Life Soundtracks:
The uses of music in everyday life

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Music is unusual among all human activities for both its *ubiquity* and its *antiquity*. No known human culture now nor anytime in the recorded past lacked music, and some of the oldest physical artifacts found in human and proto-human excavation sites are musical instruments: bone flutes and animal skins stretched over tree stumps to make drums. Whenever humans come together for any reason, music is there: at weddings, funerals, graduation from college, soldiers marching off to war, stadium sporting events, prayer, a romantic dinner, mothers rocking their infants to sleep, and college students studying for exams. Even moreso in non-industrialized cultures than in modern Western societies, music is and was part of the fabric of everyday life — accompanying activities throughout the day from gathering and preparing food, to hunting, domestic chores, crafts, and religious ritual.

Many people today use music for emotional regulation in the way that they use drugs such as caffeine and alcohol: they use a certain kind of music to help get them going in the morning, another kind to unwind after work. People use music to help make it through their exercise workout or to comfort them during emotional crises. College students study to music and brain surgeons perform their most concentration-intensive procedures while music plays in the background. Music is often employed, therefore, as a way to motivate ourselves to accomplish certain tasks, and as a means of mood induction. Music becomes "a way of organizing one's internal and social world, helping to continually reconstruct the aims of various activities." Just as film soundtracks enhance and emphasise the action on the movie screen, we all have "life soundtracks" — music we listen to that inspires, motivates, calms, excites, and generally moves along the action in our daily lives. This report reviews the ways in which people use music and why, the mechanisms by which music induces physical and psychological changes, and the types of music that can enhance people's normal, everyday lives.

**Neural and psychophysiological mechanisms.**

Music activates virtually every brain region that has so far been mapped by cognitive neuroscientists. This includes pathways both in the brain's higher cognitive centers (in the *cerebrum*) as well as in lower, more primitive centers (such as the *brain stem, pons, and cerebellum*) common to all vertebrates. Frontal lobe circuits involved in planning, motivation and the formation of expectations are activated by music listening, as are networks responsible for memory and associations and attentional systems. Music causes activity in the reticular activating system, a brain circuit associated with the autonomic nervous system and can reliably produce physical reactions, such as sweating, sexual arousal, and "shivers down the spine." Laboratory studies have also shown that music can change

- heart rate
- respiration
- blood pressure
- blood pulse volume
- brain waves
- galvanic skin response
- neurochemical levels such as dopamine, adrenalin, norepinephrine, and serotonin.
Neural circuits involved in reward, specifically the nucleus accumbens, ventral tegmental region, amygdala and hypothalamus, help to modulate levels of dopamine in the brain, the so-called "feel good" hormone. These regions have been known for decades to constitute a reward system that responds when gamblers win a bet or addicts get their drug of choice. In response to sexual stimulation, or opiates (such as heroin), the nucleus accumbens becomes highly activated, causing the release of dopamine in the brain and slowing down dopamine reuptake. Menon & Levitin found, for the first time ever, that this same region is activated in response to pleasurable music, providing evidence that this may well be a "sex, drugs and rock and roll" center in the brain! Music has also been shown to moderate levels of other neurotransmitters in the brain, including serotonin, norepinephrine, and adrenalin.

Knowing how music affects one's physiology can assist in selecting music appropriate to various activities. Most people have gleaned, through informal experimentation and a lifetime of experience, just what music will create certain moods and physical reactions. Verifying such impressions at home is relatively easy. One can listen to various kinds of music and easily track changes in heart rate/blood pressure by use of a blood pressure cuff as is available at most pharmacies, or even just by using a wristwatch and finger-on-your-wrist to track pulse. Some music will increase these measures, some will decrease them. One can also keep track of mood before and after listening by asking oneself "On a scale of 1 to 10, how happy do I feel now? How sad? Pensive? Anxious? Is my mind racing? Is my mind calm? Do I feel focused or scattered?"

**How and what can music be used for?**

*Mood enhancement* is one of the chief functions of music in contemporary society. Most music listeners are expert at being able to select the right music to achieve particular emotional goals. In particular, we are able to use music to modulate arousal, increasing our arousal levels for activities that require it (e.g. exercise, chores) or to pull us out of a slump (e.g., after a nap, when we're feeling depressed). Conversely, we use calming music to lower arousal levels, such as following an upsetting emotional experience. Reversal theory states that preferred levels of arousal depend on whether people are in an arousal-reducing (telic) or arousal-seeking (paratelic) mode. After exercise, people in one study tended to select low arousal music, presumably as a way to moderate (reduce) their arousal level, even though they had preferred high arousal music during the exercise itself. People in a state of unpleasantly high arousal (for example, while driving in heavy traffic) generally prefer quiet, relaxing music, while people who are in a state of pleasantly high arousal (for example, exercising, working out) will prefer loud, energizing music.

Adolescents report that they use music for a distraction from troubles, a means of mood management, for reducing loneliness, and as a badge of identity for inter- and intragroup self-definition. As adolescents and young adults, we tend to listen to music that our friends listen to and this helps to define our social identity as well as our musical tastes and preferences.

Music is also used to enhance concentration and cognitive function, to maintain alertness and vigilance. The theory of flow describes a privileged state of skill and
ability that occurs when people reach a particular cognitive state called *flow*, in which the person is functioning at peak mental and physical capacity. Such flow states are sought by individuals engaged in challenging tasks as diverse as painting, playing music, performing brain surgery, extreme sports (rock climbing, race car driving, stunt piloting), writing poetry, and computer programming. Optimal levels of arousal are obtained when the task strikes the right balance between simplicity and complexity, between challenging and boring; this echoes theories about aesthetics and musical preferences\textsuperscript{21, 36}. It was recently proposed that music can help to achieve such flow states by enhancing arousal and attentional networks\textsuperscript{37}. Music can train the unconscious for conditioned reflexes\textsuperscript{38} and to aid enlightenment\textsuperscript{39}; it may also have the ability to enhance certain cognitive networks by the way in which it is itself organized.

Music can also affect retail sales at a subconscious level. In one study, experimenters played either stereotypical French classical music or German classical music in a wine shop; consumers' purchases were significantly biased toward buying wine consistent with the national music, even though they were unaware of its influence.\textsuperscript{40} After listening to uplifting music (Top 20 hits such as The Corrs, Ricky Martin, Cher, Blink 182, Madonna), participants in another study were more likely to help in a charitable task then after listening to annoying music (Dennis Smalley, James Dashow, Stephen Kaske)\textsuperscript{41}.

**Selecting music for appropriate activities: Theory.**

Thirty years ago, it was speculated that "Children who begin school today have probably listened to more music than their great grandparents heard during their entire lives."\textsuperscript{42} This is clearly more true today than ever. Virtually every recording ever made in the history of the world is available somewhere on the internet\textsuperscript{43}. The issue for the consumer has shifted from "what is available" to "what are the best available strategies for searching a virtually infinite data bank, all of which is available?"\textsuperscript{43, 44}. The average adult has heard thousands if not tens of thousands of songs over his or her lifetime, has developed a sense of his or her own musical preferences, and of what particular pieces or types of music can induce desired mood states or physiological changes, including arousal and relaxation. The pressing question has now become: how do you select what you want to play given a virtually infinite number of alternatives?

Musical preferences begin to form in the womb and are the product of a complex interaction between nature and nurture, that is, between each person's personality and the environment in which they grew up. Consequently, there is no single piece of music that everyone likes, nor a set of songs that everyone will find uplifting on the one hand or depressing on the other: the relationship between music and emotional response/mood is personal and idiosyncratic. In the end, each listener needs to decide and discover for themselves which music will have particular effects on them. The rise of mp3 players and hard-disk-based playback systems has made this especially easy and convenient in recent years: listeners can place their music players in "shuffle" mode to hear songs in random order, becoming participants in a naturalistic experiment in which they can hear their entire music collections and keep track of their responses to each song.

Cognitive neuroscience has extracted some general principles of music, arousal and mood that can help to inform the topic. Mood, excitement, calm, romance, and
danger are signaled by a number of factors, but pitch and tempo are among the most
decisive. The slow, predominantly step-wise downward motion of the melody in Grieg's "Peer Gynt Suite No. 1, Morning Mood" conveys peacefulness; but in "Anitra's Dance" from the same suite, the chromatic, ascending lines (with occasional and playfully descending intervals on the way up) we sense more activity and movement. The piccolo, with its high pitch, shrill and bird-like sound tends to evoke flighty, happy moods regardless of the notes it's playing. Because of this, composers tend to use the piccolo for happy music, or for rousing music, as in a Sousa march. Similarly, in "Peter and the Wolf," Prokofiev uses the flute to represent the bird, and the French Horn to indicate the wolf. The characters' individuality in "Peter and the Wolf" is expressed in the timbres of different instruments and, each has a leitmotiv – an associated melodic phrase or figure that accompanies the reappearance of an idea, person, or situation. This is especially true of Wagnerian music drama). A composer who picks so-called sad pitch sequences would only give these to the piccolo if he were trying to be ironic. The lumbering, deep sounds of the tuba or double-bass are often used to evoke solemnity, gravity, or weight.

Many people enjoy listening to music that was recommended by friends, and this accounts for the rise in peer-to-peer (P2P) and social networks for music recommendation systems. This is related to the experimental finding that individuals derive positive self-esteem from being members of a cohesive social group, and such social groups can be formed through common musical tastes. In a large survey of British listeners (n=2532, age=under 18 to over 60) women were twice as likely as men to like Opera, Disco, or Dance; three times as likely to like R&B and Musicals; five times as likely to like Current Pop Chart music; and only one-third as likely to like the Blues. Relationship status was also a factor in preferences: single people were more likely to listen to DJ-based music, Hip-hop, Dance/House and R&B. People in a relationship were more likely to listen to Country & Western, Classical, Blues and Sixties Pop. Hip-hop listeners showed low levels of homosexuality and a high level of promiscuity. With respect to illicit drug use, an equal number of fans of opera, soul, dance/house, and hip-hop have tried "magic mushrooms" (psilocybin). Cannabis was used roughly equally by fans of Opera, Country & Western Fans, and Blues fans (~65 - 70%), even more than rock fans (61%). Least likely to have used cannabis were hip-hop fans (28.1%) but this could be due to their lower average age in the survey.

Preferences are based to a great extent on familiarity and prototypicality: we tend to like music that strikes the balance between familiarity and novelty, simplicity and complexity, and generally we prefer music that is similar to what we liked before (but not too similar), because it activates a larger number of neural circuits through connections to nearby neighbor representations of prototypes. In one study, the largest determinant of classical music preference was not complexity, but the resemblance between the target piece and other pieces with which participants were familiar.

A key component of music for mood regulation and other activities is that it is important for people to have the ability to choose their own music, rather than having music imposed on them. People are exposed to music in shops, elevators, restaurants, and other commercial and public environments without any active control, and in general, find such music aversive. This appears to be related to locus of control and the people's inability to choose or to block out the music. When forced to listen to music, few people
said they enjoyed it, but interesting genre differences emerged. 31% said Rap annoyed them, whereas only 10-15% were annoyed by Jazz and Blues. However, people reported that blues was the most likely genre to "hinder my attempts to do what I was trying to do".

Selecting music for appropriate activities: Some examples.

**Studying.** The data on music's role in studying are mixed. Some people can study or concentrate with music on and some can't (individual differences are at work). As well, the type of music and the type of material to be studied are also factors. In general, when studying text or anything that requires verbal cognition (as opposed to pictures, diagrams, maps, or simple mathematics), it is better to have non-verbal (instrumental) music so as not to saturate the limited capacity of the attentional system for verbal material. Instrumental classical music, jazz, techno and bluegrass can be effective in these contexts, depending on personal taste. Generally speaking, low tempo and middle-pitch-ranged music are best. In one study, 58% of people said that Blues music helped them to concentrate or think, 39% said this about country/folk music. The music used least for concentration was golden oldies (9.4%) and world music (9.1%), possibly because they were used for dancing or recreation.

**Cooking, Cleaning, Household Chores.** Music that is mentally engaging or physically arousing can help to take the boredom or drudgery out of chores. Music perceived as energetic typically has a tempo above 96 bpm (beats per minute), such as Paul Abdul's "Straight Up." But it depends on groove or feel – some 96 bpm music feels relaxing or contemplative, such as Joni Mitchell's "Blue" (at 102 bpm) or James Taylor's "Sweet Baby James" (which is even at 135 bpm).

**Exercise, Workout.** Many athletes use music for their exercise workout to help motivate them through the routine. Again, music that is up-tempo is helpful, and particularly music with a driving pulse that can be used to synchronize body movements. In running, jogging, stair climbing, weight training, swimming, and other activities that entail repetitive motor movements, choosing music that allows one to coordinate muscles with the beat can be especially helpful. Joggers may program a sequence of music with increasing tempo to help them speed up their gait, and then have slower tempo music for a post workout, cool-down period. The military defines a quick march at 120 bpm and double march (the basic running speed) at 240 bpm. Music with tempos that are near these rates will allow synchrony. Some athletes also find it possible to use music at double the tempo they are working out at: a workout at 110 repetitions or movements per minute could synchronize to music at 220 bpm by "feeling" the music in halftime. The Ramones' "Cretin Hop" is at 196 bpm, for example, and "I Got You (I Feel Good)" by James Brown has a tempo of 146 bpm.

**Relaxing, Going to Sleep.** People find music with a slower tempo and less of a heavy beat to be more contemplative, relaxing, hypnotic, or even sleep inducing. Slower tempos are traditionally considered as those below 60 - 70 bpm. A typical tempo for a Brahms' Lullaby is around 58 bpm. Again, however, "feel" is a factor: Fleetwood Mac's song "Hypnotized," which many people do find to be hypnotic, has a tempo of 108 bpm, but the song has a "half time" feel which puts it nominally near 54 bpm. In general, relaxing and sleep-inducing music avoid rapid changes in timbre, pitch, loudness or
rhythm. (Haydn's Surprise Symphony plays a musical joke on the audience by employing many of the devices of lullaby music, only to suddenly startle the listener with a loud chord unexpectedly.) Music with a large dynamic range (a Beethoven or Mahler symphony, e.g.) is going to pull the listener out of their reverie during the intense parts, as opposed to music with less of a dynamic range (Bach partitas, e.g.).

Romancing. Gender and age are important variables in considering what constitutes a romantic encounter and the music that would optimally accompany it. One guideline is that the music should help each partner to feel comfortable, but beyond that, a great variety of music is considered as "romance music." Different elements of a romantic encounter also lend themselves to different styles of music: candlelight dinner, after dinner dancing, and love-making suggest three distinct types of music. In general, couples that share musical tastes usually find it easy to discover the optimal music for their romantic time together.

Conclusions.

At present, we have access to more music and to more variety of music than at any other time in human history. Music has been shown to have specific effects on the body's physiology, including heart rate, respiration, sweating, and mental activity. Music is effective at moderating arousal levels, concentration, and helping to regulate mood through its action on the brain's natural chemistry. People who can have music follow them around during their daily lives can use these properties of music effectively – to form a soundtrack for their day and their lives, one that effectively provides comfort, arousal, and both mental and physical fitness.
Appendix: Sample song selections

Studying, Working:
- Mozart, Divertimenti for Winds
- Doc Watson, Foundation: The Doc Watson Guitar Instrumental Collection
- John Coltrane, Ballads
- Gary Burton and Chick Corea, Crystal Silence
- Mike Oldfield, Tubular Bells

Cooking, Cleaning, Household Chores:
- Sarah McLachlin, Wintersong
- Buena Vista Social Club
- Tommy Flanagan, Trio and Sextet
- Vivaldi Four Seasons
- AC/DC, Back in Black
- McFly, Baby's Coming Back

Exercise:
- Avril Lavigne
- The Village People
- Arrested Development
- Creedence Clearwater Revival
- The Temptations
- The Talking Heads
- Madonna, Hung Up
- Irene Cara, What A Feeling

Relaxing, Going to Sleep:
- Bach: Oboe Concertos, Triple Concerto, Flute Concerto
- Bill Evans, The Village Vanguard Sessions
- Chopin Nocturnes
- Brahms Lullaby
- Peter, Paul & Mary, Greatest Hits

Romancing:
- Amerie
- Akon, Konvicted
- The Postal Service
- Ella Fitzgerald, The Cole Porter Songbook
- Barry White, All Time Greatest Hits
- Debussy, Piano Works
References Cited

24. Krumhansl, C. in International Computer Music Conference (Thessaloniki, Greece, 1997).
42. Sundin, B. Barns musikaliska utveckling (LiberForlag, Malmö, 1978).