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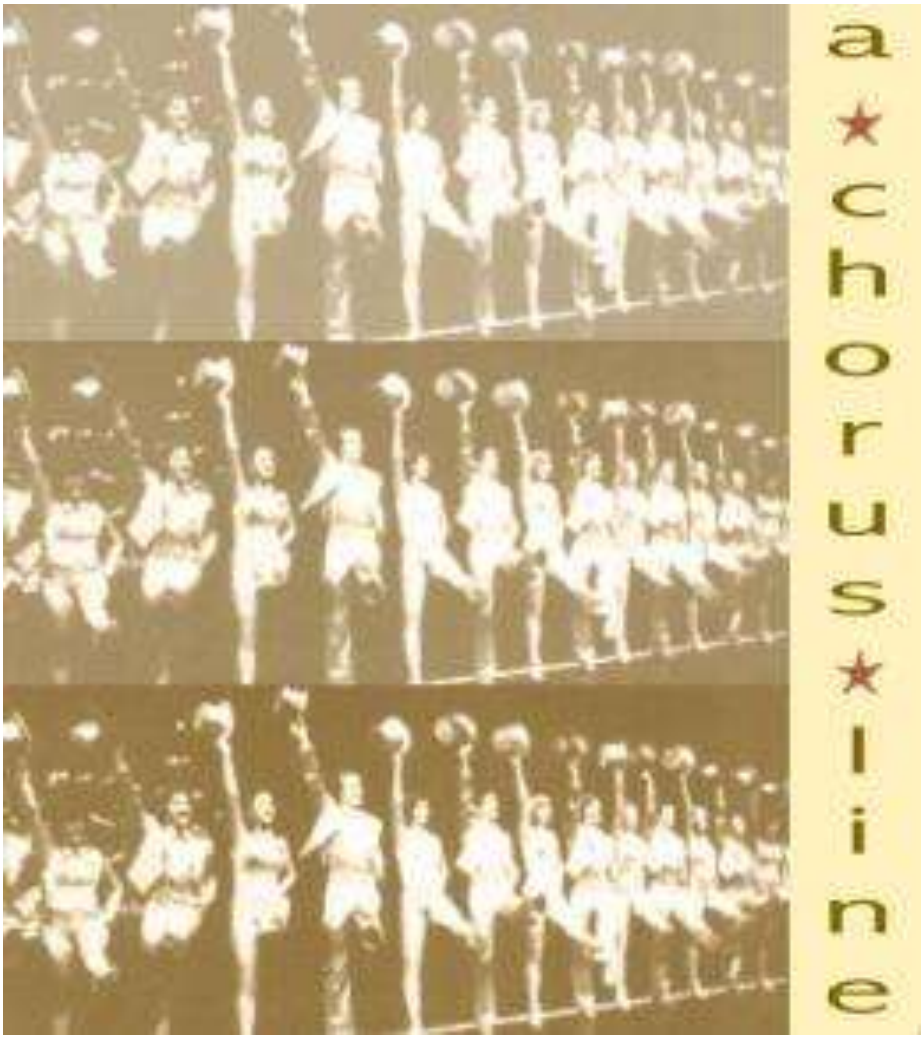

A Study Companion

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Teacher Notes

This study companion includes both website resource lists and Benchmark lists from the Louisiana Content Standards. Following the introduction of A Chorus Line, each section begins with a list of corresponding Benchmarks. Sections are as follows: 1. An overview of the genre of musical theater, including a vocabulary list, elements of a musical, a behind the scenes overview and tips for writing musicals, 2. The history of musical theater, and the origins of theater in general, 3. The relationship between music and math and, 4. An overview of theatrical productions that incorporate elements of science. The relationship between music and math has three subsections: A. The mathematics of musical instruments, B. The nature of sound and C. Music and math from the perspective of Mozart (this subsection includes lessons on easy and fun math games.) Much of this material came from the Internet and all sources are listed following each section. All graphics came from the following sites:

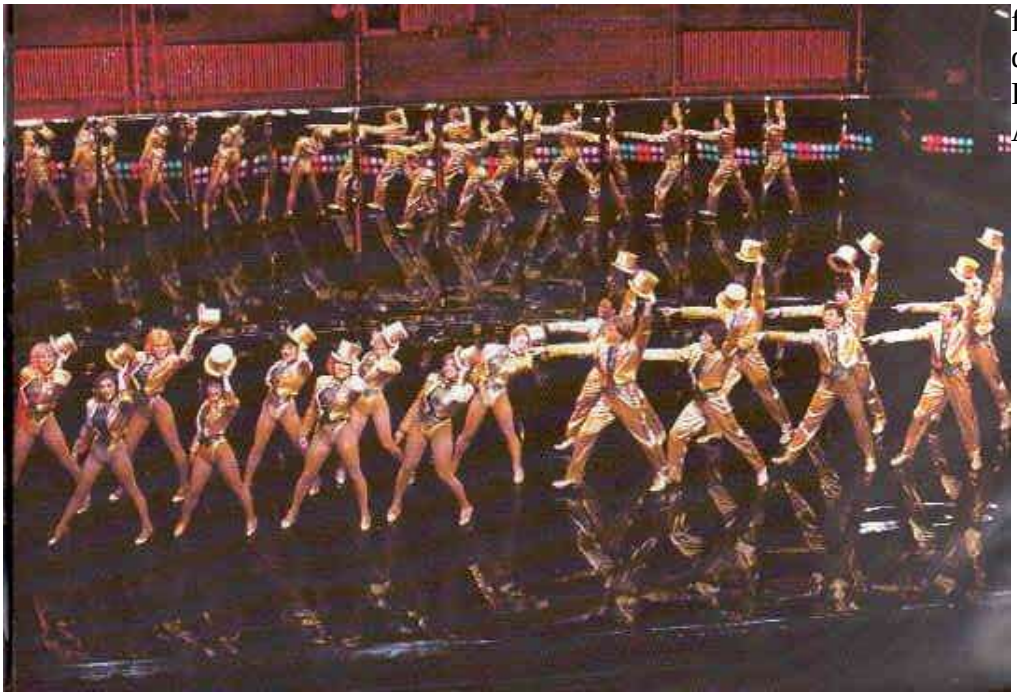
http://www.angelfire.com/musicals/acl/fromtheshow/pictures.html

http://www.lrst.com/pictures/chorus.html

A Chorus Line was a ground breaking musical. Its focus shifted off the stage to the lives of the people on it, and the commitment, dedication, sweat and tears needed to peruse an artistic carrier. By opening the door to the inner workings of both the craft and the lives of those who create it, it brought musical theater to a level beyond the trappings of costumes and sets. The director of this particular production, Mr. Ken Beck, has approached this adaptation with the necessary sensitivity required for transforming adult

material for young audiences while maintaining the integrity of the show. No characters or scenes have been eliminated. Instead, words have been substituted, in both the spoken text and musical numbers, thus altering the language without altering the tone or effect.

"One" Singular Sensation!



"One", the film finale - directed by Richard Attenborough

http://www.angelfire.com/musicals/ypwshows/aclsynopsis.html

I Hope I Get It

Again...Step, kick, kick, leap, kick, touch...
Again...Step, kick, kick, leap, kick, touch...
Again...Step, kick, kick, leap, kick, touch...
Again...Step, kick, kick, leap, kick, touch...
Right!
That connects with turn, turn out
In touch, step, step, kick, kick, leap, kick, touch...
Got it?
Going on, turn, turn, touch down
Back step, pivot step, walk, walk, walk
Right, let's do the whole combination
Facing away from the mirror
From the top
A-Five, six, seven, eight!
God, I hope I get it
I hope I get it
How many people does he need
How many people does he need

God, I hope I get it
I hope I get it
How may boys, how many girls
How many boys, how many
Look at all the people, at all the people
How many people does he need
How many boys, how many girls
How many people does he
I really need this job
Please, God, I need this job
I've got to get this job
Stage left, boys
Let's do the ballet combination
First group of girls, second group to follow
One, two, three, four, five, six
God, I really blew it, I really blew it
How could I do a thing like that?
How could I do a thing like ...?
Now, I'll never make it
I'll never make it
He doesn't like the way I look
He doesn't like the way I dance
He doesn't like the way I...
All right, let me see the boys
(Instrumental)
The whole group
Ready
A-five, six, seven, eight
(Instrumental)
Okay, Girls
A-five, six, seven, eight
(Instrumental)
God, I think I've got it
I think I've got it
I knew he liked me all the time

What's coming next	What's happening now
Still it isn't over	I've gotta imagine what he wants
it isn't over	I've gotta imagine what he does

God, I hope I get it
I hope I get it
I've come this far, but even so
It could be yes, it could be no
How many people does he...
I really need this job
Please, God, I need this job
I've got to get this show

I have to get any moment
I knew I had it, from the start
Who am I anyway
Am I my resume
That is a picture of a person
I don't know
What does he want from me
What should I try to be
So many faces all around and here we go
I need this job
Oh God, I need this show

http://www.geocities.com/Broadway/Stage/4575/Achorusline.html

BRIEF HISTORY:

A CHORUS LINE is the second longest running show in Broadway history, playing for 6,137 performances. It opened at the Public Theatre and moved to the Shubert Theatre. In London it played 903 performances at the Theatre Royale, Drury Lane.

A CHORUS LINE

Conceived and Originally Directed and Choreographed by
Michael Bennett

Book by	Music by	Lyrics by
James Kirkwood & Nicholas Dante	Marvin Hamlisch	Edward Kleban

Co-Choreographed by Bob Avian
Original Broadway production produced by the New York Shakespeare Festival, Joseph Papp, Producer, in association with Plum Productions, Inc.

http://www.tams-witmark.com/musicals/chorusline.html#brief

Song List:

I Hope I Get It - Ensemble
I Can Do That - Mike
And - Bobby, Richie, Val, Judy, and Chorus
At the Ballet - Sheila, Bebe, and Maggie
Sing! - Kristine and Al
Hello Twelve, Hello Thirteen, Hello Love (Montage Part 1) - Ensemble
Nothing (Montage Part 2) - Diana
Mother (Montage Part 3) - Ensemble
Monster Montage - Ensemble
Dance: Ten; Looks: Three - Val
The Music and the Mirror - Cassie

One - Ensemble
The Tap Combination - Ensemble
What I Did For Love - Diana and Ensemble
Bows (Finale) - Ensemble

http://members.tripod.com/~Point202/AChorusLine/chorussongs.html

Characters:

(listed in "the line" order) Don Kerr
Maggie Winslow
Mike Costa
Connie Wong
Gregory Gardner
Cassie Ferguson
Sheila Bryant
Bobby Mills III
Bebe Benzenheimer
Judy Turner
Richie Walters
Alan DeLuca
Kristine Urich
Valerie Clark
Mark Anthony
Paul San Marco
Diana Morales
Larry
Zach

Vicki
Tricia
Lois (ballerina)
Frank (head-band boy)
Butch
Roy (wrong arms boy)
Tom

http://members.tripod.com/~Point202/AChorusLine/chorusfacts.html

A Chorus Line Plot Synopsis

The Show In A Nut Shell

A lot of people audition for parts in the chorus of a Broadway show. As they make it through the audition they open up, and talk of their loves, memories, hates and a lot of other stuff too. At the end of the show eight successful auditioners are picked and then a whole lot of people dressed in gold costumes dance and sing. The end.

The Show In A LARGE Nutshell

The show opens on an audition in New York. Zach (the director) and Larry (his fairly non-descript dance assistant) watch a great many hopeful auditoners dance The Opening combination in front of the mirrors, away from the mirrors and in every which way possible. Next they learn the ballet combination (known as the ballet mark) and hang out stage right as they wait to be put into groups. As Zach and Larry call them onto stage into the aforementioned groups, the first song is sung, I Hope I get it. During the ballet combination Zach yells Vicki off stage as he realizes she has no ballet experience. Another unlucky boy gets reprimanded as he dances with his head down all the time. And still yet, here we realize that Morales dances with her tongue out. The Jazz combination comes next, followed by the first elimination. During and after this elimination is 'The Larry clump' (getting pictures and giving them to Larry) and 'The Back Up and come down' (also known as the surge or line change). The final part of the opening is a solo by Paul - as he looks at the record of his life and wonders how much of it shows the real him.

The dancers stand in line and one by one come forward to sing Zach their names, ages and places of birth. Most of these include a joke, such as Connie's 'Always Wong never Right'. As Diana announces her name, the Diana Underscoring (Morales) begins, and we first see Zach's unusual auditioning technique, as he tries to learn more about Diana. However she quickly sees what he is trying to do, and tells him that she is too nervous to just stand there and talk. He accepts this, and as he explains to the dancers what he really wants from them, a spotlight bounces head to head down the line (known as The Line Bounce.

Zach asks Mike how he started dancing, and the first solo song is sung - 'I Can Do that' telling about Mike's hilarious debut into tap dancing lessons. Next comes the touching song And... sung by all of the auditioners. This song is also known as 'The Internals' as it is a song about the thoughts running through the dancers' heads focusing especially on Judy's agony at her height/extreme thinness. These internal thoughts are repeated a lot during the Montage. Zach chooses Bobby as his next victim, and Bobby is completely unfazed as he tells his story of an ashamed father, a bizarre childhood and more. Getting Sheila to open up is a lot harder, but she eventually begins to sing At the Ballet and joined by Bebe and then Maggie, they tell of the effects that ballet has had on their lives. (At the Ballet can be divided into Ballet Backup, Balle Barre, and Ballet Blaze).

Next Al and Kristine sing a hilarious duet focusing on Kristine's distinct lack of singing talent and Al's need to finish off every sentence she says. Hello Twelve, Hello Thirteen, Hello Love (aka The Montages) is next, beginning with Mark's story of his disastrous adolescence, followed by Connie's 'Four Foot Ten' monologue concerning the effects her height have had on her career. Part two of the Montage consists of Diana's song Nothing about her experiences with her drama teacher Mr. Karp at the High School of Performing Arts. Montage part Three begins with Don Kerr's speech, followed by the 'bah dahs' and 'Mother' (Maggie's song about her mother's death, underscored with various painful childhood memories of the other dancers). Part Four of the Montage begins with Greg's story followed by the 'wah wahs' and Richie's tremendous 'Gimme the Ball' section.

At this point comes Val's monologue and her song Dance Ten, Looks Three, about her pitiful life before her plastic surgery and the amazing effects that a great body can have on a dancing career. After this song has ended, a short Paul scene commences but ends abruptly as Paul freezes up and is unable to talk about himself to Zach. The dancers exit to take a break and learn the 'One' routine and lyrics. However Cassie remains, and the first Cassie/Zach scene commences. As she begs him to give her a chance, we learn more about the history between them. The infamous Cassie dance, and song The Music and the Mirror. The Cassie dance can be divided into sections as follows: First dance section, the small mirrors (slow section), Accelerando (small mirrors raise up), Swan Lake, Red, Heat wave, The pirouettes, The backups (handshake), Layout (final pose). This dance is important as it expresses and communicates many things about Cassie, her troubles, her love of dance, her pain, and her passion. After Cassie has exited, Paul re-enters and speaks to Zach about why he feels unable to talk about himself in front of others. Paul's monologue deals with painful childhood memories and his heart wrenching entrance into show business. After this has finished, the rest of the dancers re-enter and the first run through of One begins. At first there are obviously a lot of mistakes, but slowly it comes together, and is sung and danced in groups of four. Next the boys and girls sing it separately, followed by the 'Smile and Sing' chorus, sung by the boys and girls together. As the dancers dance, Zach and Cassie confront each other and the cast become ghosts a la follies. During this section the casts voices are heard echoing, counting and chanting steps in the background. The final chorus of One finishes this section.

Zach still can't decide whom to pick, so the Tap Combination is danced, firstly in a big group, then in groups of four. During the fourth group of tappers, Paul tumbles to the ground, and 'The Accident' scene commences. The group crowds round Paul, and Cassie takes control determining the problem and giving orders to the others. After Paul has been carried of the stage Zach asks the question 'What are you going to do when you can't dance anymore?' prompting the Alternatives scene when the auditioners talk about what they would do if they couldn't dance any more (doh). At this point, the hit song 'What I did for love' is sung, largely as a solo by Diana but some backed up by the rest of the cast.

The inevitable 'Final Elimination' occurs, preceded by the 'Elimination Walk' (one at a time back in line). I won't spoil the show for those who are going to see it by saying who gets picked.

The show ends with the finale One firstly just the eight successful audtioners, then joined by the other 'liners, and slowly joined by all of the rest of the cast and original auditioners. The Finale can be divided like so: The bows, Shuffle along section, The parade (in cake walk), the wedge, Grapevine circle expanding into Jete Circle, Final lineup, the backup, Final Chorus, and the kicks. As the gold-clad dancers perform their endless high kicks, their images repeated by the mirrors behind them, the stage fades to black and the show ends.

http://www.skidmore.edu/studentorgs/cabaret/clplot.html

A Chorus Line

Music: Marvin Hamlisch
Lyrics: Edward Kleban
Book: James Kirkwood & Nicholas Dante
Conception: Michael Bennett

Director/choreographer Michael Bennett had long wanted to do a show that put the spotlight on that class of performers known as "gypsies," not the stars, but the unknown dancers, the faceless artists that persevere in the chorus, suffering through the endless auditions and almost constant rejection that comes with a life in the Theatre. So in 1974, he rented a studio and invited 24 dancers to talk about their personal and professional lives. These sessions were recorded, written down, and eventually pieced into a libretto by playwright/novelist James Kirkwood and Nicholas Dante, one of Bennett's dancers. Academy-award winner Marvin Hamlisch was brought in to compose the music, and Edward Kleban wrote the lyrics. Bennett even brought in playwright Neil Simon who--although uncredited--added several of the great one-liners in the play.

A Chorus Line would revolutionize the way audiences view musical theatre. It broke away from the rigid story line of traditional musicals, instead weaving together the stories of the ensemble cast into a seamless whole. It broke new ground technically as well, becoming the first show on Broadway to use computers in the control booth.

A Chorus Line opened at Joseph Papp's Public Theatre on April 15, 1975. After an initial run of 101 performances, it moved to the Shubert Theatre where it would remain for almost fifteen years, breaking box office records and winning almost every possible award including 9 Tony Awards, 5 Drama Desk Awards, the Pulitzer Prize for Drama, the New York Drama Critics Circle Award, the Los Angeles Drama Critics Circle Award, the London Evening Standard Award, a special citation Obie Award, and even a Gold Record Award from Columbia Records. The show finally closed on April 28, 1990, after 6,137 performances. It has been produced in over twenty countries and continues to be popular around the world. The 1985 film version features Michael Douglas.

http://www.imagi-nation.com/moonstruck/albm56.html

A Chorus Line
The Original Broadway Cast

Scott Allen . . . . Roy
Renee Baughman . . . .Kristine
Carole Bishop . . . . Sheila
Pamela Blair . . . . Val
Wayne Cilento . . . . Mike
Chuck Cissel . . . . Butch
Clive Clerk . . . . Larry
Kay Cole . .. . Maggie
Ronald Dennis . . . . Richie
Donna Drake . . . . Tricia
Brandt Edwards . . . . Tom
Patricia Garland . . . . Judy
Carolyn Kirsch . . . . Lois
Ron Kuhlman . . . . Don
Nancy Lane . . . . Bebe
Baayork Lee . . . . Connie
Priscilla Lopez . . . . Dianan
Robert LuPone . . . . Zach
Cameron Mason . . . . Mark
Donna McKechnie . . . . Cassie
Don Percassi . . . . Al
Michael Serrecchia . . . . Frank
Michel Stuart . . . . Greg
Thomas J. Walsh . . . . Bobby
Sammy Williams . . . . Paul
Crissy Wilzak . . . . Vicki

http://www.musicals101.com/choruscast.htm

An Overview of Musical Theater

The first scene from A Chorus Line starts at the stage where some dancers are in audition for a chorus. Zach, the auditioner, tests all the dancers who are nervous not to get the job (I Hope I Get It). He then picks up 16 dancers to continue to the next audition.

Benchmarks

The Arts

AP-2Th-M2 understanding individual and group roles through the exploration of theatrical methods; (1, 4)
AP-2Th-M3 exploring and understanding expression, action, reaction, movement, and space in the dramatic process; (4)
AP-2Th-M7 identifying and understanding the origins of contemporary processes, techniques, and interpretations; (1)
AP-2Th-M8 exploring relationships among theatre, other arts, and disciplines outside the arts. (1, 4)
AP-2Th-H5 constructing social and personal meaning from informal and formal productions; (2, 4 ,5)
AP-2Th-H6 understanding the importance of action and reaction in planning, producing, and performing scripts;
(1, 2)
HP-3M-M1 understanding characteristics of musical styles representative of various historical periods and cultures; (2, 4)
HP-3M-M2 distinguishing the differences in music designed for various purposes in different historical and cultural contexts; (2, 4)
HP-3M-M3 understanding the role of musicians in various cultures. (3, 4)
HP-3M-H1 demonstrating knowledge of musical styles that represent various historical periods and cultures; (1, 3)
HP-3M-H2 analyzing the role of music as it relates to the needs of society; (2, 5)
HP-3M-H3 analyzing various roles of musicians and identifying representative individuals who have functioned in these roles. (2, 4)
CA-4M-M1 demonstrating and discussing behavior appropriate for the context and style of music performed, both as audience and performer; (1, 4)
CA-4M-M2 describing musical experiences using basic elements, forms, and styles; (1, 4, 5)
CA-4M-M3 recognizing and identifying music as to function, purpose, and appropriateness as related to celebrations, ceremonies, and other events; (3, 4, 5)
CA-4M-M4 recognizing historical or cultural characteristics that determine the source of a musical style. (2, 3, 4**)**
CA-4M-H1 making judgments about musical experiences and applying the appropriate vocabulary to describe that experience; (1, 2, 4, 5)
CA-4M-H2 experiencing and evaluating behavior appropriate for the context and style of music performed, both as audience and performer; (1, 2, 4, 5)
HP-3D-M1 identifying different dance styles from historical, contemporary, and cultural perspectives; (1, 3, 4, 5)
HP-3D-M2 analyzing how time and place affect the dances of various cultures throughout history; (4, 5)
HP-3D-M3 identifying universal themes and values of various cultures as they are exhibited in dance; (1, 5)

HP-3D-M4 utilizing the basic arts components in dance studies. (5)
HP-3D-H1 recognizing and understanding that dance throughout history is a record of human experience with a past, present, and future; (3, 4, 5)
HP-3D-H2 recognizing and relating great works and great performers who have created the traditions of dance and shaped its history; (4, 5)
HP-3D-H3 comparing and contrasting dance works as forms of artistic performance and cultural expression; (3, 4, 5)
CA-4D-M1 recognizing the content and expression of various dance styles; (1, 2)
CA-4D-M2 recognizing how elements of dance communicate the choreographic intent; (1, 2)
CA-4D-M5 introducing and applying dance vocabulary in dance critique. (1, 2, 5)
CA-4D-H1 developing a criterion for forming personal preferences and opinions of dance styles; (4, 5)
CA-4D-H2 describing and demonstrating the choreographic intent of dance; (1, 2)
CA-4D-H3 applying aesthetic principles and choreographic criteria to critique dance; (1, 2 ,3, 4)
CA-4D-H4 using aesthetic principles and factors to establish individual attitudes toward creating, performing, and observing dance; (1, 2, 4, 5)
CA-4D-H5 expanding the ability to communicate and to justify aesthetic responses to the dance experience. (1, 2, 4, 5)

Language Arts

ELA-2-H2 using language, concepts, and ideas that show an awareness of the intended audience and/or purpose (e.g., classroom, real-life, workplace) in developing complex compositions; (1, 2, 4)
ELA-3-M3 demonstrating standard English structure and usage; (1, 4, 5)
ELA-3-H2 using the grammatical and mechanical conventions of standard English; (1, 4, 5)
ELA-4-M1 speaking intelligibly, using standard English pronunciation and diction; (1, 4)
ELA-4-M3 using the features of speaking (e.g., audience analysis, message construction, delivery, interpretation of feedback) when giving rehearsed and unrehearsed presentations; (1, 2, 4)
ELA-5-M4 speaking and listening for a variety of audiences (e.g., classroom, real-life, workplace) and purposes (e.g., awareness, concentration, enjoyment, information, problem solving); (1, 2, 4, 5)
ELA-4-M5 listening and responding to a wide variety of media (e.g., music, TV, film, speech); (1, 3, 4, 5)
ELA-4-M6 participating in a variety of roles in group discussions (e.g., active listener, contributor, discussion leader, facilitator, recorder). (1, 4, 5)
ELA-4-H1 speaking intelligibly, using standard English pronunciation and diction; (1, 4)
ELA-4-H2 giving and following directions/procedures; (1, 4)
ELA-4-H3 using the features of speaking (e.g., audience analysis, message construction, delivery, interpretation of feedback) when giving prepared and impromptu presentations; (1, 2, 4)
ELA-4-H4 speaking and listening for a variety of audiences (e.g., classroom, real-life, workplace) and purposes (e.g., awareness, concentration, enjoyment, information, problem solving); (1, 2, 4, 5)
ELA-4-H5 listening and responding to a wide variety of media (e.g., music, TV, film,

speech, CD-ROM); (1, 3, 4)
ELA-4-H6 participating in a variety of roles in group discussion (e.g., active listener, contributor, discussion leader, facilitator, recorder, mediator). (1, 4, 5)
ELA-6-E1 recognizing and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups; (1, 4, 5)
ELA-6-E3 identifying key differences of various genres. (1, 2, 4, 5)
ELA-6-M1 identifying, comparing, and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups;
(1, 4, 5)
ELA-6-H1 identifying, analyzing, and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups;
(1, 2, 4, 5)
ELA-6-H2 analyzing distinctive elements (e.g., recurrent themes, historical significance, literary techniques) of ancient, American, British, and world literature;
(1, 2, 4, 5)
ELA-6-H4 analyzing various genres as records of life experiences. (1, 2, 4, 5)

Let's start with a basic definition –

> **musical (noun) – a stage, television or film production utilizing popular-style songs and dialogue to either tell a story (book musicals) and/or showcase the talents of varied performers (revues).**

Book musicals have gone by many names: comic operas, operettas, opera bouffe, musical comedy, etc. **Revues** have their roots in vaudeville, music halls and minstrel shows. In the spirit of Shakespeare's "a rose by any other name would smell as sweet," we shall treat all of these forms as musicals here.

The best musicals have three essential qualities –

- **Brains** – intelligence and style
- **Heart** – genuine and believable emotion
- **Courage** – the guts to do something creative and exciting.

(And you thought *The Wizard of Oz* was just a children's story?)

Of course, quality is no guarantee of commercial success. However, musicals with these qualities are more likely to stand the test of time.

I genuinely believe that a great musical is a great musical, no matter what its point of origin. Those created for the large or small screen are no less interesting than those written for the stage. As one character in *Boys In The Band* (Crowley 1968) puts it, "Pardon me if your sense of art is offended, but odd as it may seem there wasn't a Shubert Theatre in Hot Coffee, Mississippi!" So Astaire and Rogers mean as much to the genre as Rodgers and Hammerstein.

"How Long Has This Been Going On?"

The art of telling stories either through or with songs dates back to time immemorial. We know that the ancient Greeks included song and dance in many of their stage comedies and tragedies. While the scripts to some of these plays survive, the songs have not. While these works had no effect on the development of musical theater as we know it, show tunes have been around in some form for more thousands of years.

The Romans eventually copied and then expanded Greek theatrical traditions. The comedies of Plautus included full song and dance routines that were performed with full orchestrations. To make their dance steps more audible, Roman actors attached metal chips called "sabilla" to their stage footwear – the first tap shoes.

Traveling minstrels and staged religious allegories with songs were cultural mainstays in the Middle Ages, and troupes offering popular songs and slapstick clowns were common. When the court of Louis XIV demanded song and dance entertainments in the late 1600's, Moliere turned several of his plays into musical comedies (with music by Jean Baptiste Lully).

By the 1700's, two forms of musical theater were thriving in Britain, France and Germany –

- The first were **ballad operas**, loosely constructed low comedies like John Gay's *The Beggars Opera* (1728) that borrowed popular songs of the day and rewrote the lyrics. The tale of the murderous highwayman Macheath suggested that the distinction between the nobleman and the thief was purely external – both could be equally corrupt. At a time when most plays ran less than a week, this musical ran 62 performances. By the following year, the British government was so worried about the impact of another satire that it banned the *Beggars* sequel, *Polly*. So London had to wait till the next century to see a native musical theater tradition emerge.
- The second and more ambitious type were **comic operas**, with specially composed scores and mostly romantic plot lines, like Michael Balfe's *The Bohemian Girl* (1845). While this work is almost forgotten, its enchanting aria "I Dreamt I Dwelled in Marble Halls" remains a favorite with coloratura sopranos.

Which brings us to a point of frequent confusion . . .

Are Musicals Descended From Opera?

Opera has been with us since the late 1500's, but (and there are those who will *scream* when they read this) . . . **musical theatre and film are not really descendants of opera**. From its birth in the 1800's, the musical never tried to copy grand opera. The so-called "comic operas" that dominated Broadway in the late 1800's, including *Robin Hood* and the works of Gilbert & Sullivan, are not really operas. Producers called them comic operas to make them sound more high minded, but with extended dialogue and melodies designed for popular audiences, they are clearly musicals.

Yes, some authorities disagree with me on this one, and I respect their opinions, but I have never yet heard a line of reasoning strong enough to make me change my position. The musical tradition that I trace in the pages to come did not build on the work of grand opera – as you will see, it was forced (by popular tastes and, in some cases, legal restrictions) to develop in an entirely different style and spirit.

A Chorus Line

A Selected Bibliography
Compiled by William McKay

Bennett, Michael & Kirkwood, James & Dante, Nicholas, & Hamlisch, Marvin & Kleban, Edward. *A Chorus Line: The Book of the Musical*. Applause Books, New York. 1995. Not just the standard book and lyrics, this hard cover includes two loving tributes and a large collection of very fine stills.

Flinn, Denny Martin. *What They Did For Love: The Untold Story Behind the Making of A Chorus Line*. Bantam Books, New York, 1989. Coming out the same year as the Mandelbaum book listed below, this one is the lesser work, but not by far. If you can't find Mandelbaum's, which is rooted as a Bennett biography, this is the one to have.

Gottfried, Martin. *Broadway Musicals*. Harry N. Abrams. The Netherlands. 1979. A beautifully bound coffee-table sized book – get the original hard cover edition. A must for any theatre lover or anyone interested in learning about the art form. The pictures are sumptuous and there is well-written text on what makes a great musical. Plenty of fine examples sited, including A Chorus Line.

Gottfried, Martin. *More Broadway Musicals Since 1980*. Harry N. Abrams. New York. 1991. A lesser volume (what can be expected considering the years covered?) but it offers some striking photos.

Mandelbaum, Ken. *A Chorus Line and the Musicals of Michael Bennett*. St. Martins Press, New York. 1989. The definitive book on the subject. Well-researched, lovingly and energetically written, and filled with information based on countless interviews.

Stevens, Gary & George, Alan. *The Longest Line*. Applause, New York. 1995. An unusual book that offers insights from unique perspectives – the understudies, replacement casts, backstage and production people. Plenty of facts and figures, but mostly quotes from extensive interviews. Loads of photos too.

Viagas, Robert & Lee, Baayork & Walsh, Thommie with the Entire Original Cast. *On The Line*. William Morrow & Company, New York. 1990. Written by the original cast. They have a lot to say and hold no punches. All the highlights and, even more fascinating, the low-points of A Chorus Line's production process. Lots of honesty.

Elements of a Musical:

The Score

by John Kenrick

> Scene: a sad group of teenagers sits around wondering how to get their parents, town or school out of serious financial trouble. Suddenly, Mickey Rooney looks up with wide eyes and says, "Hey, why don't we put on a show!?!" Judy Garland gushes with pride and shouts, "Oh, Mickey!," the kids roar their approval, and after a few tough weeks of writing and rehearsals, the show triumphs in their local gym and they are all promptly whisked off to Broadway.

Would that it were that easy! Every musical play or film you've ever seen – including the bad ones – involved tremendous craft. Of all the arts involved, the most noticed is the composition of the score. In the 1800's, producers could throw a show together in a matter of weeks and beef it up with songs by any number of different composers. But in an age when musicals cost millions to produce and theatergoers are expected to spend $100 a seat, such slapdash tactics won't pass muster any more. Just writing the score can take months – even years – of painstaking effort.

To give a show a sense of audible cohesion, it is now standard procedure for the songs to be written by one songwriter or songwriting team, working in close collaboration with the book writer. All these people have a say in such issues as song structure, song type, and song placement. Each of these is explained below, as is the importance of rhyme.

Showtune Structure: AABA

Most showtunes have a verse and a chorus (or "refrain"). The **verse** sets up the premise of a song and can be of most any length, while the **chorus** states the main point of the lyric. For example, think about the title song to *Oklahoma!*. The verse begins "They couldn't pick a better time to start in life," and says how happy the leads will be living in a "brand new state." The chorus starts with "Ooooo-klahoma," and sings the praises of that new state.

(While most composers concentrate on the melody for the chorus, there are exceptions. Jerome Kern's opening verses to "You Are Love" or "All The Things You Are" are almost as ravishing as the choruses that follow.)

Since the early 1900's, the choruses of American popular songs have traditionally been thirty-two bars long, divided into four sections of eight bars apiece – the **AABA** form. This format forces composers and lyricists to make their points efficiently acting more as a discipline than a limitation.

- **A is the main melody**, repeated three times – in part, so that it can be easily remembered.
- **B is the release** or bridge, and should contrast as much as possible with A.

If you examine your favorite showtunes, you will find this format used time after time. From Cohan to Jonathan Larson, all modern Broadway composers have worked primarily within this structure. In fact, AABA remained the standard for all popular music until hard rock threw many conventions out the window in the 1960's.

Those showtunes that do not use AABA tend to use a variation of the form. A song may double the number of bars (four sections of sixteen apiece). Other numbers may intentionally use a variation, such as introducing a third melody line at the end (AABC) – but the AABA structure and proportions remain the norm.

Song Types

Some people think that it is enough for a showtune to be melodic and generally entertaining. That may have been true in the days of Ziegfeld revues and screwball musical comedies, when any song could be inserted into most any show regardless of its connection to the action.

Ever since *Oklahoma*, the rules have changed. Now, a showtunes must serve as a dramatic element in a play or film by helping to develop character and/or move the story forward. As much as everyone loves a showstopper, it has to work as a cohesive part of the storytelling process – otherwise the only thing it really stops is audience interest.

The types of songs commonly required in modern musicals can be illustrated with these examples from Lerner and Loewe's *My Fair Lady* –

- **Ballads** - usually love songs ("On the Street Where You Live"), but they can also philosophize about any strong emotion ("Accustomed to Her Face").
- **Charm Songs** - let a character beguile an audience ("Wouldn't It Be Loverly").
- **Comedy Numbers** - aim for laughs ("A Little Bit of Luck").
- **Musical Scenes** - seamlessly blend dialogue and song, usually with two or more characters ("You Did It").

If you prefer an even simpler approach, Bob Fosse said that from a director's point of view there were only three types of show songs –

- **I Am** songs – Any song that explains what a character (or group of characters) is – or is not. This category includes songs describing situations. In *West Side Story*, the "I Am" songs would include "The Jet Song," and "Somewhere."
- **I Want** songs – These tells us what characters desire, giving us some sense of what motivates them. (Most love songs fit into this category.) "Something's Coming" and "Tonight" are examples, with the ensemble reprise of "Tonight" giving a rare (and dramatically powerful) opportunity for every major character to simultaneously express what they want. In "A Boy Like That," we see two "I Wants" clash, only to wind up in harmonious agreement on the undeniable power of love.
- **New** songs – This includes any number that does not fit the other two categories, usually because they serve special dramatic needs. For example, "Gee, Officer

Krupke" let the Jets express their frustrations and gives audiences a breather from the tragic story line. "The Rumble" ballet would also fit this category.

Traditional musicals carefully varied the placement of song types, while musicals of the late 20th Century showed an increasing reliance on placing ballad after ballad after ballad . . . yaaaawn!

From the 1800's on, traditional musicals tried to include at least one or two songs that might find popular success outside the show. Many a musical did better business when one of its songs became a hit and "was heard everywhere." But the rise of rock pushed showtunes out of pop contention in the mid-1960's. Sad as this development was, it freed composers and lyricists to concentrate on the dramatic needs of their shows, rather than trying to squeeze hits into a score.

Song Placement

Songs in a musical libretto must be strategically placed at emotional highpoints where dialogue is no longer enough. When Dolly Levi comes down the stairs at the Harmonia Gardens, it would be more realistic if the head waiter just looked at her fondly and said "It's so nice to have you back," but what fun would that be? Instead, Dolly and the waiters express the overwhelming joy of their reunion by singing "Hello, Dolly!" Where words are not sufficient, the music and dance take over, bringing the show and its audiences to greater heights.

A far different example comes with Kander and Ebb's "Pineapple Song" in *Cabaret*. Turning this particular moment into song was a stroke of genius -- one that many a fine composer could have easily missed. For most of us, there is nothing particularly exciting about getting a pineapple as a gift. But when it is the first token of affection exchanged between two shy middle aged people, it becomes tremendously important. The courtly manners of the grocer and the landlady, set to a romantic tune, makes for one of the most enchanting moments in all of musical theater. The music says what their restrained words cannot, showing just how much each is attracted to the other.

So song placement is of vital importance in the development of a musical. As a rule, the composer and lyricist work closely with the librettist (the script or "book" writer) to plan each number. Once a show goes into production, the director and producers also take part in this process. Three song choices are of particular importance –

- **The Opening** sets the tone for the rest of the show. It is not unusual for this number to be written after the rest of a show is in place. The bawdy farce *A Funny Thing Happened On the Way To the Forum* originally opened by proclaiming that "Love Is In the Air," which left audiences expecting a sweet romantic comedy. Consequently, it took half an act for them to get attuned to the zaniness that followed. After Sondheim replaced it with the raucous "Comedy Tonight," the entire show got a better reception. (Note – shows that open with extended dialogue still set the tone for the evening with their first songs, such as *My Fair Lady*'s "Why Can't the English Teach Their Children How to Speak?")
- **The Main "I Want" Song** comes early in the first act, with one or more of the main characters singing about the key motivating desire that will propel them (and, with luck, the audience) through the remainder of the show. In many cases, these songs literally include the words "I want," "I wish" or "I've got to." Classic examples include *My Fair Lady*'s "Wouldn't It Be Loverly," *Carnival*'s "Mira,"

Sound of Music's "I Have Confidence" and "King of Broadway" in *The Producers*.

- **The Eleven O'clock Number** takes place about midway through Act Two. It can be a ballad ("This Nearly Was Mine" or "Memory"), charm song ("Hello, Dolly!") or comedy showpiece ("Brush Up Your Shakespeare" or "Betrayed"). It does not necessarily have to mark a climactic moment in the plot, but it must be strong enough to energize the audience for the final climactic scenes. (Note: since curtain times are earlier than in years past, this number now takes place around 10:00-10:30PM.)
- **The Finale** should carry an emotional wallop, leaving audiences with a powerful last impression. This is usually done by reprising one of score's strongest numbers. *Showboat* closes with a family reunion as Joe sings another rendition of "Old Man River," and *Les Miserables* brings on ghosts of the past for an encore of "Do You Hear the People Sing?"

A **reprise** is when all or part of a song is repeated to make a dramatic point and (usually) to energize the end of a scene. In the stage version of *Funny Girl*, Nick Arnstein sings a reprise of Fanny's "Don't Rain on My Parade" to signify his need for independence **and** end a crucial scene. Fanny later reprises the same song at the end of the show to declare that life will go on without Nick **and** to finish the final scene with an emotional flourish.

From the 1800's through the 1940's, some musicals were so loosely constructed that you could easily insert additional numbers by most any composer. Al Jolson's best remembered songs (including "Swanee") were interpolated into existing scores, and no one cared that they had no connection to the story. All that mattered was coming up with a hit that could stop the show.

To either develop the characters or push along the plot, songs must be clear enough for an audience to grasp on first hearing. Anything that confuses an audience damages the dramatic action of the play, so lyricists must make their points in a precise, fresh manner, while composers (and arrangers) must not drown out the words. In August 2002, The New York Times chided the producers of the long running *Rent* for allowing the high volume music to drown out Jonathan Larson's all-important lyrics.

It remains a real mark of craftsmanship to write **showstoppers** that are fully integrated into the rest of a show. Even mediocre musicals are still expected to have a musical moment that makes the audience roar with approval. While some weaker musicals like *The Lion King* rely on clever staging to get people cheering, a powerhouse song remains the most desirable way to stop a show.

Lyrics: To Rhyme or Not to Rhyme?

Creative and entertaining use of rhyme has been a hallmark of musical theatre since William S. Gilbert's elevated lyric writing to an art form in the 1880's.

Rhyme is one of a lyricist's most potent tools, giving a song much of its comic or dramatic impact. It is easy enough to find words that rhyme -- the trick is in how a lyricist gets from one of these words to another. Fresh use of language and surprising word arrangements are the hallmarks of great songwriting, and these revolve around the careful placement of rhymes within a song.

For example, placing rhymes at the end of lines and within them ("internal rhyme") can add comic impact --

- Sondheim's "Chrysanthemum Tea" in *Pacific Overtures* describes "an ***herb*** that's ***superb*** for dis***turb***ances at sea."
- Cole Porter's "Brush Up Your Shakespeare" in *Kiss Me Kate* has such ingenious rhymes as ***heinous*** with ***Coriolanus*** and ***fussing*** with ***nussing*** ("nussing" is Porter's playful pseudo-Yiddish version of the word "nothing.")

Creative rhyme can make a difference in any type of showtune, setting classics apart from pedestrian efforts. Porter's ballad "I Get a Kick Out of You" has a famous five part rhyme ("***fly-high-guy-sky-I***") that audiences have loved since Ethel Merman first sang it in *Anything Goes* (1934).

Obvious, tired rhymes, clichéd phrases, or forced non-rhymes (like those found in rap songs) are distractions that can ruin the effect of a show song. Theatergoers have the right to expect a smooth, professional effort. Of course, the witless scores of *Footloose* and *Saturday Night Fever* prove that some audiences will tolerate anything if the volume is deafening enough. If you want to write a musical, please take the approach that your audience deserves something better.

Whatever you do, never forget your most basic priorities. Every lyric in a musical must help tell a story. The great lyricist **Dorothy Fields**, who's work spanned five decades and involved such composers as Jerome Kern, Jimmy McHugh and Cy Coleman explained it this way --

> "Sounds and rhyming can be beguiling only when they state exactly what you should say. Don't fall in love with what you believe is a clever rhyme -- it can throw you. Think about what you want to say and then look for the most amusing or graceful way you can say it."

That covers the bare-bone basics of what goes into a score. But many promising scores sank into oblivion due to badly written librettos. And so it is, justly or not, that most failures are blamed on "the schnook who wrote the book."

The Book

What is "The Book"?

The book – also called the libretto – is the least appreciated and yet most dramatically important element of a musical. It is the narrative structure that keeps the score from being nothing more than a medley of songs.

For many years, the books of most Broadway musicals were a series of scenes, jokes and sight gags designed to get from song to song. The main point of most shows was to showcase a score and/or a major star. So long as the script provided excuses for Al Jolson to sing a few hits or Marilyn Miller to do a dance routine, theatergoers were satisfied. By the 1940's, audiences were ready for something more, and shows like *Pal Joey*, *Lady In the Dark* and *Oklahoma!* made it imperative that the book and score interweave to tell a cohesive story. Now when a performer stopped the show, it was because the action had built up to a key moment of song and/or dance. This made for a much more satisfying kind of musical entertainment.

More than one expert has observed that musicals with great scores and bad books tend to fail, while those with mediocre scores and solid books have a better chance of succeeding. After all, the first job of every play or film – musical or not – is to tell a good story.

Key Book Elements

A musical book must do the following:

- Keep the story line clear and easy to follow.
- Create characters that are easy to relate to, without resorting to stereotypes. (Good luck!)
- Create situations that call characters into song.
- Move in and out of songs as smoothly as possible.
- Hand over much (and sometimes all) of the plot and character development to the songs and choreography.
- Make the audience care at all times. (If the action gets dull, nothing guarantees an audience will stay to learn the ending!)

And all this must be done within a script that seems skeletal compared to a full length drama. At least fifty percent of a musical's running time belongs to the songs and dances. Small wonder that so few playwrights are willing to attempt musical librettos – they are a separate art form.

Adaptations

Only a few successful musicals use 100% original story lines. Most are adapted from novels (*Les Miserables, King & I*), plays (*Oklahoma, Hello Dolly*) or films (*A Little Night Music, Nine, The Producers*). Others are inspired by historical figures (*Rex, George M*) or events in the headlines (*Call Me Madam, Capeman*).

When selecting a story for adaptation, the creative team must first determine that music will add to the effectiveness of the story. Not all stories sing, and relentlessly tragic tales are better suited to grand opera. The main requirement is to have a situation that allows characters to experience a wide range of emotions. It is in the transitions from hope to joy to despair to (hopefully) final triumph that characters can find something to sing about.

Since time immemorial people find it easier to connect with sentiments expressed in a song. So songs help audiences relate to the characters in a musical. Murder mysteries and French farces do not make good musicals because many of their characters are plot functions, not individuals we come to really care about. *The Mystery of Edwin Drood* does not disprove my point – in the end we learn that Edwin is not dead, so there is no real murder mystery!

Getting historical figures to sing can be tricky, since many in the audience approach famous characters with pre-conceptions. *1776* successfully made John Adams and Thomas Jefferson sing, in part because American audiences wanted to like them. (British audiences loathed the same show, forcing it to close in just a few weeks.) Henry VIII's murderous marital habits made him desperately unlikable in *Rex*, but such popular figures as Jackie Robinson, Marilyn Monroe and Teddy Roosevelt all inspired flop musicals.

Originals

The really successful musicals with original stories are few and far between. Shows most people think of as completely original often were not. *Company* was based on a series of one act plays by librettist George Furth. And, despite Alan Jay Lerner's denials, *Brigadoon* was based in part on Friedrich Gerstacker's *Germelshausen*. Some examples of how new story ideas were hatched --

- Betty Comden and Adolph Green got the idea for *Bells Are Ringing* from the picture of an overworked operator on the back cover of a Manhattan phone book.
- Michael Bennett was approached by two dancers looking to create a repertory troupe of Broadway chorus dancers to develop new musicals. Taped sessions with various dancers led to the workshops where *A Chorus Line* was born.
- Composer Marvin Hamlish's rocky affair with lyricist Carole Bayer Sager was the primary inspiration for *They're Playing Our Song*. Of course, it helped having Neil Simon to write the touching but hilarious book.

While it is neither impossible or undesirable to build a musical on a completely original story idea, it is just not done very often.

Scene Structure

As in non-musical plays, each scene in a book musical must have a clear ending that projects the action forward. Since good showtunes often capture a moment of transition, realization or decision, a song (or a brief reprise) is often used to bring scenes to a neat close. This is why librettists must work in close collaboration with composers and lyricists to determine where songs fit and how to get into song as seamlessly as possible. Audiences now cringe at obvious song cues ("Tell us about it, Jane.") Ideally, the book and score should be written simultaneously, rather than have either one built around the other.

The modern musical libretto is almost always written in a two-act format. Audiences are accustomed to it, and intermission sales (refreshments, souvenirs) provide theatre owners with crucial income. If nothing else, an audience forced to sit for hours is tougher to entertain. To put it bluntly, if you don't give audiences a pee break, they will take one in the middle of crucial scenes! Those who write a one or three act show can rest assured that others will eventually re-format it to two acts. (This fact of life has plagued the authors of *Man of La Mancha*, a one-act that is frequently performed with an unauthorized intermission).

If nothing else, intermissions force book writers to make sure the story gets somewhere by a reasonable point – at least enough to make an audience want to come back for Act Two. The first act does not have to end with a cliff-hanger, but we should be curious to see what happens next.

Examples of memorable Act One endings:

- ***Fiddler On the Roof*** – A horrific pogrom ruins Tzeitel's wedding. How will Tevye's family carry on?
- ***My Fair Lady*** – As Liza dances off with the scheming linguist Zoltan Karparthy, will her secret be exposed and Professor Higgins' work ruined?
- ***Annie*** – Will an orphan find her long lost parents?

- ***Les Miserables*** – How will the many characters we've met in Act One get through the imminent revolution?

If you have not hooked an audience before intermission time, odds are you have a flop on your hands This problem holds especially true with stage adaptations of screen musicals. The Broadway version of *Meet Me In St. Louis* turned "The Trolley Song" into a dream sequence, robbing it of any significance and doing nothing to point to the next act. The stage version of *State Fair* ended with "It's a Grand Night for Singing" – a great song, but one that did nothing to set up what lay ahead. Both shows failed despite classic scores, primarily because their cinematic story lines did not adapt well to the two-act stage format.

The end of Act Two is even more important. It is what audiences walk out with, and a powerful final scene can make up for a lot of shortcomings earlier in the show. Having a great song helps – many shows reprise their strongest ballad – but the book writer must structure the play so that the last scene packs a genuine wallop.

- ***The Sound of Music*** has the Von Trapps escape to freedom as the nuns sing "Climb Ev'ry Mountain."
- ***A Chorus Line*** brings all the dancers back for the socko dance finale, "One." It illogically contradicts much that occurs beforehand, but no one really cares. Its a sensational *coup de theatre*.
- ***Secret Garden*** has Uncle Archie embrace his niece Mary as the ghosts of the past depart to the strains of "Come To The Garden."
- ***The Producers*** has Bialystok & Bloom surrounded by the marquees for their future tasteless (and hilarious) hits -- like "Death of a Salesman: On Ice."

Check a dozen of your favorite musicals, and you will find that most save a solid dramatic or comic kick for the finale.

Rewrites

All writers had better like rewriting! It is the nature of creation that one has to reshape and perfect one's work. This is especially true when one has to appease the army of collaborators involved in a musical. With the exception of *Kiss Me Kate*, every musical that ever opened out of town (or in New York previews) required book rewrites. It is only when a show gets on its feet in front of paying audiences that certain problems become evident. Two book issues become paramount once a show is in pre-opening performances –

- **Keep the plot line clear** - People won't sit through a show if the basic story does not make sense.
- **Get the curtain down by 10:45 PM** – this avoids expensive union overtime and gets audiences home before the babysitter's curfew. If you are positive your show is the next *Les Miz* and can afford to run till 11:15, more power to you – but get yourself better medication and start cutting anyway.

When a show is in trouble, it is easiest to blame the book. After all, it cost amazing amounts of time and money to add new songs or replace people, while changing the book simply means ordering the author to cut or revise. I once worked on a musical (which shall go nameless) that was having a disastrous pre-Broadway tour. The score sucked, the director was inexperienced and the big-name star was woefully miscast – so of course,

everyone complained about the book! This was ironic because the book was probably the one solid thing the show had going for it. Thankfully, the star became ill. The show closed out of town, and the book writer's reputation survived for better projects.

A Thankless Task

Now that many musicals are virtually sung through, librettists are less appreciated than ever. The international hit *Phantom of the Opera* is often thought of as the work of Andrew Lloyd Webber, while librettist Richard Stilgoe is practically unknown outside of his own family. (Of course, the same can be said for lyricist Charles Hart.)

The book writer gets almost no credit if a show succeeds, and most of the blame if it fails. Peter Stone, the most successful librettist alive, got demeaning reviews for *1776, Woman of the Year, Will Rogers Follies* and *Titanic* – and received Tony Awards for each of them! So it is not surprising that good librettists are few and far between. Most of the people who might once have worked in musical theatre take their talents to television. Who can blame them? When writing for a sitcom can bring a six-figure annual salary, why spend years writing a musical that may never make a cent? And yet, the madness still infects a few. Those of us who love the musical will keep our fingers crossed in the new century and hope that a fresh crop of solid librettists are set to appear.

Key Players: The Production Team

by John Kenrick

Producer

In the past. solo producers (Florenz Ziegfeld, David Merrick, Cheryl Crawford, etc.) had tremendous input into the creation of a show. Many important Broadway musicals began because such producers had an idea and then hired the composer and writers. Now, producers don't come into the process until a show is already written and tested. With production costs now in the tens of millions, it takes teams of a dozen or more producers to raise the funds for a show – making it impossible for any one of them to exercise creative control over a project. Several independent producers (Fran & Barry Weissler, Emmanuel Azenberg, etc.) are still around, usually working in teams when producing musicals. They are often overshadowed by corporate producers like Disney, who have the resources to make almost anything into a hit.

Investor

Traditionally, Broadway investors contributed no more than a few thousand dollars each to a new show. This entitled them to a pair of opening night tickets, a return on their investment if the show was a hit, or a tax deduction if the show failed. Today, investors contribute hundreds of thousands each, and there is little chance they will see much of a profit. They want the prestige of saying they have invested in a show – and all too often think their dollars entitle them to creative input. These businessmen with frustrated theatrical dreams expect their suggestions to be listened to. In some cases, corporate sponsors can have far too much say in the creative process.

General Manager

General managers handle the everyday business involved in a show – paying the salaries, dealing with complaints, supervising supplies, and making keeping the show's operating expenses as low as possible. (Lower expenses make it possible for a show to keep running when business slumps.) General managers at the Broadway level tend to oversee

several shows at a time, hiring a **Company manager** to oversee the day-to-day needs of each production.

Stage Manager
This is the battle commander who makes sure the elements of a performance happen eight times a week, overseeing every actor, set, light cue and prop. To do this, the stage manager and a team of assistants have to be everywhere in the house, using a complex system of headphones, radios and computerized controls to communicate. Thanks to wireless communication, stage managers are no longer glued to their traditional backstage command podium. The complex demands of high-tech productions have made these men and women more important than ever – the unsung heroes who hold shows together.

House Manager
Talk about hard working people who get almost no credit! While the stage manager oversees the cast and crew, the house manager takes care of everything that happens on the other side of the curtain, coordinating the **House staff** of **ushers, box office managers, custodians, ticket takers, bartenders, souvenir salespeople** and more. If a theatergoer has a problem, (noisy neighbors, ticket disputes, etc) the house manager is usually the top person they can turn to for assistance.

Casting Director
Casting directors stay up-to-date on the ever changing pool of acting talent in show business. Maintaining massive files, they are ready to call in a wide selection of performers to fit any particular role. When a director or producer wants to audition a particular actor (even a major star), the casting director arranges it. Actors make a point of getting their latest resumes and photos in front of as many casting directors as possible. The top producers of the past often had full-time casting directors of their own, but most casting directors today are free agents who work with a variety of producers.

Advertising
Producers hire an advertising firm to design a show logo, posters and window cards, print and TV ads, and all other advertising materials. Theatrical advertising is so specialized that only two or three New York firms handle every show in town.

Press Representative
The more press coverage a show gets, the better – both before and after it opens. The Press Representative maintains contact with every newspaper, magazine, radio and television station, making sure that a show gets as much coverage as possible. They arrange interviews, special interest features and publicity events. They also make sure the critics are invited to press previews and treated as cordially as possible. They also try to dispel any negative rumors ("Miss Bankhead hasn't touched a drop since we started rehearsals!") that might hurt ticket sales.

Actors
Thought we'd never get to them, did you? For many years, the performers in musical theatre were divided into two distinct camps – singers and dancers. With the rise of the director-choreographers in the late 1950's, it became important for Broadway-level performers to prove their proficiency in both capacities. Right into the mid-20th Century, it was possible for chorus performers to make a fulltime living in the theatre, but that ended in the 1960's. Stage work is so uncertain that most professional performers have back-up careers as waiters, bartenders, administrative assistants, etc.

Key Players: The Creative Team
by John Kenrick

Composer & Lyricist
The composer writes the music – the lyricist writes the words. It is not unusual for one person to act as both composer and lyricist. In most cases, composers leave the dances or underscoring to the orchestrator and dance arranger. (See our section on Elements of a Musical for more on scores.)

Some lyricists act as their own librettists. Only a very few people have succeeded as composer, lyricist and librettist – such as George M. Cohan, Noel Coward, Meredith Willson and Jonathan Larson.

For many years, Broadway composers and lyricists made much of their income from the sale of sheet music. With the change in musical tastes and the near-disappearance of sheet music, they get little beyond the chance to share 2% of a show's profits and (if lucky) part of the long-term rights income if the show is ever leased for international and amateur productions. The only way for theatrical composers or lyricists to "strike it rich" is to become their own producers - as Andrew Lloyd Webber did with his Really Useful Company.

Librettist
Also called the "book writer," the librettist creates the book – or script – of a musical. In musicals where the dialogue is almost completely replaced by music (*Cats, Phantom of the Opera, Les Miserables*), the librettist is essentially responsible for making sure everything weaves into a coherent dramatic flow. Librettists are most often blamed when a show fails, and not without reason. A show with a strong score and a bad libretto usually fails, while a show with a so-so score and a great libretto usually succeeds. (Note: The success of *Footloose* and *Saturday Night Fever* seems to contradict this once-solid rule.) (Our section on "Elements of a Musical" has more on musical books.)

Director
Up to the 1940's, writers and producer's had the concept - the director was expected to stage a show and supervise rehearsals in a way that made that concept shine through. Starting in the 1950's, directors took an increasing degree of control over the creative process. Today, few producers or writers have the clout to overrule a top director's decisions.

Choreographer
The person who stages the dances and musical scenes of a show was once called the "dance director," but the title changed when ballet choreographers like George Ballanchine and Agnes DeMille began working on musicals. Since the 1940's, many musicals have been staged by directors who also choreograph. A choreographer must give a musical a sense of movement that helps hold the show together visually.

Set Designer
Until the 1970's, even the most lavish Broadway productions used painted flats as sets, creating 3-D paintings that were more suggestive than realistic. Since the 1970's, sets have become increasingly realistic, taking up more space and far more of a show's budget. Sets must move swiftly, allowing a show to flow seamlessly from one scene to

the next. Scenic effects can make or break a contemporary musical, but it is considered a fatal flaw if an audience leaves the theatre "humming the sets."

Costume Designer
Whatever you see a Broadway actor wearing onstage did not come off a store rack. Stage costumes have to stand up to heavy use and daily cleanings – and last for as long as possible without looking threadbare or tattered (unless they are for the beggars in *Les Miz*). Designers must balance sturdiness with the needs of performers to dance and sing comfortably. When the original *Kiss Me Kate* (1948) ran short of money, designer Lemuel Ayers used heavy-duty curtain fabric for some of the period costumes.

Lighting Designer
This is one of the least noticed and yet most crucial members of the creative team. Costumes, sets and actors are not worth a damn if no one can see them. With the exception of the music, nothing sets the mood for a scene as quickly or clearly as the lighting. This is one of the least noticed and yet most crucial members of the creative team. Costumes, sets and actors are not worth a damn if no one can see them. With the exception of the music, nothing sets the mood for a scene as quickly or clearly as the lighting.

Musical Director
The conductor has a tremendous effect on the sound and pacing of performances. An MD must be ready to smooth over technical glitches, reassure uncertain understudies, and handle anything else that might stop the music. The MD is also in charge of hiring and managing the orchestra.

Sound Designer
This technically demanding position was not credited in Playbill listings until the 1980's. In the 1950's, a stage manager just turned on some foot mikes at curtain time. Now every principal cast member wears a wireless body mike to provide full amplification – a complex proposition when there are dozens in a cast. Sound staff are on hand during all performances to continually adjust every microphone's setting – a task managed from a bank of computers at the rear of the orchestra section.

Orchestrator
The composer writes the melodies, but the orchestrator determines what those melodies will sound like when an orchestra plays them. For example - Richard Rodgers wrote the melody of "Shall We Dance," but orchestrator Robert Russell Bennett made its famous "BOOM, BOOM, BOOM!" sound a reality. The challenge for orchestrators is to make sure their arrangements do not drown out the singers – a task made much easier by electronic amplification. Most composers let orchestrators create the overture as well as the underscoring and scene change music.

Dance Arranger
Composers frequently allow dance arrangers to handle the time consuming task of working with a choreographer to score the dance sequences. Shows with minimal dancing may not have a dance arranger at all, leaving that function in the hands of the orchestrator.

How to Write a Musical
by John Kenrick

Have you noticed that almost all the books on how to write songs, lyrics or musicals are written by teachers, **not** working professionals? Real creators rarely try to explain how they do what they do, because what works for them may not work for anyone else. All most teachers can offer is theory and conjecture, not solid experience-based advice.

So let's settle this one right up front – **no one can tell you how to write a musical**. A seasoned pro can offer pointers, and people who have a wide knowledge of the genre can tell you what forms and approaches have worked up to now, but those who write musicals can offer few definite rules.

The creative process is intensely personal. Consider the different approaches used by four outstanding lyricists –

- Larry Hart could dash off a deathless lyric in minutes, scrawling on any available scrap of paper – even the borders of a magazine ad.
- Oscar Hammerstein II curled into a chair and labored over every song for days or weeks at a time, using neatly organized legal pads.
- W.S. Gilbert wrote in leather-bound journals, saving every idea for possible use. These meticulous notebooks still exist, a goldmine for researchers.
- Alan Jay Lerner found some lyrics far easier than others. After writing *My Fair Lady*, he had a recurring nightmare about a group of friends coming into a hotel room where he has been cooped-up for days. They ask what Lerner has written in that time. Surrounded by mounds of crumpled pages, he holds up a sheet and reads, "Loverly, loverly, loverly, loverly" – whereupon his friends cart him off to an asylum.

Things to Keep in Mind

In *A Producer's Broadway Journey* (Praeger: Westport, CT. 1999), Stuart Ostrow (who's credits include producing *1776* and *Pippin*) defines the key challenge for theatrical librettists and songwriters –

> The greatest question musical dramatists must answer is: does the story I am telling sing? Is the subject sufficiently off the ground to compel the heightened emotion of bursting into song? Will a song add a deeper understanding of character or situation? (p. 96)

If all songwriters and librettists answered those questions diligently, audiences would be spared countless hours of needless boredom. Just think of the worst musical you have ever seen, and you will find that the creators did not fully consider whether or not their story really sang.

Beyond that basic question, there are other pointers worth remembering. In the course of my production career on and off Broadway, I have worked with dozens of songwriters, including unknowns and Tony winners. Based on that experience, there are several things I would recommend if you want to write musicals –

- See as many musicals as you can.
- Study the musicals you like and figure out what makes them tick.

- Study the musicals you don't like and figure out what prevents them from ticking. You can learn a lot about what **not** to do by studying flops.
- Musical theater and film are essentially collaborative art forms. Do your best to find collaborators you can work with comfortably.
- Find or invent a story idea that gets you so excited you can spend five or more years of your life working on it with no promise (or even a reasonable hope) of it earning you a penny.
- Structure your life in such a way that it leaves you daily time to write and/or compose.
- Be sure this life structure provides a way for you to keep the bills paid.
- Write only projects you are passionate about – never take on a project based solely on it's commercial possibilities. This year's "hot" idea is often next year's embarrassment.
- Please remember that you are creating a play or film. Your primary goal must be to entertain, **not** to teach or "enlighten." If you are really lucky, **you** are the one who will learn something from your writing.
- Make sure your work has a genuine sense of humor. New writers and composers are prone to concocting ponderously serious musicals that **bore** people to death! If you want to preach, build yourself a pulpit, not a musical.

Some Rules For Writing Good Musicals

There are few clear rules for writing good musicals. The first two apply to good writing of almost any kind, fiction or non-fiction –

1. Show, Don't Tell - This is job one for writers, and a special challenge for play and screenwriters. Remember that theater and film are visual as well as literary mediums, so don't just limit your storytelling to words and music. Many a great musical moment uses the power of a visual gesture to communicate key information. The waiters in *Hello Dolly* never have to say that they love the lady – their visible reaction to her presence does that. And no one in *My Fair Lady* has to announce when Liza Doolittle becomes a lady – her wordless descent down the stairs before leaving for the Embassy Ball makes that change clear.

2. Cut everything that is not essential - Every word and gesture has to serve a clear and vital purpose. In a well written musical, removing a song or even a few lines of dialogue detracts from the effect of the entire show. The next time you see a musical that seems to be losing steam, odds are that the writers did not have the heart to cut a favorite song or scene. Don't show your audiences such a lack of respect – ruthlessly cut everything that does not serve a clear and vital purpose in your work.

Now, two rules that apply only to musicals –

3. Open With a Good Song - Every now and then, a show opens with a few pages of dialogue before the opening number, but few have ever pulled this off effectively. It is easier to get audiences interested when they are being entertained, and a good song can get your show off to a stronger start. Don't use a throw-away number. Set the tone for the show to come. Unless you are certain your show is the next *My Fair Lady*, it is best to kick-off your first scene with a song.

4. Book and Score Must Speak as One - If your libretto goes on for pages and pages between songs, something is probably wrong. Songs in a musical should occur naturally

at moments of high emotion. If you are going for long stretches without a reason to sing, your basic material may not be strong enough. In contemporary musical theater, the score and libretto share the job of storytelling. This results in frequent passages of sung dialogue, as well as scenes where characters move effortlessly between spoken word and song. Think of the hilarious "Keep It Gay" in *The Producers* or the achingly beautiful "If I Loved You" bench scene in *Carousel* – the score and libretto are seamless.

Why You Should NOT Write Musicals

Yes, I mean you. I am not out to discourage anybody, but working in the theatre is hell. Can you stand the ruthless judgment of fellow creators, producers, potential backers, critics and (gulp!) paying audiences? Can you handle years (and I mean **years**) of anonymous struggle? Are you ready to work your butt off eight hours a day at a job and then somehow find the energy to write? Can you handle the fact that most people will have no idea who you are or what you do even if you win a Tony? And can you handle doing all this for no more than maybe 2% of a show's profits? This is not a career for the uncertain. You should only write musicals if there is no **possible** way for you **not** to.

Why You SHOULD Write Musicals

If the desire to create musicals is so powerful that all the negatives cannot dissuade you, go for it – you might be crazy enough to succeed! Just be sure that you have a solid means of paying your bills and recharging your spirits in the meantime. And be prepared for a rather long "meantime – the only things more valuable to an aspiring composer, lyricist or librettist than talent and luck are patience and sheer determination.

In the early 21st Century, there are many ways to write a show. If you do decide to venture forth into this forbidding field, my best wishes – and the best wishes of thousands of theatre lovers – go with you.

http://www.musicals101.com/choruscast.htm

The History of Musical Theater, and the Origins of Theater in General

The first candidate is Bobby who tries to make Zach laugh by his jokes. However, Zach doesn't even like his jokes. Mike follows him by telling a story of how he can be a dancer (I Can Do That). Zach becomes angry since he thinks that the candidates do not take the audition seriously. He then interviews the girls. Sheila, an old one, explains her reason to like ballet (At the Ballet). Her mother married at a young age and her father is not a loving care father. She realizes that ballet is a relief from her family. Bebe adds that she likes ballet since she was not beautiful as a child and everything in ballet seems beautiful. Moreover, Maggie says that she loves ballet since she always thinks of the father she doesn't have.

Benchmarks

The Arts

AP-2Th-M7 identifying and understanding the origins of contemporary processes, techniques, and interpretations; (1)
HP-3M-M1 understanding characteristics of musical styles representative of various historical periods and cultures; (2, 4)
HP-3M-M2 distinguishing the differences in music designed for various purposes in different historical and cultural contexts; (2, 4)
HP-3M-M3 understanding the role of musicians in various cultures. (3, 4)
HP-3M-H1 demonstrating knowledge of musical styles that represent various historical periods and cultures; (1, 3)
HP-3M-H2 analyzing the role of music as it relates to the needs of society; (2, 5)
HP-3M-H3 analyzing various roles of musicians and identifying representative individuals who have functioned in these roles. (2, 4)
CA-4M-M1 demonstrating and discussing behavior appropriate for the context and style of music performed, both as audience and performer; (1, 4)
CA-4M-M2 describing musical experiences using basic elements, forms, and styles; (1, 4, 5)
CA-4M-M3 recognizing and identifying music as to function, purpose, and appropriateness as related to celebrations, ceremonies, and other events; (3, 4, 5)
CA-4M-M4 recognizing historical or cultural characteristics that determine the source of a musical style. (2, 3, 4**)**
CA-4M-H1 making judgments about musical experiences and applying the appropriate vocabulary to describe that experience; (1, 2, 4, 5)
CA-4M-H2 experiencing and evaluating behavior appropriate for the context and style of music performed, both as audience and performer; (1, 2, 4, 5)
HP-3D-M1 identifying different dance styles from historical, contemporary, and cultural perspectives; (1, 3, 4, 5)
HP-3D-M2 analyzing how time and place affect the dances of various cultures throughout history; (4, 5)
HP-3D-M3 identifying universal themes and values of various cultures as they are exhibited in dance; (1, 5)
HP-3D-H1 recognizing and understanding that dance throughout history is a record of human experience with a past, present, and future; (3, 4, 5)
HP-3D-H2 recognizing and relating great works and great performers who have created the traditions of dance and shaped its history; (4, 5)
HP-3D-H3 comparing and contrasting dance works as forms of artistic performance and cultural expression; (3, 4, 5)

Language Arts

ELA-6-E1 recognizing and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups; (1, 4, 5)
ELA-6-E3 identifying key differences of various genres. (1, 2, 4, 5)
ELA-6-M1 identifying, comparing, and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups;
(1, 4, 5)
ELA-6-H1 identifying, analyzing, and responding to United States and world literature that represents the experiences and traditions of diverse ethnic groups;
(1, 2, 4, 5)
ELA-6-H2 analyzing distinctive elements (e.g., recurrent themes, historical significance, literary techniques) of ancient, American, British, and world literature; (1, 2, 4, 5)
ELA-6-H4 analyzing various genres as records of life experiences. (1, 2, 4, 5)

As this section also assesses cultural components of Ancient Greece, Rome, and Medieval Europe, these Benchmarks can also be expanded to include :

Social Studies

G-1A-M1 identifying and describing the characteristics, functions, and applications of various types of maps and other geographic representations, tools, and technologies; (1, 2, 3, 4)
G-1A-M2 interpreting and developing maps, globes, graphs, charts, models, and databases to analyze spatial distributions and patterns; (1, 2, 3, 4)
G-1C-M5 tracing local and worldwide patterns of cultural diffusion and analyzing their causes and effects; (1, 3, 4)
G-1C-M7 explaining how cooperation and conflict among people contribute to the political divisions on Earth's surface; (1, 2, 4)
G-1B-M4 describing and explaining how personal interests, culture, and technology affect people's perceptions and uses of places and regions;(1, 2, 3, 4)
G-1C-M5 tracing local and worldwide patterns of cultural diffusion and analyzing their causes and effects; (1, 3, 4)

Greek Tragedy

Early History

The first "tragedies" were myths which were danced and sung by a "chorus" at festivals in honour of Dionysius (God of Wine). At first these festivals were of a "satyric" nature (gaiety, drinking, burlesque, etc).
The earliest presentations probably consisted of a chorus of men dancing in a ring, reciting or chanting some Greek myth while individual performers would stand on a rough wooden platform or cart. Spectators squatted on a hillside to view these early "plays".
As time passed the sung and danced myths developed a more serious form. Instead of gaiety and burlesque the "plays" now dealt with the relationship of man and the "Gods", and tried to illustrate some particular lesson of life.

The chorus dressed in goat skins because the goat was sacred to Dionysius and goats were "prizes" which were awarded for the best plays. Therefore, the word tragedy is believed to be derived from the Greek word "tragoidia" which means "goat-song".
In the open-air, day-lit Greek theatre, the chorus was a practical necessity. It made the transitions between scenes, giving actors the chance to enter and leave the playing area, and even announced what characters those actors portrayed. But the function of the chorus goes beyond this. The choral odes, accompanied by dancing and music, were part of the entertainment itself. The chorus both commented on the events and participated in them, so that it was both involved in the action and detached from it.
It was in 534 B.C. that perhaps the most important stage in the creation of drama was reached with Thespis, who invented an actor who conversed with the leader of the chorus, and by his reports of events occurring off the stage could provide the chorus with materials for fresh songs in new scenes. Through the addition of a second actor (by Aeschylus) and a third (by Sophocles), the representation was made possible of a drama which could show and develop a human situation in all its aspects.
Their purpose was to ask questions about the nature of man, his position in the universe, his relation to the powers that govern his life, in short: theirs was a serious concern with the problems of man's fate. Therefore the prime function of these dramas is the expression of the feelings and reflections excited by man's encounters with the external forces which appear to rule his life, and the actions man takes in such an encounter.
There were three great masters of Greek tragedy in the Fifth Century B.C. whose work has survived in part: Aeschylus, Sophocles and Euripides. All three wrote plays for the Dionysian festivals, but they differed markedly from each other. Aeschylus, the poet who best evokes Athenian power and grandeur, is deeply concerned with the moral issues that power and grandeur raise. He examines the dangers of overweening arrogance, the ancient rule of blood for blood, the inevitability of the misuse of power. His conclusions are his own, often breaking with traditional concepts.
Sophocles works in a different way. Where Aeschylus argues for and justifies the ways of the gods, Sophocles is content to accept them as they are, and treats them with awe and reverence. He examines the accepted view of some problem and from it draws its central truth. To Sophocles, any violation of the cosmic order creates suffering, but suffering can redeem and exalt. His power lies in his compassion, in his sympathy for his characters, however deluded or broken they may be. One of the best examples of this is his treatment of Oedipus in Oedipus Rex. Sophocles makes him a good-hearted but headstrong young man who kills his own father without knowing that he is his father, and marries his mother without realizing that she is his mother. When he discovers what he has done, he blinds himself in a paroxysm of horror and remorse.
Euripides, the last of the three great tragedians, belongs to a somewhat later generation of Greek thought, and is a far more troubled, questioning and unsatisfied spirit. Euripides is the most direct of the three in his questioning of established beliefs. Where Aeschylus and Sophocles merely suggest that the old ways may be wrong, Euripides criticizes them boldly.
The reason for this sudden interest in man and his position in the order of the universe has been widely discussed among scholars. We have become used to speaking of the fifth century B.C. as of the 'Greek Age of Enlightenment". Civilization had developed, there were numerous changes in the fields of Greek social and political life. Along with political independence went a flowering independence of thought, a new way of thinking and of looking at the world. Philosophy was flourishing. In all fields new ideas were born, one of the most important. perhaps, being the idea of harmony as ruling principle of the cosmos.
This idea of harmony was also transferred to the spiritual life of man. He would live happiest who had attained a harmonious balance in his life. However. in this yeasting age

of growing individualism it seemed to become harder than ever before to maintain a balance. Too much that was new was weighing the scales. Traditional values were regarded as open to question and the authority of mere antiquity was not enough. A growing independence from the traditional gods was developing. It was from this "climate" that Greek tragedy emerged.

The Tragic Situation

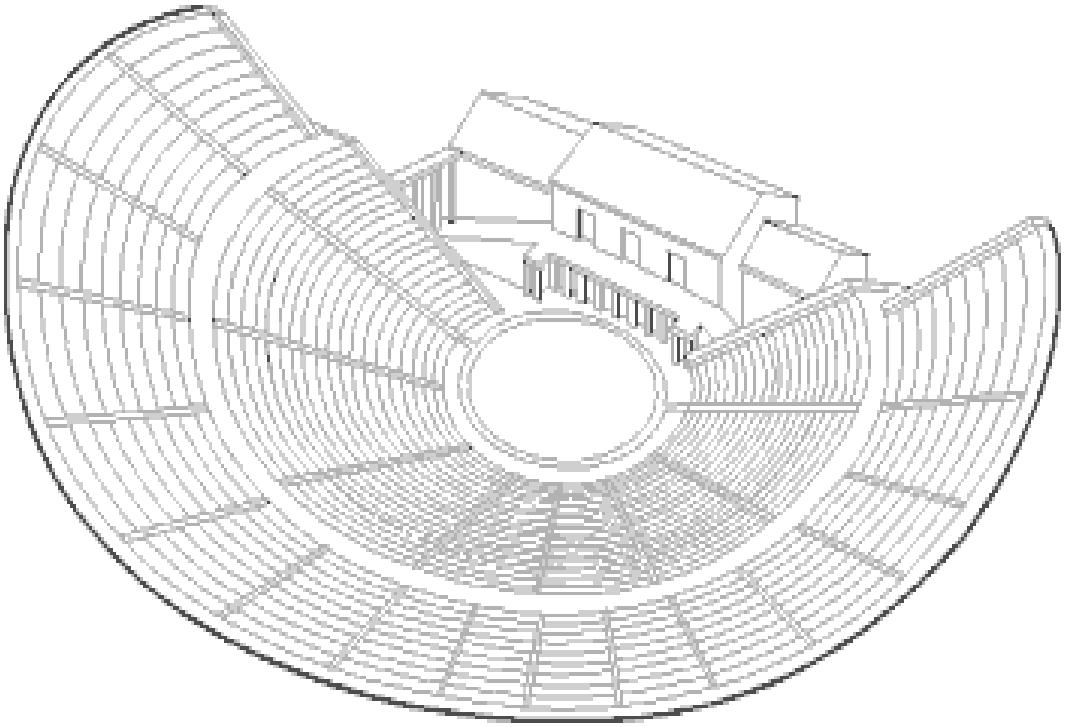
In Greek tragedy the tragic situation, in which the characters find themselves, is always a situation in which man seems to be deprived of all outward help and is forced to rely entirely on himself. It is a situation of extraordinary tension, of utmost conflict. Studying the plots of a number of Greek tragedies, one can find variations of two basic tragic situations:

1. First there is the case of man's miscalculation of reality which brings about the fatal situation.
2. The second kind of tragic situation is that of man between two conflicting principles. The protagonist is suddenly put at the crossing point of two duties, both of which claim fulfillment. This is the most compelling tragic situation and is at the game time the one that has most often been chosen by the Greek dramatists.

Every tragic situation results in severest suffering for the protagonist. This suffering -- though not necessarily leading to destruction -- and death , always carries with it the serious danger of impending ruin. In most cases the protagonist's suffering is so severe that he is destroyed by it, and very often the protagonist's entire destruction is made explicit in his death (Antigone, for example). In other cases the hero stands the pain, but his personality is broken; he is left as a ruin, inwardly destroyed and devastated. Characteristic of the tragic catastrophe is the fact that not only the protagonist comes to be destroyed, but very often innocent people are also involved in the tragic happenings and lose their lives (for example, Creon's son and wife in "Antigone".) The catastrophe. sealing the tragic situation, comes as an avalanche that overrolls both the bad and the good, the guilty and the innocent. This indicates that the individual is responsible not only for his own fortunes, but also for the fortunes of society. If he stumbles, or takes a "false stop", it is possible that his guilt may become the guilt of the society he lives in, so that his fate may throw a dark shadow over theirs as well. Everybody's fate is connected in some way with the other's and if at one point the harmony is disturbed, disaster is lurking everywhere.

It is common to all characters in a tragic situation that they are confronted with a choice. "Choice is at the heart of tragedy". This choice may be taken without much consideration, it may be taken deliberately but in ignorance of the whole truth (Oedipus) and it may also be taken because it is imperative (Antigone).
The point is that in all tragic circumstances a decision has either been made, or has to be made, by the character, and that the results of this decision -- whatever the choice may be -- are fatal. Act he must, but his action rests on a perilous freedom. This is what makes a Greek tragedy so awe-inspiring to watch; the inevitability with which the tragic character has to make a choice, which -- whatever it is like -- can never be the "right" choice and brings great suffering for him.

http://www.stemnet.nf.ca/~hblake/tragedy1.html



Greek Theatre

If theatre is to be defined as involving the art of acting a part on stage, that is the dramatic impersonation of another character than yourself, we begin with Thespis. A figure of whom we know very little, he won the play competition in honor of the greek god Dionysus, in 534 B.C. While it is uncertain whether Thespis was a playwright, an actor or a priest, it is his name with which the dramatic arts are associated in our word "Thespian".

Greek theatre took place in large (the largest ultimately held twenty thousand people) hillside ampitheatres. The players included a chorus and their leader, and the "lines" were more chanted than spoken. The chorus performed in the "orchestra", not on a raised stage. The use of masks to represent characters and high-soled boots worn to add height to the players limited the movement of the actors. Indeed, the concept of "actors" themselves was not originally a part of Greek theatre, but was developed as a consequence of certain playwrights of particular genius.

Greek drama was dominated by the works and innovations of five playwrights over the 200 years following Thespis. The first three of these were tragedians. Aeschylus (525-456 B.C.), who is most famous for his tragic trilogy the *Oresteia*, introduced the concept of a second actor, expanding the possibilities for plot and histrionics through the interaction of two characters in his dramas. While Aeschylus ultimately used a third actor, it was Sophocles (496-406 B.C.) who actually initiated this innovation. Sophocles is most famous for his trilogy *Oedipus Rex*, and in his works the role of the chorus in Greek drama diminishes in favor of the interplay between characters and the development of character itself. It was Euripides (480-406 B.C.), however, while winning less competitions than Aeschylus or Sophocles, who foreshadowed the ultimate form of drama as we know it -- employing a far more naturalistic or human approach in his

works, in contrast to the remote scale and formalized conventions used by his contemporaries.

The last two Greek playwrights were the authors of comedies: Aristophanes (448-380 B.C.) and Menander (342-292 B.C.). There was a separate competition for comedy which, while also dedicated to Dionysus, took place at the smaller winter festival, rather than the major spring festival at which the tragedies were presented. As has been true throughout the history of theatre, the comedies, dependent on topical humor and satire for much of their content, have not survived the ages as well as tragedy -- which deals with more universal themes. However, the universal popularity accorded these playwrights during their lifetimes attests to the significance which this dramatic form can have. The popularity of their work, and the diminishing appeal of tragedy to the audiences of the time, can also be interpreted as a comment on the role which theatre plays in society at large. Tragedy was at its height in Greek society when that society was at its height, while comedy -- an outlet for the frustrations of society as well as a diversion for the masses -- was most popular during the decline of Greek government.

Roman Theatre

The decline of Greek government and society coincided with the rise of the Roman Republic and subsequent empire. The Romans borrowed extensively from Greek theatre. Although Roman theatre may not be held in the same high esteem as that of the Greeks, we have inherited much from the influence of the Roman Theatre, including the word "play" itself, which derives from a literal translation of the Latin word *ludus*, which means recreation or play. Roman theatre took two forms: *Fabula Palliata* and *Fabula Togata*. *Fabula Palliata* were primarily translations of Greek plays into Latin, although the term is also applied to the original works of Roman playwrights based upon Greek plays. We are familiar with the latter from the works of Terence (190-159 B.C.), who introduced the concept of a subplot, enabling us to contrast the reactions of different sets of characters to the same events or circumstances. The *Fabula Togata* were of native origin, and were based on more broadly farcical situations and humor of a physical nature. An author of some of the better examples of this type of drama is Plautus (c.250-184 B.C.).

Again, perhaps as a reflection of the society itself, performed drama in Rome consisted primarily of *Fabula Togata*, as well as the spectacles of the gladiators and chariot races made familiar by modern Hollywood treatment of the Roman Empire. Plays of a more serious literary nature continued to be written, but these were not intended to be performed so much as read or recited. Although we have few works by Roman playwrights surviving to us in forms that would lend themselves to revival, the influence of the Roman world on the form of the stage is one which had more lasting effect. The semi-circular orchestra of the Greek theatre came to be eclipsed by the raised stage and the more vigorous style style of acting employed by the performers. However, the greatest impact Rome may have had on the theatre was to lower it in the esteem of the Church -- an impact that was to retard the growth of the dramatic arts for several centuries.

The bent toward low comedy and its mass appeal -- coupled with its association with the entertainment of the arena (which involved the martyrdom of early Christians) -- almost certainly contributed to its disfavor by officials of the early Christian Church. Plays, or *ludii* were associated with either comedy of a coarse and scurrilous nature, or with pagan rituals and holidays. It was the latter, however, which may account for the survival of theatre through the Middle Ages.

Medieval Theatre

Some have written that theatre died following the fall of the Roman Empire, and its memory was kept alive only in the performances of roving bands of *jongleurs*: itinerant street players, jugglers, acrobats and animal trainers. However, while such troupes did help to maintain certain aspects of theatrical art, particularly that involving stock characters, the Church itself contributed to the preservation of theatre.

It is ironic that the Church, which caused theatres to be outlawed as the Roman Empire declined and then fell, was one of the primary means of keeping theatre alive through the Middle Ages. This resulted from the Church's need to establish itself in the community -- a community still steeped in pagan ritual and superstition which manifested itself in seasonal festivals. The Church ultimately linked its own religious holidays with these seasonal festivals and began to use dramatic form to illustrate the stories underlying these holidays so as to reinforce their religious connotation and to better communicate the stories to an illiterate congregation.

At first the parts played in these simple religious re-enactments of the nativity and adoration of the Magi were played by priests in the sanctuary of the church. However, as the repertoire of the Church grew to include the passion and crucifixion of Christ, the Church was confronted with the dilemma of how a priest should portray Herod. While division of opinion in the Church continued as to the worth of dramatic interpretations, the members of the congregation clearly enjoyed and were moved by them. The dramas continued to grow, moving out of the sanctuary and into the open air in front of the Church. Ultimately, the members of town guilds began to contribute to these dramas, which continued to grow more elaborate with time. Known as passion plays, miracle plays and morality plays, they continued their close connection with the Church and church holidays, but began to introduce elements of stock characters that were more contemporary in nature. With the growth of towns and the introduction of stable governments in Europe, the stage was set for the Protestant Reformation, the Catholic Counter-Reformation and the secularization of theatre as it emerged from the influence of the Medieval Church.

Renaissance and Reformation

During the 15th and 16th Centuries, European Society was influenced by the Renaissance -- a "rebirth" or rediscovery of the classical worlds of Rome and Greece -- and by a movement toward nationalism -- the building of coherent nation-states such as England, France and Spain (with Germany and Italy following later). The impact of these changes on the theatre went beyond mere secularization of an art form that had been dominated for centuries by the Church.

The Renaissance, while having a major impact on the other arts, had less influence on theatre in England than in Italy, where classic Roman plays were revived for performance. Of greater impact was the Protestant Reformation and the movement toward nationalism which accompanied the Reformation. The rediscovery of the classics did influence the development of the stage -- first in Italy, then in France and England and the rest of Europe. It was in Italy that the first steps were taken toward the development of the proscenium, or "picture frame", stage with which we are so familiar today.

In the England of the 15th and 16th Centuries, however, the proscenium stage was still in the future. The stages on which the works of a growing body of "play-makers" were performed evolved from the use of the enclosed courtyards of inns to stage performances. These "apron stages" were surrounded by galleries and were therefore "open" stages. Indeed, they were so "open" that members of the audience not only sat in the galleries surrounding the stage on three sides, and in the groundspace around the elevated stage,

but on the stage itself. The emphasis was on dialogue as opposed to blocking or action, and the plays still had a moralistic tone. The themes of religious virtue were replaced by those of loyalty to government or to a stable society.

The term "play-maker" refers to the fact that the emphasis was on the performers. Troupes or companies of actors developed a repertory of plays for performance. These companies were still guild-like in their organization, with a group of owner-actors, journeymen and hirelings. The plays that were performed were based on simple plots or previous works, and a writer "made" a play more as a technical than a truly creative process.

The Protestant Reformation and the break of England from the Catholic Church during the reign of Henry VIII influenced a change in this pattern. England in the 16th Century moved back and forth from Catholicism to Protestantism, back to Catholicism during the reign of Mary, and back again to Protestantism with the accession of Elizabeth I. For intellectuals, including those who "made" plays based on the works of the classic world, the choice between revival of Latin works (associated with the Church in Rome) or Greek works (associated more with Protestantism in the England of the time), could literally be a choice between life and death as a heretic. It's no wonder that playwrights began to avoid a revival of the classics in favor of original, secular works of a general, non-political and non-religious nature.

Theatre companies were still somewhat beyond the pale of normal society during this time. Fear of plague that might be carried by the traveling companies, as well as the possibility of civil unrest that might be occasioned by patrons who had to much to drink, made civil authorities sometimes ban the performance of plays and even refuse entry into a city or town by the company. Theatres were also associated, in the minds of merchants, with temptation for idle apprentices to while away their time watching entertainment instead of working. In the view of the wives of play-goers, theatres were associated with the women of ill-repute who frequented the areas surrounding the play-houses and public inns where performances took place. Ultimately, these concerns led to the licensing of official companies by the throne, and the domination of theatre by the state.

Elizabethan Theatre and Shakespeare

It was in this world that William Shakespeare (1564-1616) wrote and acted in his plays in the late 16th and early 17th Centuries. Elizabethan and Jacobean theatre produced a number of notable playwrights, including Christopher Marlowe and Ben Jonson; but Shakespeare towers above them. We won't enter the controversy concerning the "authorship" question. (Well, maybe we will, we take it on faith that Shakespeare wrote the plays attributed to him).

Shakespeare had the good fortune to be a share-holder in the companies he was associated with, earning him income as a maker of plays, an actor and an investor. Born in Stratford-upon-Avon, he wrote plays that are timeless for their understanding of human nature and character. He was a member of several companies including the Lord Chamberlain's and King James I's own company, and was also a part owner of the Globe and Blackfriars playhouses.

At this time, the plays written and performed in England were still presented in open-air theatres such as that displayed at the top of this page. Although Hamlet exhorts the actors in the play of that name to be natural in their performance, this would not be "natural" acting in the way that term is understood today. Shakespeare and his contemporaries did encourage a more natural style of speaking, as opposed to the declamatory demagogueing then practiced by some, but was not likely an advocate of the type of realism and natural character portrayal that we see in today's theatres.

http://www.ebicom.net/~tct/ancient.htm

The Relationship between Music and Math

The Mathematics of Musical Instruments

Benchmarks

Social Studies

G-1B-M1 explaining and analyzing both the physical and human phenomena associated with specific places, including precipitation and settlement patterns;
(1, 2, 3, 4)
G-1C-M5 tracing local and worldwide patterns of cultural diffusion and analyzing their causes and effects; (1, 3, 4)
G-1B-M4 describing and explaining how personal interests, culture, and technology affect people's perceptions and uses of places and regions;
(1, 2, 3, 4)

* Study of the mathematics of music dates back to Pythagoreans.

* Bone flutes and whistles were found at Neanderthal sites.

* 9, 000-year-old flute is world's oldest playable instrument.

THE WILLOW FLUTE
(SELJEFL_YTE)

* a member of the recorder family

* has no finger holes

THE MATHEMATICS OF MUSICAL INSTRUMENTS
By Rachel W. Hall, St. Joseph's University
rhall@sju.edu
and Kresimir Josic, Boston University
josic@math.bu.edu
http://www.sju.edu/_rhall/newton

http://www.sju.edu/~rhall/newton/hsbslides.pdf

The Relationship between Music and Math

The Nature of Sound

Benchmarks

Math

N-4-M demonstrating a conceptual understanding of the meaning of the basic arithmetic operations (add, subtract, multiply and divide) and their relationships to each other; (1, 2)
N-5-M applying an understanding of rational numbers and arithmetic operations to real life situations; (1, 2, 3, 4)
N-6-M constructing, using, and explaining procedures to compute and estimate with rational numbers employing mental math strategies; (1, 2, 3, 4)
N-7-M selecting and using appropriate computational methods and tools for given situations involving rational numbers (e.g., estimation, or exact computation using mental arithmetic, calculator, computer, or paper and pencil); (2, 3, 4)
N-1-H demonstrating an understanding of the real number system; (1, 2, 4)
N-5-H selecting and using appropriate computational methods and tools for given situations (e.g., estimation, or exact computation using mental arithmetic, calculator, symbolic manipulator, or paper and pencil); (3)
A-2-E modeling and developing strategies for solving equations and inequalities; (1, 2, 3, 4)
A-3-E recognizing the connection of algebra to the other strands and to real-life situations (e.g., number sentences or formulas to represent real-world problems). (4, 5)

As this section includes explorations of rates and patterns in rhythm (ie: measurements of quarter notes, half notes, whole notes):

M-1-M applying the concepts of length, area, surface area, volume, capacity, weight, mass, money, time, temperature, and rate to real-world experiences; (2, 3, 4)
M-2-M demonstrating an intuitive sense of measurement (e.g., estimating and determining reasonableness of measures); (1, 2, 4)
M-3-M selecting appropriate units and tools for tasks by considering the purpose for the measurement and the precision required for the task (e.g., length of a room in feet rather than inches); (2, 3, 4)
M-6-M demonstrating the connection of measurement to the other strands and to real-life situations. (1, 2, 3, 4, 5)
M-2-H demonstrating an intuitive sense of measurement (e.g., estimating and determining reasonableness of results as related to area, volume, mass, rate, and distance); (1, 2, 4)
M-4-H demonstrating the concept of measurement as it applies to real-world experiences. (1, 2, 3, 4, 5)

Life Science

LS-E-A5 − locating major human body organs and describing their functions;
LS-M-A5 − investigating human body systems and their functions (including circulatory, digestive, skeletal, respiratory) (5-8)
LS-H-F1 − identifying the structure and functions of organ systems;
LS-H-F3 − recognizing that behavior is the response of an organism to internal changes and/or external stimuli;

Physical Science

PS-E-A2 − measuring properties of objects using appropriate materials, tools, and technology;
PS-E-A3 − observing and describing the objects by the properties of the materials from which they are made (paper, wood, metal);
PS-E-C1 − experimenting and communicating how vibrations of objects produce sound and how changing the rate of vibration varies the pitch;

As this section can include experimentation, Benchmarks can also be expanded to include :

Science as Inquiry

SI-M-A1 − identifying questions that can be used to design a scientific investigation;
SI-M-A2 − designing and conducting a scientific investigation;
SI-M-A3 − using mathematics and appropriate tools and techniques to gather, analyze, and interpret data;
SI-M-A4 − developing descriptions, explanations, and graphs using data;
SI-M-A5 − developing models and predictions using the relationships between data and explanations;
SI-M-A6 − comparing alternative explanations and predictions;
SI-M-A7 − communicating scientific procedures, information, and explanations;
SI-M-A8 − utilizing safety procedures during scientific investigations.
SI-M-B1 − recognizing that different kinds of questions guide different kinds of scientific investigations;
SI-M-B2 − communicating that current scientific knowledge guides scientific investigations;
SI-M-B3 − understanding that mathematics, technology, and scientific techniques used in an experiment can limit or enhance the accuracy of scientific knowledge;
SI-M-B4 − using data and logical arguments to propose, modify, or elaborate on principles and models;
SI-M-B5 − understanding that scientific knowledge is enhanced through peer review, alternative explanations, and constructive criticism;
SI-M-B6 − communicating that scientific investigations can result in new ideas, new methods or procedures, and new technologies;
SI-M-B7 − understanding that scientific development/technology is driven by societal needs and funding.
SI-H-A1 − identifying questions and concepts that guide scientific investigations;
SI-H-A2 − designing and conducting scientific investigations;
SI-H-A3 − using technology and mathematics to improve investigations and communications;
SI-H-A4 − formulating and revising scientific explanations and models using logic and evidence;
SI-H-A5 − recognizing and analyzing alternative explanations and models;
SI-H-A6 − communicating and defending a scientific argument;
SI-H-A7 − utilizing science safety procedures during scientific investigations.
SI-H-B1 − communicating that scientists usually base their investigations on existing models, explanations, and theories;
SI-H-B2 − communicating that scientists conduct investigations for a variety of reasons, such as exploration of new areas, discovery of new aspects of the natural world,

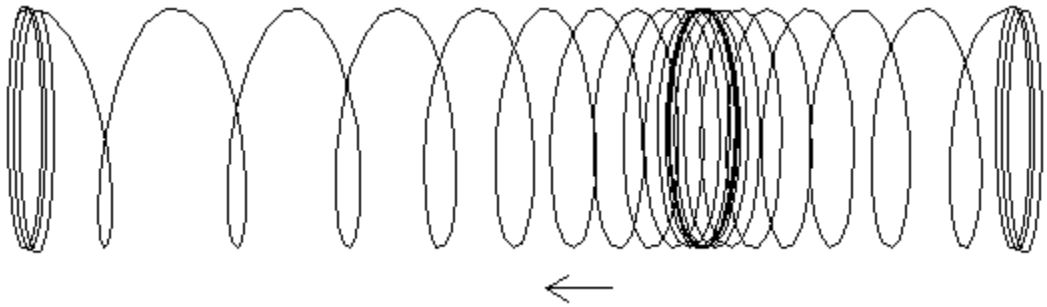
confirmation of prior investigations, evaluation of current theories, and comparison of models and theories;
SI-H-B3 − communicating that scientists rely on technology to enhance the gathering and manipulation of data;
SI-H-B4 − analyzing a proposed explanation of scientific evidence according to the following criteria: follow a logical structure, follow rules of evidence, allow for questions and modifications, and is based on historical and current scientific knowledge;

Fourier Approximations and Music

Part 1: The nature of a musical sound

Sound moves as a pressure wave -- compressing and then rarefying the air. Since we cannot see this wave in the air, it may help to use an analogy. Think of a long, soft spring lying on its side on a smooth surface. If you suddenly push on one end of the spring, a wave of compression and then expansion moves along the spring. In a similar way, the source of sound generates compression and expansion of the nearby air. The regions of compression have slightly higher air pressure than average and the regions of expansion have lower pressure. When this pressure wave reaches our ear, it alternately pushes in on the ear drum and allows it to relax.

Compression wave traveling through a spring



Part 2: Musical notes

2.1 The essential characteristics of a musical note

Musicians point to three distinguishing characteristics of musical notes: loudness, pitch, and timbre (or "quality"). There are other characteristics, but we will focus on these three.

- The **loudness** of the note is measured by the magnitude of the changes in air pressure. This is controlled by how hard a piano key is pressed or how hard one blows on the mouthpiece of a saxophone.
- The **pitch** of the note is the frequency of repetition of the basic pressure pattern. More precisely, the frequency is the number of times the basic pattern is repeated per unit of time. The frequencies of interest to us will be measured in cycles per second -- one cycle per second is called a **hertz** in honor of Heinrich Hertz. So, for example, a note with pitch 440

hertz has a pressure function that repeats itself 440 times per second, i.e. with period 1/440 seconds. Human hearing is confined to frequencies that range roughly from 20 to 18,000 hertz.

- The **timbre** of the note includes those characteristics that enable us to tell a piano note from a violin note with the same loudness and pitch.

2.2 Pitch and the naming of notes

When we hear a musical instrument sound a note, we have a general sense of its pitch. For example, we know that the piccolo sounds relatively high frequency notes and the tuba sounds relatively low frequency notes. The names associated with these notes -- "A," "$C^{\#}$", etc. -- are determined solely by the pitch.

The most widely accepted naming convention for notes, in place since the mid-19th century, uses the following method to assign note names to specific frequencies. The frequency of 440 hertz is assigned the note A. This is the note you hear from the oboe when the orchestra is tuning up. You sound this note on a piano by striking the 40th key from the right, counting both black and white keys. There are thirteen named notes between 440 hertz and 880 hertz -- counting both boundary frequencies. These notes are A, $A^{\#}$, B, C, $C^{\#}$, D, $D^{\#}$, E, F, $F^{\#}$, G, $G^{\#}$, A -- where the symbol # is read "sharp." The ratio of the frequencies of any two successive notes in this list is approximately the same, i.e. the frequencies form a geometric sequence.

Thus, if you start at the 440 hertz key on the piano (40th key from the right) and strike it along with the next 12 keys to the right in order, you will play these notes. The first and last notes in this sequence have the same name -- "A." The same naming pattern applies to the notes between 880 hertz and 1760 hertz, and so on up and down the range of audible frequencies.

Thus, for any two successive notes with the same name, the frequency of the higher note will be twice the frequency of the lower note. It is said to be one **octave** above the original. (When you sing the do-re-mi scale, the do at the beginning and the do at the end are one octave apart.) A full-size piano has 88 keys and hence spans a little more than 7 octaves. The highest A note on the piano (third white key from the right end) has a frequency of 3520 hertz.

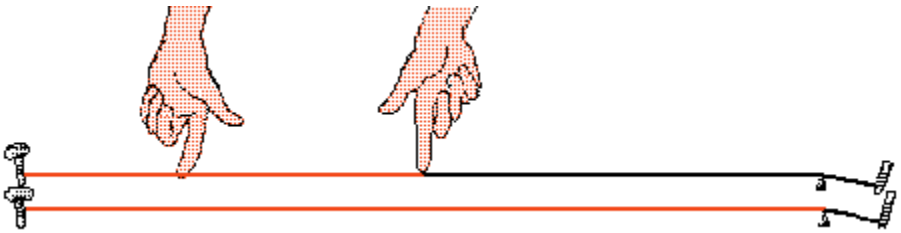
http://www.math.duke.edu/education/ccp/materials/postcalc/music/contents.html

Actual musical patterns that correspond to mathematical equations can be heard at:
http://www.geocities.com/Vienna/9349/

Pythagoras (6th C. B.C.) observed that when the blacksmith struck his anvil, different notes were produced according to the weight of the hammer. Number (in this case "amount of weight") seemed to govern musical tone. . . . .

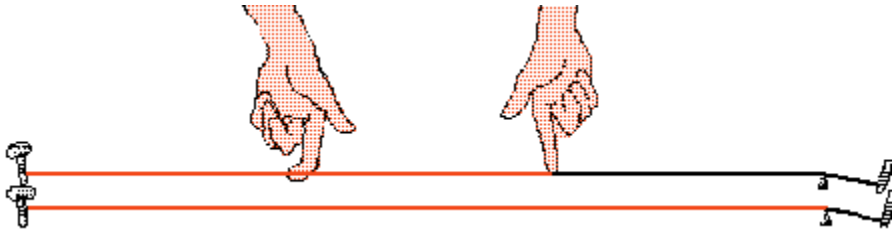
If you have something like a SoundMachine that can play sound (.av), you can pluck the strings to hear the notes: the sounds may take some seconds to reach you *but each is under 22K*....See if you can hear the sound in your imagination before it comes, by judging from the proportions of the string lengths (the first one's easy.....)

Further, he observed that if you take two strings in the same degree of tension, and then divide one of them exactly in half, when they are plucked the pitch of the shorter string is exactly one **octave** higher than the longer:



Again, number (in this case "amount of space") seemed to govern musical tone. Or does musical tone govern number?

He also discovered that if the length of the two strings are in relation to each other **2:3**, the difference in pitch is called a **fifth**:



...and if the length of the strings are in relation to each other **3:4**, then the difference is called a **fourth**.

Thus the musical notation of the Greeks, which we have inherited can be expressed mathematically as **1:2:3:4**

http://www.aboutscotland.com/harmony/prop.html

Music and Math—A Successful Combination

A new study from the Department of Education shows that students who are deeply involved with any kind of instrumental music score significantly higher than other students on standardized math tests. While listening to music is not enough to boost math scores, playing the music is. The study also found that students involved in drama had better reading skills than those who weren't.

Think about the Problem

- For the musicians in the class: Make a list of "math vocabulary" that is used throughout music, e.g., time signature, a D7 chord, etc.
- For the non-musicians in the class: Choose one of your hobbies--e.g., drawing, cooking, carpentry, photography, sports--and make a list of "math vocabulary and concepts" that are used in this hobby.

http://www.riverdeep.net/current/1999/10/100299.music_math.jhtml

There are many points at which math, science, and music intersect. For additional activities, as listed below, that will help you see some of the connections, please visit :

http://www.riverdeep.net/current/1999/10/100299.music_math.jhtml:

- Making Music, a Mathematics Toolbox activity about combinations and probabilities
- Mutant Music, a Mathematics Toolbox activity about combinations and permutations
- A Plucked String, a Physics Explorer activity about the behavior of a plucked string under various conditions
- Tuning a Guitar, a Physics Explorer activity about the function of spring constant and particle mass
- Resonance, a Physics Explorer activity about resonant frequencies

The Relationship between Music and Math

Music and Math from the Perspective of Mozart

Benchmarks

Benchmarks for this subsection are identical to the preceding one

Music and Math à la Mozart

Compose Music with Dice

Did you know that a 200-year old musical dice game uses probability and other mathematical concepts to help compose music. Find out how you can compose your own music using the flip of a coin or a roll of the dice.

The Musical Dice Game

In the late 1700's, some musicians and composers enjoyed creating dice games that would allow people to create different melodies by randomly putting together musical fragments from an array of choices. The most famous of these games is the *Musikalishes Würfelspiel* (Musical Dice Game), which is often attributed to Wolfgang Amadeus Mozart (1756-1791).

How the Game Works

For each of the 16 bars of a Viennese minuet, the Musical Dice Game offers 2 choices for the eighth and sixteenth bars, and 11 choices for each of the other 14 bars. Using a pair of dice to select randomly among the alternatives for each bar, the player can generate a wide variety of different melodies. The choices for each bar are designed in such a way that no matter which combination of bars you end up with, the result is a pleasing melody that satisfies all the harmonic and compositional requirements of a Viennese minuet of the late 1700's.

Did Mozart Compose the Musical Dice Game?

A number of 18th century composers, including Joseph Haydn (1732-1809), were interested in chance and musical composition. What's often called "Mozart's Musical Dice Game" was published a year after his death. The publisher attributed it to Mozart, but most scholars now think that Mozart actually wrote a different musical game, and that someone else wrote Mozart's Musical Dice Game. No matter who made up the game, however, the music sounds like Mozart's, and it's fun to create the minuets using a pair of dice. Perhaps the composer had a good understanding of the mathematics involved in his game, which contributed to its success.

How to Play the Musical Dice Game

Roll the Dice and Choose the First Bar

Let's say you throw the dice to select one of the 11 choices for the first bar. The dice turn up a 3 and a 4. The sum is 7. Subtract one (so that 1 can be an option with two dice) and you get 6, so your minuet will begin with the sixth choice for bar one. We'll call it 1-6.

Toss Again for the Second Bar

Now let's say you toss the dice to choose the second bar and you get a 2 and a 6. The sum is 8, and 8 minus 1 is 7, so for bar two, you plug in the seventh choice, which we'll call 2-7. When you roll the dice for bar three, let's say a 5 and a 6 turn up. That makes 11. Subtract 1 and get 10, so you choose bar 3-10. Then you do the same for bar four, bar five, and so on.

Picking Bars 8 and 16

Remember, there are 11 choices for each bar, except for the bars eight and sixteen. The two choices for bar eight are 8-1 and 8-2. Use 8-1 if you roll an odd number and 8-2 if you roll an even number, and choose 16-1 or 16-2 in the same way.

How Does Probability Affect the Musical Dice Game?

In the Musical Dice Game, do some bars get chosen more often than others?

To pick among the 11 choices for the first bar, you would roll a pair of dice and subtract 1 from the total. Let's say you roll a 2 and a 5 for the first bar. The sum is 7, and 7 minus 1 is 6, so you use the 6th choice for the first bar, which we call 1-6.

There are six different ways in which a pair of dice could add up to 7:

- 1 + 6
- 2 + 5

- 3 + 4
- 4 + 3
- 5 + 2
- 6 + 1

Therefore, there are six different outcomes of the dice for which you would choose bar 1-6.

The only way to end up with bar 1-1, however, would be to roll a 2 (since 2 – 1 = 1). The only way to roll a 2 is to roll double 1's, so there is only one possible outcome of the dice for which you would choose bar 1-1.

Since there are six possible outcomes of the dice that lead to bar 1-6 and only one outcome leading to bar 1-1, bar 1-6 is six times more likely to get chosen than bar 1-1.

http://www.studyworksonline.com/cda/content/explorations/0,,NAV2-95_SEP1237,00.shtml

Students can use the musical dice game to compose their own minuets by going to :

http://www.studyworksonline.com/cda/content/article/0,,EXP1237_NAV2-95_SAR1275,00.html

Science Observer

March-April 1996

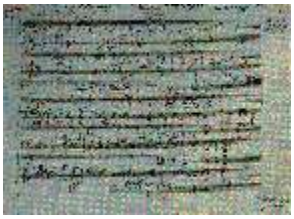
Did Mozart Use the Golden Section?

Mike May

Antonín Dvorák, a 19th-century Czech composer, said that "Mozart is sunshine." Although most people agree that Mozart's music sparkles brilliantly, no one knows for sure how Mozart created those shimmering sounds. Perhaps he relied on musical genius or inspiration from daily events. On the other hand, he might have composed measures of music with mathematical equations.

Considerable evidence suggests that Mozart dabbled in mathematics. According to his sister, Wolfgang "talked of nothing, thought of nothing but figures" during his school days. Moreover, he jotted mathematical equations in the margins of some of his compositions, including *Fantasia and Fugue in C Major*, where he calculated his odds of winning a lottery. Although these equations did not relate to his music, they do suggest an attraction to mathematics.

The structure of Mozart's music attracted the attention of John F. Putz, a mathematician at Alma College. "My son--who is a composer and pianist--told me that Mozart's piano sonatas are divided into two distinct sections," Putz recalls. "I knew that Mozart's music is highly regarded for its elegant proportions, among other things, so I thought it would be interesting to check whether the divisions Mozart used were very close to golden-section divisions."



The golden section--a precise way of dividing a line, music or anything else--showed up early in mathematics. It goes back at least as far as 300 b.c., when Euclid described it in his major work, the *Elements*. Moreover, the Pythagoreans apparently knew about the golden section around 500 b.c. The oldest examples of this principle, however, appear in nature's proportions, including the morphology of pine cones and starfish. Moreover, Putz said, "The golden section is thought by some people to offer the most aesthetically pleasing proportion."

To describe the golden section, imagine a line that is one unit long. Then divide the line in two unequal segments, such that the shorter one equals x, the longer one equals $(1 - x)$ and the ratio of the shorter segment to the longer one equals the ratio of the longer segment to the overall line; that is, $x/(1 - x) = (1 - x)/1$. That equality leads to a quadratic equation that can be used to solve for x, and substituting that value back into the equality yields a common ratio of approximately 0.618. That value has been given many names, including the golden ratio, the golden number and even the divine proportion.

In the October 1995 issue of *Mathematics Magazine* (68(4):275-282), Putz described his investigation of whether the golden ratio appears in Mozart's piano sonatas. According to Putz: "In Mozart's time, the sonata-form movement was conceived in two parts: the Exposition in which the musical theme is introduced, and the Development and Recapitulation in which the theme is developed and revisited.... It is this separation into two distinct sections ... [that] gives cause to wonder how Mozart apportioned these works." That is, did Mozart divide his sonatas according to the golden ratio, with the exposition as the shorter segment and the development and recapitulation as the longer one?

Putz represented the two sections--the exposition and the recapitulation and development--by the number of measures in each. In the first movement of the *Sonata No. 1 in C Major*, for instance, the exposition and the recapitulation and development consist of 38 and 62 measures, respectively. "This is a perfect division," Putz writes, "according to the golden section in the following sense: A 100-measure movement could not be divided any closer (in natural numbers) to the golden section than 38 and 62." An equally good approximation to the golden section exists in the second movement of that sonata. The third movement, however, deviates from the golden section.

A clear answer to Putz's question required looking at more than one sonata. So Putz examined 29 movements from Mozart's piano sonatas-the ones that consist of two distinct sections. Then he plotted the number of measures in the development and

recapitulation versus the total number of measures in each movement, which is the right side of the golden--section equality as given earlier. The results reveal a stunningly straight line-so straight that its correlation coefficient equals 0.99, or nearly the 1.00 of a perfectly straight line. Moreover, the distribution of the ratios of the number of measures in the development and recapitulation to the total number of measures in each movement lies tightly packed and virtually on top of the golden ratio.

Although those results might seem like solid evidence that Mozart did use the golden ratio when he divided the sections of his piano sonatas, Putz knew that another comparison must be made. If Mozart used the golden section, then the other ratio from the golden--section equality--in this case, the ratio of the number of measures in an exposition to those in the recapitulation and development--should also equal the golden ratio. A plot of those measurements also produces a very straight line, but one with a lower correlation coefficient of 0.938, which Putz interpreted as "somewhat less goodness of fit." In addition, the distribution of the ratios of the number of measures in the expositions to those in the recapitulation and development peaks near the golden ratio of 0.618, but it also covers a considerable spread, ranging from 0.534 to 0.833.

The results from the two analyses seemingly conflict. The first analysis suggests that Mozart probably did use the golden section, but the variability in the ratios from the second analysis suggests that he did not use the golden section. That disagreement, however, did not surprise Putz, who wrote that the mathematics behind the golden section predict that "what we have observed in these data is true for all data...." That is, the ratio of the longer segment to the overall length is always closer to the golden ratio than is the ratio of the shorter segment to the longer one. As such, Putz concentrated on the distribution of the latter ratio as constrained by sonata form, and the spread in the distribution of ratios from that analysis suggests that Mozart did not apply the golden section to his piano sonatas.

In the end, we may never know if Mozart composed his sonatas, even in part, from equations. "We must remember," Putz writes, "that these sonatas *are* the work of a genius, and one who loved to play with numbers. Mozart may have known of the golden section and used it." Nevertheless, Putz thinks that the considerable variation in the data "suggests otherwise." In any case, Mozart did create divine divisions in his piano sonatas-making the interplay of sections shine like sunlight. Yet he apparently timed those divisions with his mind--not with math, or at least not with the golden section.

http://www.sigmaxi.org/amsci/issues/Sciobs96/Sciobs96-03MM.html

Additional teaching resources for lessons and activities that integrate music (as well as other artistic disciplines) and math can be found at a website maintained by the Kennedy Center:

http://artsedge.kennedycenter.org/teaching_materials/curricula/curricula.cfm?subject_id=MAT

a website maintained by Lars Kindermann of the Auckland University of Technology, Auckland, New Zealand:

http://reglos.de/musinum/

and an interactive MIT website, detailing the works of mathematician M C Escher, constructed by public school students in the Boston, MA area :

http://lcs.www.media.mit.edu/groups/el/Projects/EW/start.html

Additional writings on the connections between math and music can be found at :

http://hilbert.dartmouth.edu/~matc/eBookshelf/music/

and :

http://mathforum.org/library/topics/music/