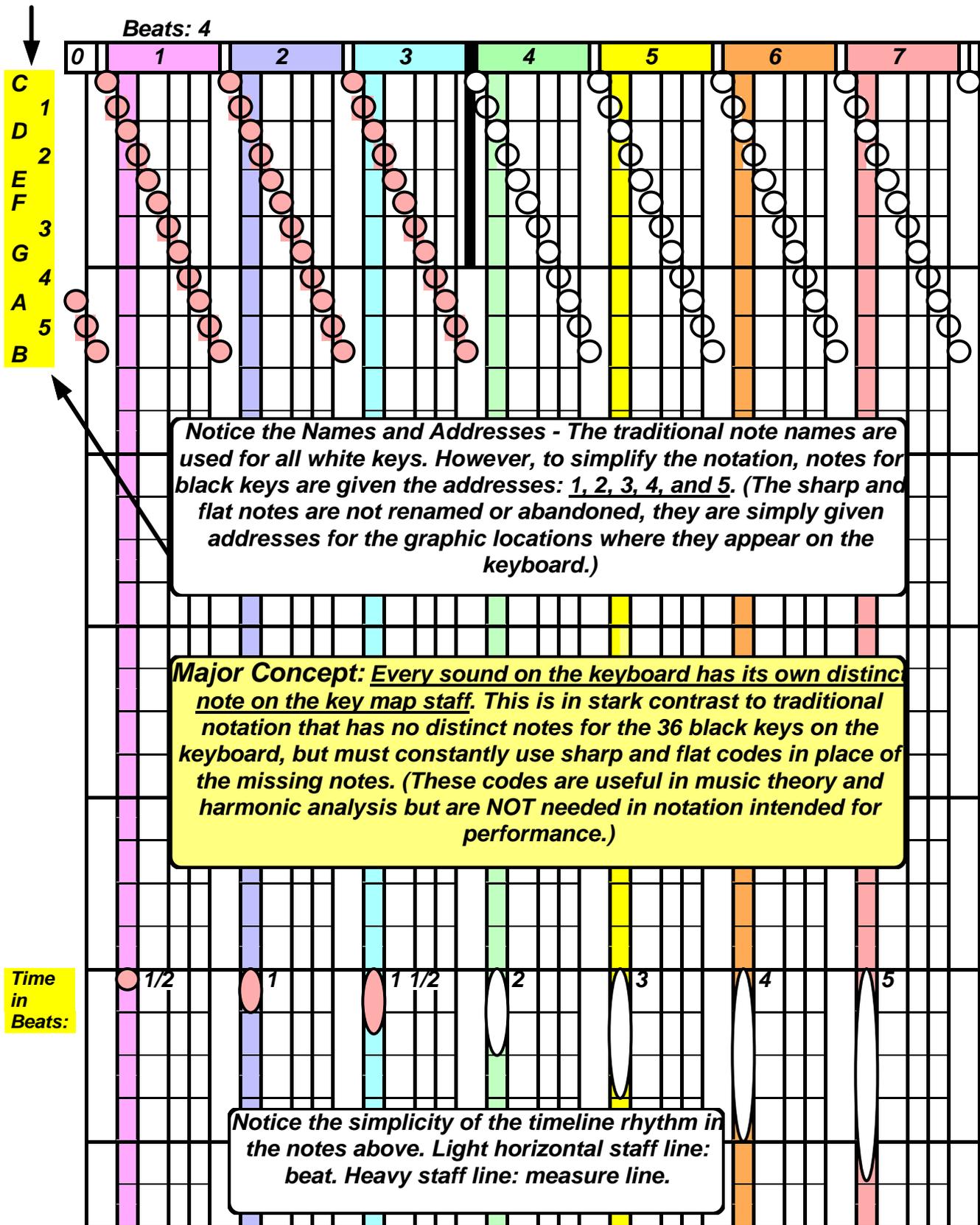
Concept: The width of a key map staff is made practical by only using a staff wide enough to cover the range of sounds required on each page of a piece.

The 7 notes of the green octave group at the right have been highlighted to show the full set of notes needed for white keys on key maps. (The full set of notes for black keys is 5.)

Concept: Four Way Identification of Octave Groups on the Key Map Staff. 1. Distinctive colored stripe in D space of each group. **2.** Colored stripe across the top of each group. **3.** Each group has a sequence number at the top with standard numbering. **4.** Each group is distinguished by its physical location among the other groups.

Key Map Showing All 7 Octave Groups and a Note for Every Key on the Piano

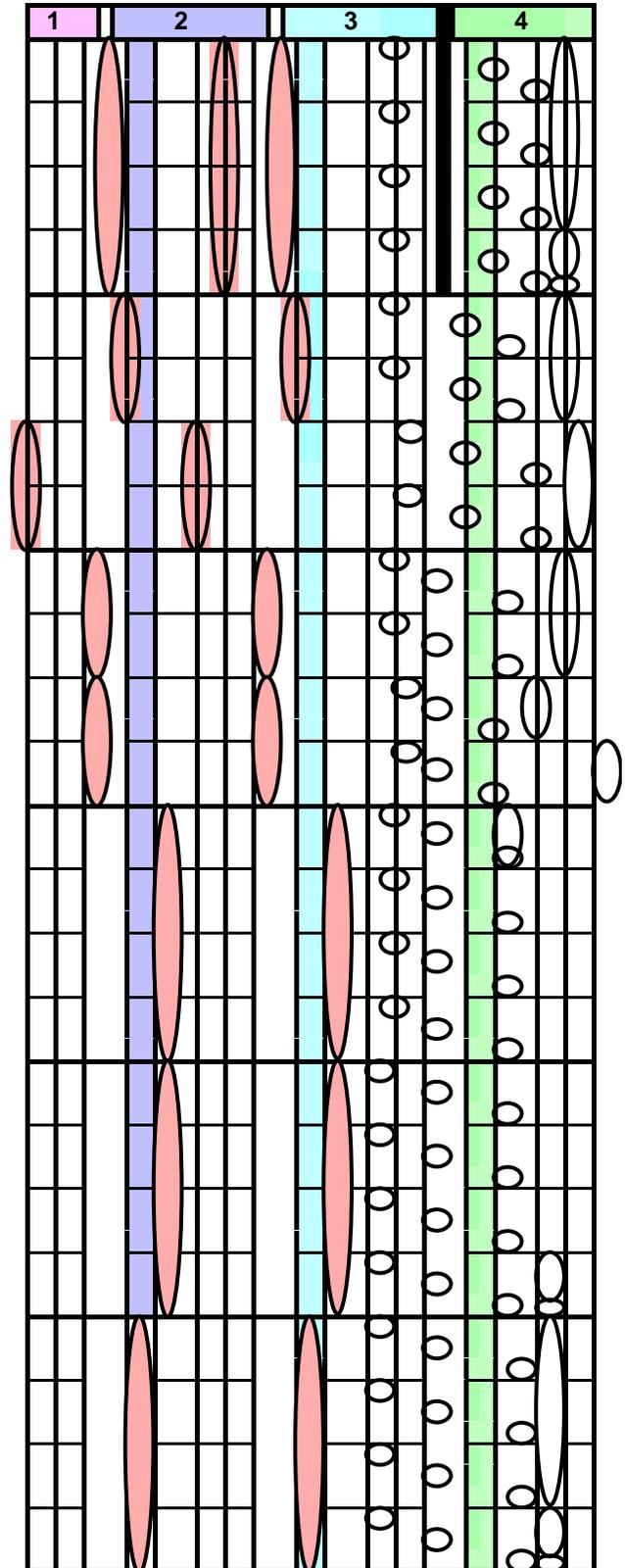
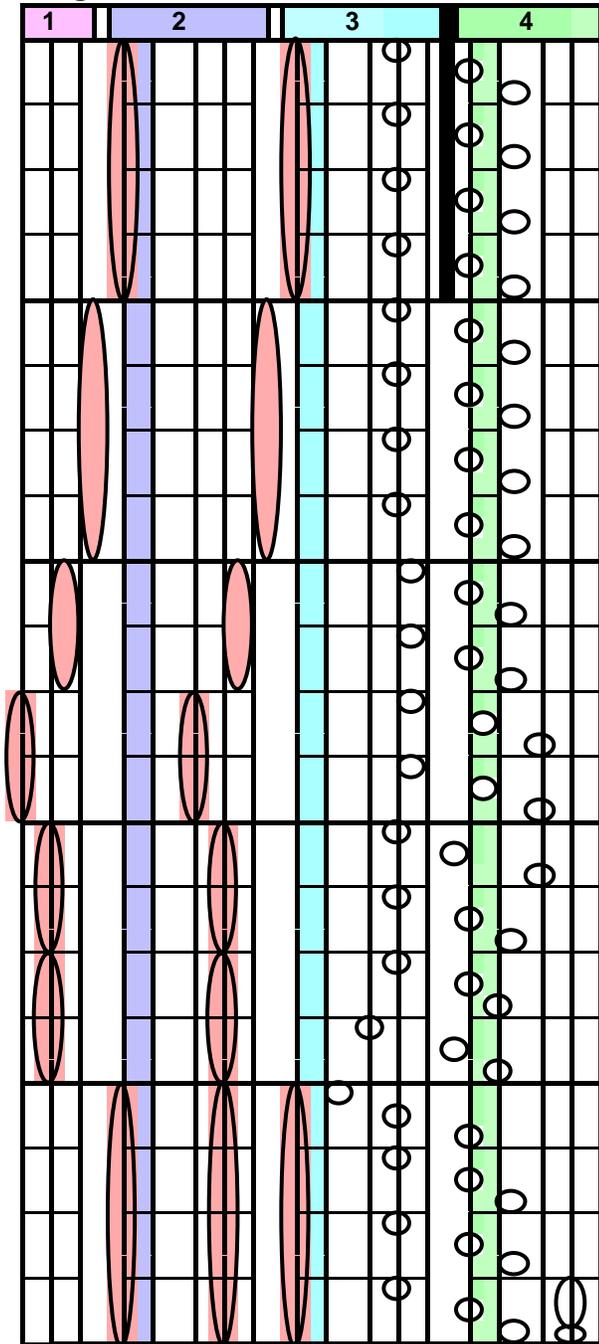
Name/Address



Example - Key Map

Opening Bars of Beethoven's Moonlight Sonata

Adagio sostenuto # : 4 Beats: 4 MM: 52



The vertical lines are the locations of the black keys. The notes with the pink fill are for the left hand. The heavy horizontal lines mark the measures; the light lines, the beats. The physical length of each note is proportional to its time in beats.

Key Maps Design Concepts - Summary

This page and the next are intended to serve as a review and summary of the previous pages. You may also find a few ideas not already covered.

The Graphic Design of the Keyboard. Making the notation closely resemble the keyboard was the major challenge in designing the key maps. The key maps had to match the keyboard well enough so that one could easily find and play any key displayed on a key map. The solution involved a number of critical decisions that took advantage of the very special way that the keyboard is designed. Fortunately, and unique among musical instruments, the keyboard provides a graphic display of all of the useful music pitches, in order, from the lowest to the highest. Not only that, but the half-step equal horizontal spacing of these pitches made it possible to design a graphically matching keyboard notation based on this equal half step spacing.

The Vertical Staff. Perhaps the most significant concept in the development of the key map notation was to use vertical lines, horizontally spaced like the black keys, as the musical staff. This staff is vertically oriented so that time flows downward, instead of horizontally as with traditional notation. The great advantage of this vertical orientation is that the left/right movements of the notes match the corresponding left/right movements of the fingers on the keyboard.

Notes on the Vertical Staff. Notes for the **BLACK KEYS** are placed directly on a vertical staff line. Notes for **WHITE KEYS** are always placed in the space next to a vertical line and touching the line. C, E, F, and B touch one line. D, G, and A are each located between 2 staff lines, touching both of them. (See the example at the right.) These locations visually match the locations of the corresponding keys on the keyboard.

Minuet in G
Allegretto #: 1 Beats: 3 J.S. Bach

Read Down

Pink notes - left hand
White notes - right hand

The Natural Grouping of the Octaves. Another essential element in the design of an interface between keyboard and notation is the natural grouping of sounds into octaves. Again, the visual aspect of the keyboard is itself the critical factor in making this practical.

Patterns of Sound. The process begins with the nature of musical sounds and the patterns that they form. The piano keyboard produces 88 different sound pitches. These 88 musical sound pitches occur in patterns that are the basis for making music. Among these naturally occurring patterns are half-steps, whole-steps, and octave intervals. The piano keyboard itself, is a visual display of these patterns, and provides half of the visual basis for the graphical interface. The other half of this pairing is the visual display provided by the key maps that we have been discussing.

Octave Intervals. These intervals form especially useful and interesting sound and visual patterns. Octave intervals are 2 sounds that are related by their frequencies. The highest sound of the interval has exactly double the frequency of the lowest sound. (And, of course, the lowest sound has half the frequency of the highest sound.) Two sounds that are an octave apart have the same name and they sound so similar that it is often hard to tell the difference.

Octave Groups. These octave intervals on the keyboard are an essential element in the graphical user interface (GUI) of the notation. The "octave groups" of the keys on the keyboard consist of 12 keys (black and white) beginning with C and ending with B. The octave groups of notes in the sheet music are made up of 12 adjacent notes beginning with C, visually matching the keys with the same names on the keyboard. There are 7 of these visually identical "octave groups" making up the entire piano keyboard. Notation for the 3 octave groups at the middle of the keyboard is displayed at the right. These identical groups are distinguished from each other by their locations, by their colors, and by their numbers, from low 3 to high 5 showing at the top of each octave group.

Read Down **Minuet in G**
Allegretto #: 1 Beats: 3 J.S. Bach

Pink notes - left hand
White notes - right hand

Conclusion

One of the most convincing reasons for learning to play the keyboard with the key maps is shown in the chart on the next page. This page shows graphically the huge differences between the numbers of notes to be learned just for the white keys in the two notation systems:

Natural Notes - Grand Staff: 52 - Key Maps: 7

Not Shown on the Chart:

Sharp Notes - Grand Staff: 36 - Key Maps: 5

b Flat Notes - Grand Staff: 36 - Key Maps: 5

and b on White Keys - Grand Staff: Rare - Key Maps: None
Double Sharps and Flats - Grand Staff: Rare - Key Maps: None

It is true that the notes at the extremes of low and high are almost never used and don't need to be learned before they are needed, but this still leaves a huge gap in the numbers of notes that need to be memorized.

To conclude, it seems fitting to remember how well the graphic user interface matches the notes with the keys, both visually and by touch. There are also the benefits of the TruScaled Pitch and Rhythm and the added beauty of the multi-colored formats.

We Three Kings of Orient Are

Lead Sheet Version

John Hopkins

Moderately #: 1 Beats: 2

Chords: Em, B7, Em, B7, Em, D, G, D7, G, F#dim, Em, B7, Em, D, D7

Lyrics: We three kings of O-ri-ent are; Bear- ing gifts, we tra-verse a- far, Field and foun- tain, moor and moun- --- tain, Fol- low- ing yon- der star. O ---

Chords: G, C, G, Em, C, G, Em, D, G, C, G, D, Bm, G, C, G

Lyrics: Star of won- der, Star of night, Star with roy- al beau- ty bright. West- ward lead- ing, still pro-ceed- ing, Guide us to the per- fect light.

Addendum

Identifying the Black Keys

The Names of the Black Keys. In traditional grand staff notation the names of the black keys are derived from the names of the adjacent white keys. When a black key functions as a flat (b), the letter portion of the name is the name of the adjacent white key on the right (example: (Ab - A). When the black key functions as a sharp (#), the letter portion of the name is the name of the adjacent white key on its left (G - G#). There are no note positions on the grand staff for the black keys. The notes for white keys are altered by flat (b) and sharp (#) signs to identify the black keys.

The key maps have a note for every key, including black keys. Key maps use ADDRESSES to identify the black keys. The black key addresses in each octave group begin with the first black key at the left end of the octave group. The addresses of the keys in every octave group are 1,2,3,4, and 5 which match our key map numbering of the black keys on the keyboard.

Issue - Space for the Sharp and Flat Notes

A Serious Matter. Simply stated, the grand staff doesn't have any note positions for black keys (but the key maps do). This is a serious matter. It is undoubtedly the WORST feature of the grand staff. It provides the greatest amount of stress and anxiety of all the issues facing those learning how to play the keyboard! The issue is avoided like the plague among many of those writing piano courses. Many courses avoid the 36 black keys of the piano entirely until well into the course of instruction. (Our own basic course actually BEGINS with these keys because they are so easy to locate and play. By the way, the black keys are where we must first look to find any of the white keys.)

Are there any redeeming features for this omission? Some come to mind. First, the omission reduces the vertical size of the grand staff significantly. In fact, this is so significant, it actually makes the omission look like a reasonable one. Another reason that comes to mind is its affect on the spelling of the scales. All scales are spelled with a letter and a sign for each black key. By having signs for the black keys (b and #), it is possible for all of the scales to be spelled with the ordering of the alphabet intact (f, g, a,b,c, etc.) This is very helpful for students working on memorizing the scales.

What is so Difficult About Notes For the Black Keys? The problem is with learning and reading the notation. Because there are no locations for black key notes on the staff, the notes for white keys must be used for the black keys. They must be altered by the # or b (flat) signs. The problem is that most of the time the signs are NOT placed by the notes but are placed at the beginning of each staff! (They are not placed by the notes unless they are "accidentals" which are infrequent.) Reading notation with flat or sharp notes mingled among the natural notes becomes more and more difficult as the proportions of these sharps and flats increase. It is only with years of study and practice that it gradually becomes less of a problem.

Key Signatures Altering the Keys to be Played

D Major

D E F# G A B C# D

Db Major

Db Eb F Gb Ab Bb C Db

Above are two major scales with signs at the beginning of the staff which alter all of the notes that have the same names as the signs. In the top scale, the # signs are placed on F and D. This means the player must play a sharp key for every F and D note encountered. Similarly, in Db major, all 5 of the notes marked will have to be played on the black flat keys. Note that the signs have NOT been placed close to the notes that they are altering.

#:2 D Major

D
E
F#
G
A
B
C#
D

Same Scales as Above

For the key maps, however, the notes visually match which keys are played and which sounds are heard. No special signs are needed or used.

b:5 Db Major

Db
Eb
F
Gb
Ab
Bb
C
Db

Features of Key Maps

A key map is a special kind of SHEET MUSIC designed for playing a musical keyboard (piano etc). The map visualizes the movements of the fingers on the keyboard, making the keyboard much easier to learn.

The vertical lines map the black keys. These lines appear in groups of 2 and 3 mapping the groups of black keys of the keyboard. The notes on (straddling) these lines are played on black keys. The notes adjacent to these lines are played on the corresponding white keys. THERE IS A NOTE FOR EVERY KEY, making it unnecessary to alter notes with sharps and flats!

A key map combines a HORIZONTAL DIAGRAM of the keyboard, visualizing pitch, with a VERTICAL TIMELINE visualizing rhythm. Unlike traditional notation, the time dimension of the music is vertical, rather than horizontal. This arrangement makes the left/right movements of the notes match the left/right movements of the fingers on the keyboard.

The notes are drawn to scale, just as in an ordinary map. The left/right movements of the notes are proportional (in distance) to the movements of the sounds on the keyboard. The vertical length of each note is proportional to the length (in beats) of each sound.

A key map is colored to show the elevations (in sound) of each octave, just as in a contour map of the earth. Given these proportionalities and elevations in color, the map becomes a fascinating and beautiful visual expression of the musical sounds.

The map also shows other information expected of sheet music - such things as tempos, key signatures, title, composer, song text (if it is a song) dynamics, fingering, chord symbols, and the like.

Finally, the key maps are beautiful visual expressions of the music in a manner similar in concept to the decorations of the illuminated manuscripts that we have as treasures from the middle ages.