

The Sacred Computer

Calculus of Art I – Music I

Todor Iliev Arnaudov – Tosh*

Abstract: On origins, criteria, confusions and methods for measuring the musical beauty and beauty in general sensory modalities and domains, and a discussion and answer to the paper “*Musical beauty and information compression: Complex to the ear, but simple to the mind*”, which rediscovers some core conclusions from the earlier *Theory of Universe and Mind* about the universality of compression and prediction for cognition, the origin of cognitive pleasure as a by effect of the general operation of intelligence: maximizing matching and successful prediction of sequences and the common origin of science and art and music as prediction and compression; however “Calculus of Art” challenges claims and methods for measuring the complexity and cognitive pleasure from the referred paper and proposes methods and ideas from Calculus, requiring Art, Music and any domain to be “pleasurable” or predictable, compressible etc. in the whole range of scales of time and space and to be explored, studied, produced, generated, perceived, evaluated etc. incrementally, gradually, step-by-step expanded both in time and space, starting from the smallest possible ones and continually growing and evaluating the ranges, features, qualities, “pleasure”; and when comparing beauty, evaluating the features which humans or a generally intelligent compression system would recognize, compress and predict. A broader introduction and justification of prerequisite concepts and the basis of the reasoning is given in the first half of the exposition. This is a program paper, which is an entry to more technical future works and practical implementations.

Preface I: The work is also part of the book: *The Prophets of the Thinking Machines: Artificial General Intelligence & Transhumanism: History, Theory and Pioneers; Past, Present and Future*, Todor Iliev Arnaudov – Tosh (2025, upcoming) et al. (the other authors: citations, translations, selected and edited summaries of works, citations of/from abstracts of papers and other writings, parts of interviews, references etc.). It is a continuation of the sequence of the aforementioned *Theory of Universe and Mind* and particular publications from this body of work, for example “*Creativity is Imitation at the Level of Algorithms*”, 5.2003¹ and the major treatises *Universe and Mind 3*, *Universe and Mind 4* and the research plans in *Universe and Mind 5* (2004), as well as the computational creativity research proposals, published in late 2007 and early 2008 (see for example [2][14] for references).

Keywords: Art, Music, Compression, Prediction, Beauty, Aesthetics, Creativity, Computational Creativity, General Intelligence, AGI, Science and Art, Comparative Analysis, Calculus, Minimal Music, Minimal Art, Scale Space, Multiscale Analysis, Low compute computational creativity, Computational creativity with minimal computing power and memory, Incremental Art, Incremental Cognition, Seed AI; Conceptual Reasoning, Qualitative Research ...

* **The Sacred Computer:** Thinking machines, Creativity and Human Development

First published: 10.6.2025. **Version of the corrections:** 12.6.2025

¹ <https://tweekid.com/agi/Creativity-is-imitation-at-the-level-of-algorithms-todor-arnaudov-2003-2025.pdf>

Year-long open virtual conference of

**The Sacred Computer: Thinking machines, Creativity and Human development:
Thinking Machines 2025 | Self-improving general intelligence 2025 (SIGI-2025)²**

Целогодишна Виртуална конференция на

**Свещеният сметач: Мислещи машини, творчество и развитие на човека:
Мислещи Машини 2025 | Self-improving general intelligence 2025 (SIGI-2025)**

<https://github.com/twenkid/SIGI-2025/> <http://twenkid.com/agi>
<http://artificial-mind.blogspot.com>

Preface from 26.5.2025 – 10.6.2025

“Calculus of Art” is a work originally written in December 2012. The paper was inspired as an answer to another paper about music and beauty, which in the message about beauty and pleasure as prediction and compression rediscovers conclusions from the Theory of Universe and Mind (TUM, 2001-2004); however I challenged other suggestions, conclusions and *specific measurements*, which IMO were not justified or specified clearly enough or were confused.

Back in 2012 I wrote a letter to the author of the paper, informing him that I was writing a response, part of it is included³ below. However, as an introduction and grounding of my reasoning I added also a lot of prerequisite ideas, related to psychology, social science, neuropsychology (neurochemistry), aesthetics etc., which grew too much and I thought it needed even more elaboration, technical details or editing in some parts, which however I didn't complete at the time and didn't publish only the more focused and technical part either – until now for SIGI-2025. Some sections still have some note-like remarks which are additional fragments⁴ from the R&D program for adding more detailed content and expansion of the proposed reasoning.

I publish the work as it was with some notes and clarifications in square brackets [...]; more technical continuation will probably be elaborated in other works with running implementations as computational creativity or experiments with evaluating beauty, originality, progress, complexity etc. This direction probably will be completed in the planned publications of a big body of unpublished and future works that will follow the upcoming “*Prophets of the Thinking Machines:...*” with a working title “*Creation of Thinking Machines*”.

The successful techniques in Machine Learning can be labeled a kind of “*Calculus of Learning*” or when applied on artistic modalities for generating art pieces – *Calculus applied for producing pieces of art*; they compute gradients, i.e. derivatives and differences between

* ²<https://github.com/Twenkid/SIGI-2025/>

* Дружество „Разум“ <https://eim.twenkid.com/old/razum/index.htm>

* ДЗБЕ: <https://eim.twenkid.com/dzbe/> | <http://artificial-mind.blogspot.com>

³ Nicholas kindly answered.

⁴ See also the author's human-generated set of poetic works based on a prompt and example: “Fragments”, T.Arnaudov, 2006 [23] (Фрагменти, originally in Bulgarian)
<https://bglog.net/BGLog/4882#gsc.tab=0>

the pieces and intermediate steps, they are “*differential*”; the representations and the functions that ML finds in the vectors and weights are “*differentiable*”; the Diffusion methods incrementally produce more clear image starting from noise and solves differential equations etc. These techniques are hierarchical and incremental within the order of the layers and the time and space of the training procedure cover broader scope of data or span of their “perceptive fields” (context) and make broader generalizations – applicable for a wider span, range, volume, length etc. of data, inputs, variations, classes, ...

Therefore the mainstream ML is related to ideas from this work, however one point where it is different is that the current mainstream ML is heavily *numerical* and poor in concepts and in their *structural understanding, conceptual grounding, reasoning* (in the genesis of the systems, not in the “reasoning” as benchmarked in the LLMs) etc. in their “mechanics” and the ML practitioners usually lack the artistic skills, attitude and “machine code of the mind”’s capabilities to reason about the creation in a more efficient way – their “code” is inefficient compared to the code of an artist in particular trade; while this piece, the following continuations and the previous work in my line of research and the yet unpublished system or Language of Reason/Thought “Zrim” are intended, designed and supposed to be *conceptual* (some would call them “symbolic”) and *qualitative*; these methods are intended to be applicable *by hand*, even with pen and paper and they aim to achieve human level capabilities and results with modest or minimal computing power⁵. See also the counterintuitive predictions about the creative intelligence, which I made in [26] in 2013 and came true.

Broader Introduction of concepts and ideas about aesthetics, art, music and the Calculus of art

If you want to start with the compression and the more focused discussion and notes about the paper to which I responded, without first reading the more broader discussion and prerequisite ideas, skip to ~ **page 23, “Todor Arnaudov’s answer to: “Musical beauty and information compression: Complex to the ear, but simple to the mind”⁶ by Nicholas James Hudson”**

⁵ Possibly even on “obsolete” PCs from early-mid 2010s, say 32-64 GB RAM. When targetting low resolutions of causality and control and smaller domains I speculate that possibly even “very old” computers will achieve human-level and super-human capabilities – I still can’t estimate what could be done and of course I might be wrong. Anyway I plan to check what even an Apple[[would be capable to represent, learn, think, create and generate with the 8-bit CPUs 6502 and Z80 and memory expansion, and possibly also with more powerful PCs based on Z80, 68000, 8086, 80386 etc. and going up in the development of the CPUs. I started experimenting in this direction on 6502 and Z80 machine code since about 20 May 2025. See [24] In the context of calculus, compare symbolic solutions for differential equations, which were figured centuries before the numerical ones became widely applied and refined for detailed calculations with electronic computers: finite difference methods etc.

⁶ **Musical beauty and information compression: Complex to the ear but simple to the mind?**

Jan 2011, Nicholas James Hudson, BMC Research Notes 4(1):9 DOI: 10.1186/1756-0500-4-9 SourcePubMed,

https://www.researchgate.net/publication/49770962_Musical_beauty_and_information_compression_Complex_to_the_ear_but_simple_to_the_mind

Find: Ctrl+F: #music

Approximate Contents and topics

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- * Calculus of Art
- * Art must be art in all scales
- * The models of art evaluation, appreciation, pleasure etc. should include an explicit and objectively addressable model of the evaluator as well and not only of the art pieces and not only black-box-like ranking labels of the piece
- * Aspects which are not related to the substance of the media and the content as core data and information are confused for part of the art and are biasing the evaluation towards wrong criteria.
- * Creativity (“Originality” (Оригинальность))
- * Music is the sound.
- * The Act of Doing Something – Rituals
- * Beauty [as a concept, word] is [often] a Social Reward and a ... ? Stamp [or Beauty as a social reward and a stamp]
- * Mathematician's Bias on Beauty
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- * Issues with like/dislike voting...
- * Continuity
- * Horror films, music ..
- * Sound: easier to be realistic and to fool mind that it's real
- * The difference of perception of audio – lesser than for video ... ? when watching movie is lesser than the Video
- * Calculus of Self
- * Fake Integral Selfs
- * Reading the dictated speech, Auto-Q, ...
- * No true radical novelty
- * Pixels, Images – More complex than the PFC/top-level/what's accessible to consciousness/working memory

- * The whole is not more than the sum of its parts, and the confused concept “Radical Novelty” [TSIMTP = The whole is more than the sum of the parts, vs N.TSIMTP]
- * Reductionism and Holism
- * Resolution of perception and causation/control
- * Span of the records
- * Specific coordinates and ranges in time and space
- * d) Specific sequences of variations in measurement
- * [An agent’s relative intelligence measure of superiority:]
- * Local Superiority in local measures
- * Confusion of the “Origination” of music
- * What if the author hadn't heard the music?
- * The paradox of the apparent higher originality or creativity of the inferior author
- * “I don't care if someone can play very fast ...”
- * Cognitive and Physical “Beauty”
- * Arthur Schopenhauer's and genius’ aesthetics – art is intellectual
- * Humans act like “robots” and real robots will act like the model fantasy “humans”
- * Mechanical automatic pianos, ...
- * What is the minimal music?
- * Integral of Beauty Over a range of Infinitesimal steps

*** Todor Arnaudov’s Answer to: “Musical beauty and information compression: Complex to the ear, but simple to the mind” by Nicholas James Hudson**

- * Why lossless compression?
- * Obvious (expected) results
- * The main claim in the paper “Complex to the ear, but simple to the mind” is confused at least in the following aspects:
- * Beauty must be examined and evaluated for the tiniest possible audible segments, and incrementally expanded to the biggest
- * The lossless audio compression algorithms are not the right way to compare to mind, ...
- * A generally intelligent compression algorithm
- * Noise/unpredictiveness as cognitive ugliness
- * The texture of sound is not conceived at all
- * Also, it is not true that everybody would agree that the classical music is more beautiful than pop music
- * Symphonies – it's not just the composition, but also the orchestra, timbres, coverage * of the spectrum of scales
- * Table at p.7 Comparison of different degrees of compression:
- * Hi-fidelity musical texture is not crucial for the appreciation of music
- * [Maximal Speed of Music as Rhythm and Beats per minute]
- * Vibrato (requires additional time span)/tremolo
- *!!! Levels of correlations/matches (see below)
- * Not only levels, but types of correlations; possibly derived from a common root process.
- * [Measurements and scales of the predictiveness; ladders and tables; comparison to a set of possible predictiveness from a set of sound “tissues” and sequences, raw and processed to

tokens of features and correlations.]

- * Drums:

- * Phonological loop: **~ 3 sec buffer (sometimes 4-5), when taking notes

- * Drawings/pictures and photographs, different scales, different regions of them, compare, understand, which is

- * Minimum Image Minimal Picture, minimal line, circle, triangle, curve, ... area, ...

- * Reference TILT: Efficient Rectification ... [12]

- * Reference the techniques, “Reverse Rendering”, ... (Max Planck Institute ...)

- * Beauty of smooth/continuous nature scenery

- * Minimal Length | Maximal Length | Shepard’s Tone

- * Several cycles of an almost-periodic function

- * Attention load ... cognitive ugliness, cognitive overload ...

- * Lossless compression

- * following notes are adjacent, and it's easiest to play adjacent notes, as the virtuoso often do

- * Higher harmonics

- * Lyrics invoke ... associations, making the music more “ordinary”/concrete

- * Integral of Beauty Over a range of Infinitesimal steps

- * Integral of Personality Over a ...

- * Comparison between features of different genres of music

- * Piano concerto vs Instrumental neoclassical rock

- * Naïve Analysis

- * Missing the Sensori-motor grounding leads to wrong interpretation of Information theory

- * Integral of the compression

- * Pop-music, concerts

- * Appendix

- * More Notes and a “Rant” about the injustice regarding the non-funded researchers who preceded the works of the official academic publications but don’t get acknowledgment and support]

- * Literature

Conceptual Confusion - Generalizing intelligence vs General Intelligence

I claim, that the average humans are **not generally intelligent** in the strong sense, applied here*. Even almost all of the apparently talented or smart people are also **not generally intelligent**. They are all just “**generalizingly intelligence**”, they do generalize (for language and abstract thinking) and they do possess general-purpose sensory inputs and motor output.

However they apparently can't master many skills which are structurally trivial, sometimes pathetically trivial.

The more fields one can master (after investing enough focus), the easier is for him to do, the more true general intelligence one possesses.

Average humans can only generalize, but they're actual general-purpose talents and capabilities are missing. How good are you in visual arts, in music and all performing arts – dance, acting, juggling, ...; in creative writing in all genres; in maths and other hard sciences; in computer science and engineering domains? In literature, linguistics, learning foreign languages, social sciences, philosophy?*

It is all trivial. Music, art, dances, acting. (...) It seems as “special” because most people can't do it⁷, but that means both: the talented ones are talented, and the non-talented [ones] are just incapable of doing activities which are trivial for the talented ones.

Humans can learn, but that's faulty exaggerated: there are basic skills which non-talented humans or ones lacking enough of cognitive prerequisites are incapable to master, no matter the practice, or they have to practice 1000 times more than talented ones in order to achieve even mediocre results, which makes them throw away the guitar, piano, pencil etc. *immediately*, because they notice there's no progress in their skills.

In order to keep intrinsic interest in an activity, you have to be capable to do meaningful things, and **to progress**. Talented ones can do meaningful things even without training or with almost zero practice immediately when grabbing an instrument, taking up a [dramatic] role, reading a paper etc., and they do progress at lightning speeds, compared to the non-talented ones. **The structure, system, algorithms, correlations in particular art are obvious and trivial for the talented ones, while for the non-talented ones that's unreachable “magic”, even though it appears as something that everyone with general intelligence should be capable to do: e.g. painting and drawing, playing musical instruments (e.g. piano and drums) – slow is OK.**

Notes

** Intelligence is often confused with *obedience*. What's called “emotional intelligence” - EQ, while in some cases it is constructive and displays skills for not braking relationships for stupid reasons, it can be often called “conformist quotient” and quotient of pleasing your superiors (in a fake social hierarchy, usually) or ones you want to milk or exploit in one way

⁷ ..can't do it... + 26.5.2025: and can't learn to do it very well; or they do it significantly worse than the talented ones.

or another, or ones you're afraid to hurt, even if they do hurt you and do you harm. Yes, the “social climbers” are “emotionally intelligent”, they know how to *deceive* or create fake reactions. Of course, the expense of this is a diminished *self*.

Pseudo-general specialized one-directional generalizing intelligence

One directional – there's an asymmetry (see ...), can recognize the beautiful, but cannot reproduce it, unless they copy it as precisely as they can, only the superficial representation . . . (see... Creativity is imitation at the level of algorithms [3] ...).

Pseudo-general and specialized – it's apparently not general-purpose,

* Boris Kazachenko... [He declares himself as a] “Generalist” and [for him] other people are “specialists”. See... The author of this work was marked as a “serial specialist”⁸.

For a GI agent they can quickly become boring, because a lot of the popular art is trivial, which however should imply that they are elementary to master or to display quick progress in by a true GI. ... Wrong *social* view on art ... But there are “high” arts which are less trivial.

“It's about emotions “, social ... (see emails...)

Animal identities are confused for Human due to their strength

Basic emotions are not our *human identity* , but our *animal-self*

It's all about social – in ...

Being in the focus of the attention of many people, being a celebrity – that's a reason for many people to desire to be filmmakers, actors or so. [As well as the feelings of that participation.] However *that's not the art*. The artist and art have intrinsic qualities *even if there's no single person watching them at the moment*. ...

(Quantum ... analogy ... the act of observation makes a performance “meaningful” ... otherwise it “doesn't exist” ...)

The art is in the ... , if an GI agent starts even before any previous experience.

Wrong Attribution and the notion of what “*man* can achieve” [or a man]

Society and AGI-ers (emails, Matt ... “hard problems of art and language”) promote that “man” does art and sciences, and ... and all different fields. In fact *only a handful* of men on Earth can, and most humans on Earth are narrow specialized generalizing agents.

A concept I've used in the AGI List discussion: “mathematical blindness”, “artistic blindness” etc.

That's a defect which has been hampering the development of AGI – most AGI-ers are

⁸ [However] what he calls “generalist” though is a “generalizator”, and not one with general intelligence in the sense defined in this work and not understanding that a GI agent has. While he [seems to be] is knowledgeable in a lot of sciences, he doesn't appear to be skilled or interested *at all* in creative or performing arts – to name one [26.5.2025: of the gaps of his expertise in order to be recognized as truly “general”, versatile”; also, his work, the so called Cognitive Algorithm is rather not generalist, but again *specialist*; a highly focused narrow interest without demonstration of its relations to the other field; it may connect, process all kinds of input, however the algorithm *itself* would “understand” this data and domains – if the developers did, they should be able to discuss them and practise them themselves too.].

blind in many fields of the general intelligence spectrum, and they themselves **are not generally intelligent**.

That inevitably implies that they cannot see aspects and correlations which are obvious for people who possess truly general intelligence [or for the specialists in the respective fields, who however lack other capabilities, required for communicating their understanding with others]. That's a “damaging”⁹ discussion, too – you can't make a mathematically blind person to understand your math, and you can't make a visual arts blind person to understand the fundamentals of intelligence, encoded in trivial 3D-reconstruction and sensory-motor resolution and coordinates adjustments, unless you write it down in code and run it – **because they can't run that code in their heads**¹⁰.

Brain is Quasi-Universal

... Externalized ... Only recognizes/detects “intelligence”, but can't reproduce it ... (see emails!)

Mathematicians, who have never written a novel and can't play any different role than their own boring one [in life]; philosophers who can't solve a simple Integral or don't know and care what a “vector field is”; physicists, who can't play a 20 tones tune on a piano or an electric guitar, and believe they shouldn't - “*they are physicists, not musicians*”.

Programmers and computer scientists, who can't see further than structs, classes and programming code, but have no clue of behavioral sciences, psychology and all of the above [so they can't explain them in code].

The wrong attribution is very strong in arts, ...

Social reactions and mass appreciation are prone to terrible social-dynamical biases

The *act of saying* “I like *this* song” or “I don't like *it*” is messy, it's loaded with tons of cultural noise.

Maybe evaluating children reactions? But the age, their musical talents and training also have to be taken into account.

Of course, real measures are dopamine¹¹, brain activity neurodynamics and other [objective] ones ~~measures~~. See **Issues with Like/Dislike voting ...**, [Arnaudov,2012]

Antisocial and anti-individual

Бисер Киров, БТВ ~ „Днес песните се оценяват по това колко се върти, не колко е качествена като музика ...“ 16/12/2012 [Biser Kirov, a singer, on BTV ~ “Today the songs are evaluated based on the number of plays and not on their qualities as music ...”]

+Calculus of Research
+Calculus of Invention
+Calculus of Engineering

TRIZ. [A Soviet/Russian theory for solving problems of invention.]

⁹ I have originally written “hurting” instead of “damaging” [26.5.2025]

¹⁰ However many of the ones who can run drawing and 3D-reconstruction code in their head, couldn't or just didn't write it as a code executable by others or machines, except for other visually and rendering-gifted persons.

¹¹ It is not only that and the dopamine theory is simplified. See notes in “The Prophets of Thinking Machines:...”, T.Arnaudov, 2025 [upcoming]

“Be different” 23/12/2012

Attention Attraction

[The piece] Must sound “different”, otherwise you'll be mistakenly recognized as the other, or as a copycat, an imitator...

So creativity is seen as **“being different”**. [Comparative to known templates, expectations etc.]

Smiling Machines

Advertisements ...

Neurotransmitter Junkies

Oxytocin, dopamine, ...

Pseudo Abstraction – Pseudo Abstract and Pseudo “Concepts”

The mystery was unveiled in the 20-th century:

“Happiness” == oxytocin, dopamine, serotonin, in appropriate doses¹². Some like also adrenaline.

“Good” and “bad” is just the complementary neurotransmitters and levels:

oxytocin – cortisol/adrenalin
high dopamine/low dopamine
serotonin / low serotonin

Love ...

However then, the cognitive system which does generalization and abstraction tries to make sense of the low

See: Rationalization; Feedback-Feedforward disbalance (Articles, blog)

#23/12/2012

...

[31.5.2025: However of course it is not *just* these neurotransmitters, but the whole system and even the Universe, with the rest of the “variables” kept “constant”.]

¹² Also with appropriate brain in appropriate state which generate, need, react to, appreciate etc. such substances in such coordinates, distributions etc. See the above mentioned book and “Is Mortal Computation Required for the Creation of Universal Thinking Machines?” and “Universe and Mind 6” by the same author.

Calculus of Art

[A key idea:] → **Art must be art in *all* scales.** [Yet there is a minimum, boundaries, limits, ranges, resolutions, ways of “integration” – computing the integral, for computing “derivatives”, - “differentiating” etc. – how the music or the evaluation of its qualities or “beauty” changes with a small change of its substance, the way it was generated/created; the change of the acoustic properties, the technical quality of the texture of the sound etc. – see in the “focused” part of the answer.]
– Where ... Observers and ...

[Generalization of the section below:]

[1. The models of art evaluation, appreciation, pleasure etc. should include an explicit and objectively addressable model of the evaluator as well and not only of the art pieces and not only black-box-like ranking labels of the piece¹³]

[2. Aspects which are not related to the substance of the media and the content as core data and information are confused for part of the art and are biasing the evaluation towards wrong criteria.]

Thus, the definitions may/should include a model of the observer/evaluator ..
dopamine/..../serotonin etc. Something “Different” ...

Creativity (“Originality” (Оригинальность)): Comparison between the capabilities of other agents. Talent of an agent has a value because *the other agents* lack it. In a *class* of pianists, [the skill of] playing the piano is nothing special.

- The composers of the classical masterpieces were also virtuoso performers, they did stand out and were “stars” *because* of this, which was the first filter to allow their music to last. Furthermore, the pop-culture and history imprinted and iconized them.
- Social support/mirroring/ ... see (Issues with like/dislike...)
- A big part of modern popular music **is not created and performed** by the most technically superior or talented musicians, than their peers¹⁴.
- Answering the question of the author of [1] – Kylie Minogue is apparently not that “great” a musician, because there are very many contemporary other performers, who **can copy** her performance or are better, perhaps *many* in each country of the world.

“Better” musician is *not* a subjective notion, it is [can be, objectively]: a wider vocal range, stronger voice/more dynamics; instruments playing skills [and their degree]; improvisation and composition skills. That can be enhanced by “artistic skills”/acting and dance skills. The attractive look is in another dimension – physical pleasure, some aspects of dance also go there.

Someone would add “showmanship”. * Acting skills is part of it, and part of showmanship is acting, but another part is not a part of the actor's skills, is rather largely *an attribute of the audience*, which wrongly attributes it to the performer.

“She makes me feel fine.”, “She makes the public dance, clap, move...”, “She's a great showman”, “She's the greatest singer in the world”

¹³ See “Issues with Like/Dislike Voting (...)”, Todor Arnaudov, 2012

¹⁴ [Some are actually inferior than many unfamous and struggling to earn or amateur musicians.]

Well, what about:

- The scale of the promotion for this particular event, compared to the scale of promotion of another singer/show? [and the scale of the attributed *importance* in the eyes of the target group; *not* the music per se, but “a famous musician”, a “world-reknowned performer”...]
- What about the *scale of the stage*, compared to the stage of the other singers/shows?
- What about the *scale of her team*, compared to competition? [and the scale of the audience during the performance, the socially acceptable reactions for this particular style, the age and type of the audience etc.]
- What about her *social-status/rank* before the show, compared to the status/rank of the competition?

Some may raise objections, that these advantages are just an *indication* that she is “a greater musician”, and that's a part of the *confusion*:

That's not music.

Music is the sound.

[.. and the *structure* and its *relations* to other structures, and the *generators* and *comparators* of these structures]

When the music is put in the above context and setting, it loses its “*abstract* grounds” [and it's *own identity*], it becomes a *social* phenomenon¹⁵, it's a way of identifying with particular social group, movement, (...) a way to go “have fun”.

“*But of course music is a social phenomenon!*” - one may object.

Yes, but **socially significant** doesn't mean **musically significant**. [For example] a lot of [musically] awful rap is appreciated and liked.

– *Music is for having fun!*

Of course, but “having fun” during a show at a stadium has components which are far from musical.

Adrenaline, ... fear and excitement, When you listen to music in your bedroom or in a quiet bar and you feel safe, you don't feel the effects of adrenaline. Actually, you believe that you are safe, also because your brain doesn't detect adrenaline in your blood. Classical music rarely use **percussion**¹⁶, drums, fast rhythm (esp. piano, violin, ...) ...

The Act of Doing Something – Rituals [and the role of the social status of the actors, perceived by the art evaluator in ranking the pieces of art and the performances; the neurochemical aspects of art appreciation]

¹⁵ [It then becomes similar to other events and phenomena which happen on stage or involve many people, celebrities etc. e.g. political gatherings, film premieres or even the addresses of the pope in Vatican City]

¹⁶ [It does sometimes, but not in the way of Rock or Metal or Pop, and for particular parts for inducing target emotions.]

Three types of actors: 1. Theatrical. 2. Cinematic. 3. Combined

The theatrical actors play for the *feeling in front of the public* – the feeling of being observed, in other's people attention (and directly sensing it).

The cinematic actors play [more] for the *technical* part of the sake of acting itself, they enjoy acting itself and want to perform and depict particular characters and behaviors and to expand the range, not ritualistically to *repeat* the same stuff for the sake of the act of doing¹⁷.

The combined type covers both.

When both opportunities are present for an actor, the delimitation may come if the actor can choose. Notice that not all actors who appear in front of a camera are “cinematic actors” by nature.

Cinematic acting has other biases [or attributed stereotypes] in some communities ... “being important”¹⁸ ...

The syndrome of girls falling in love with famous actors... The looks is not the real reason, it is rationalized as one. ... Expression of emotions... However generalizing over the *evidences* (...) suggest that what is liked or adored is rather the *displayed social status* – the “great actors” are the ones who are displayed on a big screen, where *everybody* or many people, *social agents*, look at [and believe the object/subject on the screen is important]. If *the same actor*, the same *person*, weren't that famous, obviously he wouldn't get the same attention, appreciation and “love”.

Of course, often the great actors are handsome, ... they are often selected, ... [however being “attractive” or “charming” is not enough]
See *Guppy Syndrome*¹⁹....

Money? It's not only money ... Actors reporting that they are not for a stage ...

The act of *publishing* a paper on the conference is *more important*, rather than the content.

A young girl flashing her breasts in front of strangers online ... to see the reaction ... Can be seen by many, but *she* doesn't see them; the act of *seeing* that you were watched ... [or more correctly: the act and feel of *believing that you are watched, observed*, connected with *your expectations and valuation* of that state and of the observers that you perceive or believe that you perceive, or believe that they exist etc.

The number of types of actors is reduced to several, in order to make the classes more manageable, otherwise there can be huge amount (however finite) of classes, giving particular

¹⁷ [Of course there are other meaningful motives. They are also in front of a public when working with a filming crew, but it's a smaller one. They could be financially motivated if they were successful or they wished to be. They could feel more anxious in front of a wider audience, lack the skill to remember in full long scripts etc. However the *performance* can be executed just once or several times, if it's “fine” that's enough. For theater, as it is advertised at least in Bulgaria, the *higher number performances, the better*, like an obsessive-compulsive disorder. Sure, perhaps there are differences, but still that kind of repetitions is not attractive for some actors who still love to act.]

¹⁸ [Many viewers assume that the ones who like cinematic acting or make videos with themselves acting perform them because they believe that they will become “famous” thus they are feeding their ego etc. However they don't realize the fun that an actor may experience with that activity, even if nobody else appreciate his work.]

¹⁹ [a fish species and their sexual relations, which can be seen in human relations as well]

constraints of the complexity, attributes to be included...

Theatrical performance – doing 2 months of rehearsals, then replaying over and over the same sequence. ... Because ... what's important is the “*feeling*” in all times: oxytocine, adrenaline, dopamine, ... [and the state of the mind]

[Note also that some assume, that] It *shouldn't be recorded*, because it will “*destroy the magic*”. *Resembles Quantum Mechanical interpretation of the wave-function collapse. * If the particle is not observed, it can be anywhere within the probability density function, it's wave function. Once an observation happens – the particle is impacted by another particle – then the wave function “collapses” into a spike, the measured position, and if another measurement is done immediately, a position close to that one is expected.

Recording “collapses” the magic of theater... [thus turns it from quantum to “classical” state]

Happening *for real* – oxytocin, adrenalin etc. , “*real*” ... – such *sensations* are a feature of “realness”, “reality” for many. See: “The Matrix in the Matrix is a matrix in the Matrix”, T.Arnaudov, 2003

The *magic* is the detection of the levels of those chemicals, that can't be shared. “The *path* is more important than the destination”

... Examples and evidences are about providing matches ...

Beauty [as a concept, word] is [often] a Social Reward and a ... ? Stamp [or Beauty as a social reward and a stamp]

An example is the common goal of “*being²⁰ beautiful*” in particular. A popular slogan, that circulated in the social media profiles of the women some years ago was “find a man who will call you *beautiful*, not sexy”.

Being “ugly” is an insult (it shouldn't be said), while “beautiful” is interpreted or valued more as a compliment rather than an “objective” measure.

[The fact that it is *social* biases it. Some scholars give an example about the “Ruben's women”, how the aesthetics change etc. but this is a wrong example []: *painting* some subject, object *doesn't imply that it was “beautiful”*, however it is considered that if it was painted, then it was “important” or that it was so *not for the painter/author/the one who commissioned the work*, but “for the society”, “humanity” etc.; see a reverse example: in some possible cultures things which are the most or just “beautiful” or valued might be *forbidden to be depicted* or they shouldn't be pictured, because they are “divine” etc. Some religions do not allow depiction of human figures and faces, and only the “ugly”, “disgusting” (semantically tighted with the “physical” reward system) might be depicted as “warnings”.]

²⁰ [Or the activities which are labeled with the word “beautiful”; the actual meaning in a broader sense is or could be different and is rather about some acceptance, social ranking etc. For example putting botox or making their lips or breasts huge with implants. That's often considered unattractive or even ugly by many men, but the applicants of the procedures believe something else. They do it for their own feeling of beauty or attractiveness or for their “targets”.

Similar reasoning could be applied for men also and the approach of some of them at being handsome, e.g. abusing performance enhancing drugs etc. The phenomenon is not sexually limited to women.]

Mathematician's Bias on Beauty

Schmidhuber is a mathematician, compression, elegant, ... but fame, wealth, advertisements on thousands of radios and ... due to the performers higher musical

Pseudo Abstract Concepts and Pseudo Generalization

I claim, that many concepts, which are considered as “abstract” are in fact very specific and basic, but they are wrongly associated with abstract concepts which makes them sound more “special” and general than what they really are.

“Good” and “Bad” - dopamine/oxytocine/... vs adrenaline, cortisol
(See.. Rationalization and confusions ...)

“*Pleasure*” is mistaken for “*Beauty*” ...

... micro-acts... alignment between the cognitive and the physical system ...

Issues with like/dislike voting... [17]

What if she were replaced by a clone that looked the same and acted in an indistinguishable way for the audience?

The audience would act the same way, it reacts not to the particular performer, but to the particular setting and set of settings and expectations.

The audience reaction is also “encoded” in themselves, i.e. in the nature of “psychology of the crowds” - metal fans react the same way to a band that has sold 100 million of records, and a band that hasn't sold nothing [yet, but has its local fan base at the local festival, club etc.]... However, a band that's *technically superior* than a popular band may also get close to zero attention and applause and almost no audience would go to their concert, **because they are unknown, don't have a good “distribution”** and a few would even *check* who they are and are they good, even if the ticket for their performance cost 1/10 of the price for a famous band.

...

22-12-2012-START

Continuity

//musi112 17 ~ 35 min

//**Horror films, music** .. Craig ... We respond more to the *sound*, than to the visual input ...

35:10

Sound – smoother simpler continuity than visual

Sound: easier to be realistic and to fool mind that it's real

[It is more directly connected with the Will – in Schopenhauer's terms – and can't be inhibited by closing your eyes; the sound is more “biological”, the images are more “intellectual”.

28.5.2025]

The difference of perception of audio – lesser than for video ... ? when watching movie is lesser than the Video

...

Visual: they say 60 fps, flicker 75Hz-85Hz ?

24 fps, 23, 22, 20 – feels slower, 15 fps – slow motion

...

Make experiments!

....

22-12-2012-END

...

Calculus of *Self*

3 seconds? Buffer Speech, записване, слушане при диктуване

[records when dictating; the phonological loop]

Fake Integral Selves

News presenters or TV-Show hosts who are reading the Auto-Q, staring at the screen and their eyes are going right-left-right-left. Occasionally they react with appropriate facial expressions, look to their partner left, right...

[They create] Fake personalities. [If the Auto-Q is removed, the news-readers cannot tell these stories and cannot appear as authoritative “all-knows” anymore and turn into empty puppets, usually dressed in suits, which also serve for suggesting authority to viewers who don’t understand the trick.]

...

Reading speech, Auto-Q, ...

Преписване на формули – 3-4 знака? [Formula rewriting – 3-4 characters per span.]

!!! Времето за изписване! ? [!!! The time period for writing it down! ?]²¹

Complexity of a symbol, operations, moves, hand,

...

Default Network? [Neuroscience, see [15]]

Large scale can expand without clear limit, while to small scale ...

Limit: Scaling up – no clear boundaries / more complex

Limit: Scaling down – clear limit, receptor cells, neural fibers etc. or sensory matrix single rods, cones, “pixels”, hair-cells, ... muscle fibers, ...

No true radical novelty (see also emails)

²¹ See the phonological loop.

Pixels, Images – More complex than the PFC/top-level/what's accessible to consciousness/working memory

Reduction of the complexity of the *last* step to the *amount of the working memory* ...

Fixed complexity of the last step.

Complexity unloaded to lower level/external tools in steps equal to the border capacity per level ...

! Physics, Maths development

! Biology, Chemistry... Child psychology

...

The whole is not more than the sum of its parts, and the confused concept

“Radical Novelty” [TSIMTP = The whole is more than the sum of the parts, vs N.TSIMTP]

Reductionism and Holism

“The whole is ... “ but ... as other ... is confused and “*Radical novelty*” is always relative. (see Ben Goertzel, ... Emergent. ...) [See “*Chairs, Buildings, Caricatures, ...*”, *AGI Digest 2012, T.Arnaudov et al. at AGI List*]

The meaning of “sum” is apparently vulgarized. The fact that there are *by-effects*, which are “noticeable” by the evaluator, while in the cases where the “*whole is equal to the sum*” there are not **observable/noticeable** unexpected “by-effects” and that's taken for “normal”.

However, ... if a seed is put in ... earth and watched for 30 minutes, nothing will happen. For a fresh observer it seems that that's not a system, there's no interaction. If you wait more, however, the seed starts growing, and now the observable by-effects make the evaluator conclude that TSIMTP and see “jumps”, abrupt “phase transitions”. [The sum according to *his account* and whatever “sum” means in *his* formulas.]

We know, though, that if the resolution is increased and the range is reduced, we reach to particles/wave functions for which the “phase transitions” are part of a continuous [or discrete, but constant] process, such as the phase transitions of the states of a fluid.

The molecules don't change as molecules, their *parameters* change, and the interface/interactions between different molecules change due to the changes in those parameters, but all that can be expressed in terms of coordinates of the particles.

The different phase is measurable only after applying some forces... at a *larger* scale...
Light ...

The observer decides, that certain differences are *significant enough* so that it's a “*phase*”.

A hypothesis: brain just reduces to several classes ... [per level, range, step of processing etc.]

Biological processes are not proven not to obey physical ... laws are not proven not to,

and if put under a microscope or chemical analysis they behave as they should as their parts.

The “whole” as a “*radically*” *new* system, is an illusion that works only in minds, through their generalization and prediction way of perceiving the world. Both concepts are a confusion of the evaluator/observer, a view to the system which unveils properties which require a way for measurement or detection which were *previously unknown/not applied/forgotten* by the evaluator, [or require a larger or unaccessible scale, range, domain, modality, data, ...], but those methods do not really unveil something that [for itself] did not [or could not] exist [potentially, wasn’t already encoded] prior to the observations.

The differences in the *new view* can be:

- a) Resolution of perception and causation/control
 - b) The span of the records that are evaluated
 - c) Specific coordinates and ranges in time and space
 - d) Specific sequences of variations in measurement
 - [e] The domain, modality, coordinate space; {K}: Contexts in my works since 2013-2014]
- Etc.

Resolution of perception and causation/control

That's well illustrated throughout the history of physics and technology. Gravity and $F=ma$ were first formally described, because they allowed to be applied and tested on large scale “magnified” experimental test benches - the celestial body trajectories. The planets which are further away and the small satellites of the other planets apparently couldn't be seen without telescopes, the same goes for the cells without microscopes.

As of causation – from the crude stone tools, to the clockworks and jewelry, to the Moore's law in semiconductors and nanotechnology.

Span of the records

Big scale: The planets' trajectories required prolonged precise records (Kepler's work)
 Small scale: From the Muybridge motion-photographs of a horse ... (1877-1878), cinema (16, 24, .. fps), TV and video (50 fps, 60 fps, 120 fps...) high-speed photography (1 million etc. frames per second ...) to the current femto-photography (...). The smaller changes *can't* be seen or detected or recorded without the advance of the finer instruments. [However we assume that the properties at the smaller scales existed before we were able to “zoom in” close enough; respectively the properties at the bigger scales, for example watching the Earth from mountains, aircrafts, the space, for example for observing and measuring atmospheric phenomena etc., or being able to record longer periods of data – longer motion sequences, longer audio records etc., to process longer spans of digital data at once, higher resolution/higher detail etc.]

Specific coordinates and ranges in time and space

To discover the nature of *anything*, it must be first spatio-temporally *localized*. [To be *addressable* and *recordable* in some medium.]

d) Specific sequences of variations in measurement

[The discovery of] moons of .. [various planets] .. lowest resolution, obvious to measure using the available technology in 17-th century [etc.]. Going in finer ... If you're inside a [living] cell, you don't know that there's a body, you're not part of any “system”. One sees a system after expanding the field of view to a wider area/volume that encompasses more cells and other “items”, which happen not to match the notion of a “cell” [which are *different* enough for the *observer-evaluator*].

Also, if you are inside a cell's *organelle*, [now] you don't know that you're in a cell – you only know the “signals” that you “feel”, the interactions *inside* and on the *boundaries* etc.

Etc. until reaching to quarks or electrons, for which *we* usually don't care and don't know whether they are “alive” in some sense or is assumed that they are not “alive” in the sense of these larger scales[, but yet – are the *organelles* alive, if they are out of the cell – do they still “live” and for how long, etc.]

That method works also in time: for a given infinitesimal short period you might not be able to distinguish a living being from a dead one even if you can encompass the whole living organism in a given very high resolution. The reason would be that this particular period of time would be *so short*, that the metabolic processes don't have enough time to run [and still there aren't enough changes which can be detected without “static” features, e.g. particular substances], and it's too short to measure the distances that red blood cells have passed [or haven't passed after the heart has stopped beating], and you can't decide is the blood still moving or not, is it clotted [if you can't measure a big enough range, you may not detect any red cell in your region] etc.

(See: 2002, Letters between the 18-years old Todor Arnaudov and the Philosopher Angel Grancharov, The Sacred Computer, Issue 18 ...)

We say that tissues are built of cells, but in fact ... Thermodynamics is ... Different ... In many cases like that, it's ///It is subjective, see below.

[An agent's relative intelligence measure of superiority:]

In general, in the past, the greatest musicians were virtuosi, and there were not many other performers, who could copy them. [With a sufficiently high resolution of causality and control – speed, precision.]

That's my measure for originality/superiority of an artist, researcher or performer of any cognitive activity. That is: If agent A (**Superior**) *could emulate* agent B (**Inferior** (even in his most advanced activities (*hardest to predict*,...),) but agent B **cannot emulate** agent A, then agent A is cognitively superior compared to agent B.

**[I think that was stated in the classic Theory of Universe and Mind, 2001-2004 as well]*²²*

[However:]

Cognitive, artistic, musical etc. superiority **is not strictly correlated with popularity and the appeal to the majority of people which leads to corrupted measures and wrong generalizations. (...)**

***** Local Superiority in local measures ...** - to grow in hierarchy, serve, ... - different qualities, ...

²² See also Michael Levin's TAME – Technological Approach to Mind Everywhere, 2021]

Issues with ... Like dislike voting...

In the case of pop-music, talented musicians can probably reproduce or compose equivalently complex pieces to some popular pieces at the age 5-6-7 years old... Or say any beginner or an amateur could reproduce it. On the other hand, the children, amateurs and the mediocre popular musicians **cannot** reproduce music, which is performed by the really gifted ones.

In music-centered ranking, based on the measure above, the virtuosi should be the greatest **musicians**, because if they wished, they could perform the music of all other musicians, who have less of skills.

Confusion of the “Origination” of music

As early as the kindergarten, I myself asked myself about the finiteness of music. Perhaps everybody who has talents in both music and mathematics/science also has asked this. My claim is that the music is in fact [already] exhausted, and the new combinations are not really new.

Besides, that is not really an invention**, it's a *marking* of “*territories*”.

One of the reasons for the “*greatest*” classical musicians from the past to stay as *icons* and their music to be assumed as non-transient is that they **just were the first there**. They did exhaust the “cheap”/easy/obvious harmonies in the musical system and occupied the place. [Their students and descendents repeated them, they knew the “territory” belonged to the “classicists” and so every newer is compared to the past records. The same goes for other domains, except when sometimes the original discoverers are not know or get forgotten, because they were not in a proper “recorder” or “legal” position to protect their “possession”.]

The works of the following composers then should either match something old, which according to some copyright-maniacs*** who may not have a clue about what music [actually] is at [*low level and as code*]*, means for sure that they “*plagiarized*”, so they shouldn't do it

- or [they should] be “different”, “radically different” or even “radically novel”(4), otherwise “the newer pieces are plagiarized”.

However, even if one strictly pushes herself towards making a piece of anything with the goal of being [verifiably and undeniably] “*different than something else/everything*”, in order the latter requirements to be completed *for sure*, she should be aware, know, take into account *all that was created*, he should know the past and she would be under the influence of the past, [driven by being different]. [If she didn't know the past, she may have reinvented it.]

What if the author hadn't heard the music? – [Then it is a rediscovery and still *creative* for the author as of his knowledge and trajectory of development and search.]

As someone may notice, though: “I don't care if someone can play very fast, blah-blah, if he doesn't initiate feelings, if I can't have fun on his music, blah-blah. He is just someone

who can play well, but he's not a *great musician*.” That direction is inclining towards the topic of social, egocentric (subjective) and confused views about art (as something that “*produces emotions in the viewer/listener/appreciator*”, no matter how complex/hard-to-reproduce/original/requiring talents etc.

[Then *everything* and *anything* “that produces” emotion in the selected observer-evaluator, i.e. *anything*, depending on her peculiarities and state, can count as art or artistic or “beautiful” or “great” – however *it doesn't*, including for the persons which have the view, reminded above. A painting of Picasso is “ingenious”, if a 4 or 5 years old child has painted structurally similar image, without knowing about the Spanish master, her piece will not be valued the same by the “prestigious” art critics; it is the social status and the way something is presented and by whom which has a stronger impact to their reaction and emotions than just the *image*].

The wrong foundations of this view can be illustrated by the following example: Imagine an 18-month infant, a boy or a girl, or an older, but mentally retarded person, who's hitting the same key on a piano over and over. C-C-C-C-C-C-C-C-C-C-C-C-C... He's smiling and enjoying it. (See below). For that child that's the most brilliant music – the other kind is out of his reach, she doesn't understand it, it's not beautiful. For the mother of the infant, that act of making music also makes her feel proud of her “little prodigy”.

Is it the **music** that invokes those reactions, though?

No.

Cognitive and Physical “Beauty”

Both reward systems are messed up in the brain ... Pleasant is not beauty. ...

Arthur Schopenhauer's aesthetics 20/12/2012

“ **Wikipedia:** In the philosophy of [Arthur Schopenhauer](#), a genius is someone in whom intellect predominates over “[will](#)” much more than within the average person. In [Schopenhauer's aesthetics](#), this predominance of the intellect over the will allows the genius to create artistic or academic works that are objects of pure, disinterested contemplation, the chief criterion of the aesthetic experience for Schopenhauer. Their remoteness from mundane concerns means that Schopenhauer's geniuses often display maladaptive traits in more mundane concerns; ... “

Schopenhauer's concept of “will” is related to the concept of “physical pleasure”, which drives basic drives such as lust, hunger, thirst etc., or physiological self-preservation. The intellect, the “idea” * is my “cognitive pleasure/reward”, also Schmidhuber's and Hutter's and Leg's rewards Kazachenko's “cognitive algorithm” and generalization ...

“The pure contemplation” of Schopenhauer are the cognitive drives, science, research. **Predictions, ..., ...**

Humans act like “robots” and real robots will act like the model fantasy “humans” 18/12/2012

There's a stereotype about robots as beings: [Or there *was* a stereotype – it was gone since as late as the early 2020s, 26.5.2025]

Piano playing – if there's no varying velocity/sound amplitude dynamics

(Electric) Guitar – no vibrato, no varying speed, pauses
Drums – monotonic (less variability than “non-monotonic”)
Voice – like for all instruments

Mechanical automatic pianos, ...

Occam's razor – only **local**, and physical laws ... (see GSM notes)
Local “simplest” representation for the agent ...
Physical laws – the smallest particles/local regions have shorter memory/complexity than the bigger, which contains many of those small particles|
Humans – main universal resource for socially untrained individual: **time**.
(But cognitive ugliness, overload)
Brain cannot? plan and sense well; internal cortical load, only roughly (does it feel tension, ...), and internal circuitry can “short-circuit” itself.
Time is more predictable, it's based on muscular activities, observable, measurable.
Still – confusions, old memories, ...

See: “Ada” 1/2004, a SF/fantasy novel [the chapter with the mechanical piano]

What is the minimal music?

* 2000 – the “texture” of sound ... a friend of mine ... they reach puberty. * to Anastasios
also popular, society of g ...

Integral of Beauty Over a range of Infinitesimal steps

I've been interested in sound ... Pravetz-8M, pulse-modulation... Apple][...
Access to a PC with ... (2000, “Звуков господар” – Sound Master) ...

Integral of *Personality* Over a (see [10]) [Akasia ... Nature or Nurture paper – cite ...]

...

[Start with a rhythm: time periods; the set of single tones/different oscillations with different type of functions: sine, triangle, ... amplitude envelopes, multiple frequencies in more complex spectrum; ... combinations of two tones in time; harmonies of two tones; three tones ... combinations of combinations ... multiple channels: two channels, ... multiple scales: octave harmonies ...]

#music

Todor Arnaudov's

Answer to: “Musical beauty and information compression: Complex to the ear, but simple to the mind”²³

by Nicholas James Hudson

Written in the end of 2012. First published in mid 2025 with notes in [...] and footnotes.

Why *lossless* compression?

The choice of lossless compression is not justified in the artistic settings and the recording media (see below), and humans are well-known for their poor capabilities in lossless compression.

[Also *lossless* depends on the measurements of an observer-evaluator. It is measurable in digital records, if stored in bits, or with some “SNR” – Signal to Noise Ratio if analog or with digitized as well, however it still depends on the granularity of the analysis and some losses for one detector or scale are still perceived as lossless by others evaluators and that's used for multimedia data compression.]

Obvious (expected) results

The results of compression of music often are well **predictable** without using “formal” proof with algorithms, to make the test scientific.

For example records of classical music, especially the piano, organ, violin concerto, consist of **one single** instrument, where the tones are obviously compressible in their low level oscillatory representation, there's no additional noise and no overlapping sound waves.

One obvious form of lossless compression is the **sheet music**, in fact that's *what* classical musicians play, [what drives their performance] – [they] hit the keys/pull the string/blow the instrument as *these commands* state. That representation can be compressed little more by using delta-coding and employing scale boundaries as guides. The kind of *decompression* is used during playing and improvisation – usually adjacent or close notes/keys/frets are hit. That's related to the fact that they are the *easiest* to reach and can be played faster and easier, and to the octaves – the scale cycles.

[Also if two positions were too difficult to reach and required too long a time to move your hand, that would create a longer pause and an interruption of the sound or missing the rhythm – or it will require too slow a beat; that kind of *interruptions* and *discontinuities* are usually “*unpleasant*”. That's how the performance sounds when an ambitious guitarist tries to play a solo which is beyond his capabilities or when one tries to improvise and play along a backing track, but she can't figure out the right tones quickly enough. Thus *continuity* is important.]

There are a few other parameters for example for an electric guitar: vibrato, tapping; hummer-up/pull-down, with fingers, slide etc. [There are also peculiarities of the particular

²³ **Musical beauty and information compression: Complex to the ear but simple to the mind?**

Jan 2011, Nicholas James Hudson, BMC Research Notes 4(1):9 DOI: 10.1186/1756-0500-4-9 SourcePubMed, https://www.researchgate.net/publication/49770962_Musical_beauty_and_information_compression_Complex_to_the_ear_but_simple_to_the_mind

instrument: what exact electric guitar with what strings, fretboard, electronics, settings, adapters etc.]

... repetitiveness of the most s one other obvious reason – they are a...

Even if you just imagine how music is performed: for a piano concerto, it's just presses on one keyboard with varying force, speed etc., with a few tones polyphony from a small set, often repeating or the same; sometimes a few pedals are used; this type of performance can be compared to music which is performed by more instruments and consists of more presses, moves and more diverse set of physical adjustments per second.

In another representation of music, the sheet music, the **notes** – [maybe] the obvious meaning of “**simple to the mind**” – are even more compressible and elementary, i.e. high level digested data (which for the player is not even digested), besides additional parameters involved in vibrato, tremolo; piano/forte; fast/slow.

...

Most people **do not have absolute pitch**, they cannot recognize //“corruption”

The main claim in the paper “Complex to the ear, but simple to the mind” is **confused at least in the following aspects:**

* “Complex to the ear” is not well defined and it is confused. A virtuoso piano concerto, or even not virtuoso, just a piano piece, is complex to the **hands** of a non-talented and/or not-trained individual. The mind part can be the **length and intensity of the training and/or neurodynamical /cognitive /talent prerequisites** for a human in order to get capable to play it with given speed and accuracy. Motor cortex and motor activities are part of “mind”, then it's “complex to the mind”. However, that all is an interpretation of mine, the author of [1] didn't seem to mean that with “mind”, because he's talking about the *listeners*.²⁴

The author talks about “ear” and “mind”, without stating what he means exactly. [Is it valid for] the activity in the A1 auditory cortex? Or possibly the compressibility by an “objective” computer algorithm?

Complexity, as defined in this paper, is **low for music than “non-music”****, both for the ear and for the mind for both the listener and the player, because **every tiny piece of a record of a piano concerto is “simple”** - see below.

As of popular music – it also includes classical instruments sometimes, like piano in Jazz or popular music, sometimes played technically better and requiring more skills than particular classical pieces.

* If *music* is seen [viewed, observed, evaluated] from a POV of “*sound*”, classical music is

²⁴ [Of course the complexity can be measured for example with a dictionary-mapping and formulas of a scale of difficulties per motions, sequences, chords; speed, precision in time of hit and time of holding the note an the pedals, range of the consecutive tones etc. mechanical and timing measurements; it can be either enumerated from the space of possible actions or taken from a record or records of the development of real players – the ladder and chronology in the curriculum of a pianist. “Do-re-mi-fa-...” with pace A, Hey, Susana; “Happy birthday, to you!”, “Twinkle, Twinkle, Little Star”, “Мила моя мамо, сладка и добричка...“, „Тръгнал кос, гол и бос“ ... fragments of Mozart, inclusion of both hands and simple chords and rhythm ... Für Ellise, ... Well known by the professional piano teachers and encoded in the educational programs for music schools. You can generate one from the LLMs with say: “Give a curriculum for piano learning for a beginner. Exact pieces and their sequence and complexity. Include sheet music.”]

not complex neither to the ear, nor to the eye and hands (for reading and playing), if compared to “*complex*” sounds, such as noise, which in its worst apparently cannot be compressed (on the other hand in fact it *can*, because the fact that it's noise makes the specific values of it *meaningless* for the listener, thus it can be encoded as just “noise” with length x [as the listener *cannot recognize, differentiate, remember* more details, features about that sound and the specific parameters of the wave function; that is true for the harmonic sounds either, there is a limit of the frequency differences that can be recognized etc.]).

In sound terms music, *any music*, is **simple to the ear** (harmonies, **compression at the very low level of sound**) and **simple to the mind** (compression at all higher levels – scales, arpeggios, intervals, reverse, chords, repeating segments, repeating parts in altered scale/tempo...), and in the same time **more complex to the mind (having longer range matches)** than less sophisticated music, in which musical segments are more repetitive and the pieces are shorter – they don't allow for longer range matches and models. (See degrees of predictability ... 1, 2,3, 4,...)

[It is actually **simpler** ... rather than **simple**... Relative scales are more appropriate – music is *simpler* than other compared sounds, which require more explicit and concrete, detailed record of the sound texture and can't be represented just as tones or notes from predefined scales – these are the *audio* records, concrete pieces of wave data, frequency spectrum etc. The *scales* themselves in the music are also a tool for *simplifying*, shortening, *compression*: they put the allowed possible sounds, sub-periods, ranges of the input, records, perceptions, in a reduced set of categories, explicit and specific ranges with a reduced cardinality, so they are enumerated and addressed explicitly, allow “fuzzy matching” with redundancy etc. and lead to the *predictability* of the musical sounds if perceived as notes – when there are mismatches to the expectations, the trained or untrained listeners perceive *mistakes*, which are generally “unpleasant”, although they can be perceived as inventive or an end, interruption, a mark of a change of the melody, a beginning of a new sequence. The sequence division, the segmentation, are general problems in cognition and perception for all modalities and the decision depends both on the input and the memory and will of the observer-evaluator.

Notice that “*relative scales*” are also native for the way music is remembered by humans, unless by performers with absolute pitch – when replaying or singing a song by memory, often there is a margin of error of at least a semitone or a few tones or whatever, sometimes depending on how convenient it is for the performer – for example on a guitar, it may be more comfortable a solo to be performed transposed; also the guitar could be tuned up or down to the original setting; or the ear or the memory of the guitarist may have such amount of error in frequency recognition; for singing – the difference may be due to the skills, adjusting to the scale which is reachable by the singer or the instruments that play along etc. A bass couldn't play it in high pitch, so it is transposed down and the songs sound “the same” as recognizable melodies in all scales etc.

Overall: the melodies and chords are still recognized and remembered mostly by their relative coordinates and values, not the absolute, which is also reducing the length of the code.]

*** Beauty must be examined and evaluated for the tiniest possible audible segments, and**

incrementally expanded to the biggest. The shortest is one period of an almost-periodic function or 1 sample, a longer is “sound texture” - the minimum audible segment - starting right from the beginning of the piece till the end, because classical music and any music starts being pleasurable for ones who enjoy it right away from the very first beats, or the first seconds and not after 20 minutes²⁵.

The overall “I like it”/“dislike it” falls in the class of the absurd and “corrupted” “overall” measures of the social opinion, discussed in [Arnaudov, 2012].

The [1] considers that there are variations in speed and silence that may cause variations [of the complexity?], but there's no definition of “*sound texture*”.

It's naïve to calculate compression over an entire song/piece, and listeners certainly *don't do it like that* – they are supposed to be pleased/relaxed/moved/or kept interested by *any* segment of the song [throughout the whole piece²⁶].

*** The lossless audio compression algorithms are not the right way to compare to mind,** because those algorithms are “dumb”/“fools”(5) and humans **do not remember losslessly rich media (try repeating even “lossy”, with your mouth, what you've heard 10 seconds ago)²⁷.**

A generally intelligent [compression algorithm] (not lossless compression algorithms) would be closer [to the algorithm of the mind, more similar to mind's one], but general lossy compression might be in fact [even] *closer* [to mind's one], because humans hardly remember sounds exactly²⁸.*

Information theory is applied [in a] too blinding [way] by dismissing the *lossy* compression, because it “...reduce[s] information via “acceptable” losses of fidelity. (...) What's “acceptable” is subjective. ...“

IMO this “literalism” suggests two possible assumptions of the author:

– The *texture* of sound is taken into account, i.e. *only high-fidelity* audio is [considered] “pleasurable”, but I only assume that, because I didn't find it explicitly stated (it's only realized that a *faster paced* piece would require *more data* to encode, if the rest is “the same” [for a given amount of time]). While the fine sound texture certainly adds to the pleasure of listening, making it cleaner (less of noise(6) or more “realistic” (7)), it's not what makes **compositions** and **music** of high quality. That's the feature of the “**sound**” [acoustic properties, quality of the sound engineering etc.], like a good sound in a club vs. bad sound in the... toilet. However, a virtuoso will sound as a virtuoso in both places.

[The virtuoso or the more talented performer will be <i>recognized</i> as such in records

²⁵ [Here the memory may play a role as well. The pleasure comes also from the process of recalling. If the piece is considered “new” for the listener, it still can be similar enough to one heard earlier – the tones and scales and distinctive timbres are a limited number and the mind is also searching for matches. A very young listener or baby may have a moment when hearing music for the first time, but it still may resemble the sound of her mother, father, animals etc. and when the very first sound were heard, the brain would be in a very early stage.]

²⁶ While of course they still can have preferences for different parts of the song.

²⁷ A reader of the paper has suggested testing with FLAC etc. methods:

<https://emilkirkegaard.dk/en/2012/12/paper-musical-beauty-and-information-compression-complex-to-the-ear-but-simple-to-the-mind-nicholas-j-hudson/> Silence o

²⁸ [I.e. a *superior* than human thinking machine would be “more distant” to the way human mind remembers the music. A machine can remember and reexperience *everything* in its records (memories), if it wishes, without additional external tools.]

with both kinds of acoustic properties. In other words, the essential features of the quality of the performance are “invariant” to these transformations and “robust”; at least this is true to a greater extent than to the acoustic low level properties. One reason is perhaps because what is compared and evaluated as “better” or “worse” performance or skills is extracted after *segmenting, decoding* the acoustic signal into meaningful *musical and performance-related* elements such as tones, speed, variation/application of vibrato etc. and that segmented data is compared to templates – not the raw sensory input. A favorite tune also will be recognized and enjoyed even if it is recorded in either higher or lower fidelity and even with mistakes and depending on the attitude even the performance with mistakes may be enjoyed due to the recall of the particular loved song.]

* **Noise/unpredictiveness as cognitive ugliness** ... “Realistic”, as in [2003,] - closer to the distribution to reality, matching reality

* **The texture of sound is not conceived at all**, but just some vague overall “compression of entire pieces”, only pieces as a whole “*message*” (in Information Theory perspective) are considered – which is flawed, as explained above. Every little meaningful segment of the musical piece should be nice to listen to, and the listener doesn't wait for a 70 minute symphony to complete before saying to himself “oh, Bethoveen is more beautiful than Kylie!” **Also, it is not true that everybody would say that** – people's appreciation of classical music is not justified and it's overgeneralized, apparently [the majority of] people prefer pop-music, rock, oriental, house etc. [or folk or pop folk music from their regions]. Many people even *hate* classical music, especially violins – in Bulgarian there's an expression “Цигу-мигу” - „Tsiguh-miguh”, a negatively loaded interjection used to call any unpleasant, for that listener, “scraping” on a violin, viola or other similar string classical instrument. ... – the experiment with the “best violinist in the world” in the metro – social corruption scribing – ...

[3.6.2025: **“The most beautiful music” p.6. Beethoven Symphony** ... It's not just the *composition*, but also the *orchestra*, the set of all instruments, thus voices, timbres which fill the spectrum and create more harmonies = matches within a broader range. The “enduring classics” were also exploiting the *easiest* “good sounding” harmonies and easiest to play etc. See [8], 2002, the prediction that the thinking machines will probably discover the same harmonies like humans, but they are already “occupied” and if you didn't know about them, they existed and you will repeat them, thus the performances with a priority are “greater”. In addition: the historically and socially reinforced repetition and ranking.

The “apparently complex” pop music, measured as audio compression of files, is due to the sound *texture, percussions* (noise, high frequency). However as mentioned, humans *don't remember* the music or the sounds as records of the wave functions or precise spectrum, but as tones in scales, usually relative; possibly the lyrics when there are some etc. In the specific case of vocal pop music, the lyrics and its content also plays a role, it makes it may make it “less great” for the listeners, because it is about mundane topics. The symphonic and classical music are more “epic”, because they have no lyrics, no textual associations with

specific concepts and especially every-day ones (besides possibly the *title*, which usually is more abstract: “Moonlight sonata”, “5-th symphony”; also their official social representations is as “more prestigious” and when somebody *answers* questions about it *in public*, *believing* that the answer may reflect how the interviewer may look at him, present him etc., then his opinion may be biased and reflect what she *believes his model of the “society” believed she was supposed to say*. That’s a general unreliability of methods for researching taste and aesthetics by asking people.

Table at p.7 Comparison of different degrees of compression:

Jackson Pollock’s pictures are classified as ‘at the edge of chaos’ and invoking ‘pleasure’ – I challenge this. Picasso’s work are referred as at the edge of regularity – a highly overrated artist, many non-counted-as-talented children, if measured by their art pieces, are as talented as Picasso, they haven’t copied him and were original for their own, however they are not classified as “genius” – because the genius and the evaluation of Picasso’s work is based on the corrupted social measures, ranking and cycles with media and the public (largely incompetent or inert about the technical part) and not on objective measures of the actual content. In general the evaluator-observer has to be defined as well. What is “edge of chaos” for one is trivial for another, and whether it is “chaos” depends on the evaluator’s memories so far, compared patterns etc. See also Universe and Mind 4, 2004 and “Ada”, 2004 (...)

]

*** Hi-fidelity musical texture is not crucial for appreciation of music**

A flashy example of the acceptableness of the lossy compression is that people enjoyed listening to good music on the very old gramophones with a several kHz band, poor quality AM radio with similar band, poor magnetic tapes and micro cassettes, poor mp3 files at 56 or 64 kbps, where 128 kbps of “artefact” sound on the cheapest speakers or headphones was considered “CD-like” quality, and videos on youtube in the era of 240p and the first 360p with poor 22kHz highly compressed mono.

The summary of the above is that: while **sound** might be far from acoustically perfect, the **music** may still be fine, because it's **highly compressible by definition, and it's not in those high-frequency hi-fidelity components**. The same goes for **voice**, which is a part of pop-music and choral music - vocoders were the first examples to display how low bandwidth is required for recognizable vocal sounds, due to the periodicity of the tonal vowels. The high-fidelity and high-frequency components add for the feeling of reality (see Todor 2003). The stereo or surround also add to the feeling to reality - notice, that the detection of sound direction happens in evolutionary ancient subcortical nuclei, **based on two components – phasic and time-difference. (CHECK)** That is small local differences.

(In that dichotomy, everything can be reduced to match and difference, done at different levels and with different ratios in between)

The components don't end here: the audio recording and playback systems, even in case of “perfect” digital records. Speakers and the acoustics of the rooms of an average listener also “colorize” the sound. What about the cheap speakers of the TVs? Did the people didn't enjoy music, played from the old TV sets? In 30-ies? 40-ies? 50-ies? [Mobile phones, cheap headphones, portable transistorized radio receivers, ...]

What about the hum and the buzz of the computer fans?

Last, but not least - **what about human ear and auditory system itself?** Human ear is lossy, the frequency resolution of the ear is not as sharp as 1 Hz (and the sound/waves have intrinsic “bugs” in discriminating adjacent frequency components), and the quality constantly degrades with aging. Most teenagers and 20-30 years old people – some of the major and most enthusiastic music lovers - can't hear above 15-16 kHz, or even 14 KHz – the figures may be *worse* for the bigger music lovers for whom the *social* part or the intense emotion and loudness were attractive. It gets worse for elder people, who could go below 10 or 8 kHz. Still, there are pianists who have been concerting and appearing to enjoy the music in their 70-ies and 80-ies. [Cite]

A symphony is still perceived and recognized as a symphony in either 8000kHz/8bit PCM mono and low fidelity, or 192 kHz 24 bit 7-channel “hi fi, because humans have just 2 years, and the **essential sound spectrum and correlations that make the audio to count as music** are well below these frequencies, *not in the absolute numbers*, and they are preserved even after heavy “lossy” compression.

Finally and reminding that, after all – the sheet music is a lossless representation of a symphony or any piece – [“of the “essence” of it if the instruments and the orchestra are available,] – and it is obviously very “simple” as information content – short as a code. [Additionally, the essence which is enough to *recognize* a symphony or a piece is much smaller, depending on the listener’s experience: if she has *less of experience* of less variety or is less discriminative, she might recognize a piece with *less of features*, just a timbre, a several consecutive tones in one or a few seconds etc. Listeners with a lot of experience and musicians also do. Furthermore, given musical experience and skill, after recognizing scales, rhythm, melodies for a while, their possible and expected variations can be predicted and continued in the mind of the experimenter.]

– No, [poor] humans, 10-20-30-100 pages of notes is *not* “a lot”, your brains are just *frail*.. – said the Thinking machine.

The sound carrier just transmits that tiny amount of information which the brain detects and classifies as music, tones, rhythm, timbre, of which it remembers only a tiny amount of it ****.

It is like the **modem** – it uses modulation-demodulation to encode digital data. An example*...

That's a sound wave of “Прехвърляч-8М“ /Prehvurlyach-8M [2001-2002]. Encoded as 8kHz audio it occupies ..., but the “meaningful” data is just ...

A very simple code, where 1s are encoded in 1000 Hz/ 0s at. ... 2000Hz . 8000Hz/8-bit recording fitted well – 8 or 4 bytes encode 1 bit, so there's 32 to 64 times redundancy, and probably it's well justified for it's original purpose – recording on 70-ies-80-ies home portable cassette recorders...

– Yes, that's a very primitive encoding, it's not compressed**, there are advanced “phases” etc.... Expanding the analogy to humans, though – we cannot decode [even] that data by a naked ear. Not even that “simple” width-pulse-modulation*** encoding at [average] ~1500 Hz/bps. We couldn't do it perhaps even at 300 bps [in that format].

[Maximal Speed of Music as Rhythm and Beats per minute]

- Random checks – the drum machine of RP250 – up to 240 bpm. Synthesizer Yamaha E313 – 270 bpm max.
- More precise experiments must be done, but music that goes at more than 300-350 bpm starts getting “intractable”. And that means that many notes or hit keys or string pulls, and each of those hits involves at least **several cycles of an almost-periodic function**, that allows for recognition of a tone (at least two cycles) and there must some kind of **separation** – a pause, different tone, different sound (noise, percussion), change in the dynamics of the sound (attenuating, ...)

20 – possible, too fast ... //Rising Force, 240 bpm? Find records ! – at 50% музиката се различава още [Yngwie Malmsteen] [slowed down to 50% with a Winamp plugin effect, the music is still distinguishable]

Maybe up to ~ 10 hits/sec 0,1 sec ... 10 Hz/ 100 Hz – 10 cycles, 50 Hz – 5 cycles – There obviously can't be bass at high speeds...

Bass – lower max speed ... [of playing, performing and hearing of distinct sounds per unit of time. [Each cycle of the oscillation of the sound wave takes more time, if at least 2 are needed to detect a repetition, a sound at 50 Hz require 1/25 seconds for the theoretically minimal 2-cycle period.]

Vibrato (requires additional time span)/tremolo

!!! Графично да го видя, графики, ефекти

[Observe the vibrato graphically, effects! i.e. watch and measure the graph of the sound – waves, spectrum and all kinds of features ... This can be more simply defined by the generating functions of the oscillations with additional carriers/”vibrating”, shifting the main frequencies, adding other waves/functions etc.]

...

Technically ... 440 Hz... =

1/80 Hz Thalamus ... 1/40 ... = 0,0125 s / 0,025 sec + pause /2 ==> 0,05 sec for sound²⁹

300 bpm = 5/sec = 0,2 sec

Speed: Min/Max

Length: Min/Max

Complexity: Min/Max – Define complexity

Minimal Speed of Music

1. Depends on the bearable length of repetitions “boringness”... [local match within recent memory buffers for comparison and search]
2. Other stimuli [that can attract and switch the attention of the cognitive system as a united whole body]

3. Strobe cycles? Saturation [some number of repetitions is not boring like the verses in songs; a single repetition is a match that reaffirms, confirms the first encounter of a sequence]

!!! Levels of correlations/matches (see below)

1 – repeating cycles

2 – repeating variations of the cycles

3 – ..

[4 – finer and related to specific memories and occasions matches, which may be related to the Sensual/Physical pleasure; e.g. being with a loved one, feeling happy at the time of listening to particular song etc. which can be associated with particular features of the song, sound, rhythm like “conditioning”, reinforcement learning]

+ Predictive decline/rise of the amplitude (predictive degree of decrease of the amplitude)

+ Predictive decline/rise of the frequency (repetitions of the rise/decline of freq)

- легато? Плъзгане

- scale up

+ Predictive cyclic oscillation of the main frequency – vibrato

[Measurements and scales of the predictiveness; ladders and tables; comparison to a set of possible predictiveness from a set of sound “tissues” and sequences, raw and processed to tokens of features and correlations.]

– **Main frequency?** The lowest – because higher fits inside ...

– **Span** of the match within the sensory matrix:

– Force of match – many different types/levels of matches reinforce it

– Many consecutive matches from the same type – inhibit?

– Boris'/Schmidhuber – compressibility *progress*

– Tosh: Predictability becomes predictable – boring?

– When predictability is unpredictable is interesting.

– Ratios between frequencies: one oscillation fits another one [harmonies between tones and scales]

Drums: matches of ~ exact records (spectrum windows) within time window.

[The periodic oscillatory lower frequency features of the tones are not detected. The melodic tones also have detected times of onset, begin, end; may have an amplitude envelope and a “center”, pique etc.]

– What's maximum time window for perceiving as consecutive from the same sequence? – Depends on expectation, attention ...

– !!! In order to dance, the rhythm/drums speed cannot be too low!!! Dance determines that speed. Height of humans, muscular strength – stay on one foot!

– Elder people – slower moves, but dance is possibly created initially by young ones, who were agile. [However] the young/youngest one also have limits of staying on one foot [the toddlers and learners to move tend to fall even when walking]. For steady dance with jumps –

minimum time. [Да се снимам как танцувам, примерни кадри! Завеси черно, ...]³⁰ [Or measure on other videos.]

– Walking – fast 120 steps/min (each foot +1)

– Hands for fighting, also speed limits (for upper speed), and limit for the drummer.

– In order to be able to dance... За да може да се танцува (The minimum is 1/80 or so – above, repeat experiments ...)

****~ 3 sec (sometimes 4-5) buffer, when taking notes from Phys201, Eng non-native language ...³¹**

!!!! Рисулки и снимки, различни мащаби, различни области от тях, да сравня, разбера, кое е!!! Ver.7.**

**** Преходът/границата между пикселите, минимални области „красиво“ ... „тъканта на рисунката/образа“ - да спомена че бях чел през октомври? Или май септември [2012 г.] статия на Тодор Георгиев, за някой от ефектите на Фотошоп, трансформации на Лаплас, бла-бла, а по-просто казано – (моя интерпретация) ? гладкост на градиентите, т.е. Достатъчно нисък контраст между съседните пиксели, освен ако не оформят друг елемент – частите от една линия ще имат нисък контр. Помежду си, и по-висок спрямо околностите ...

[Translation 30.5.2025:]

!!!! Drawings/pictures and photographs, different scales, different regions of them, compare, understand, which is!!!**

The transition/boundary between pixels, the minimal areas of “beautiful”... the “tissue of the drawing/image” – I should mention that I had read in September or October [2012] a paper by Todor Georgiev [a Bulgarian researcher in the Adobe Photoshop team] about some of the effects of “Photoshop”, Laplace transforms etc.; said simpler (an interpretation of mine) ? the smoothness (continuity) of the gradients, i.e. low enough contrast between adjacent pixels, except if they don’t define the shape of another element – the parts of the same line would have low contrast inside themselves and a higher contrast to their surroundings ...

Minimum Image Minimal Picture, minimal line, circle, triangle, curve, ... area, ...

My Hypothesis? Patterns are independent of memory, also for reconstruction, and for light reconstruction – no previous model needed, everything can be derived from the pure data

– Reference TILT: Rectificat.,... [12]

– Reference the techniques, “Reverse Rendering”, ... (Max Planck Institute ...)

Detection of “objects” and “beauty” independent from recognition? (Or not really, but not too dependent, i.e. without training even children can detect that an image is beautiful etc.,

³⁰ Square brackets of the Bulgarian note – from the 2012 text

³¹ I self-took/watched two Physics courses from Yale online around that time by a funny professor, originally from India

without examples. Beauty is **self-containing** (works from the **Theory of Universe and Mind, 2002-2003-2004**) Also must be compared to others, but some samples can be generated ...

Recognition – comparison between ...

Compression is [often] tuned around the *average* [possibly because it “usually works” and in order to cover broader scope and also possibly *because* of the expected Gaussian probability distribution, which usually or often is appropriate, however not in all cases so the average could be the default in general, but it is not the best for *all* dataset and environments.]. However the building blocks are available *in many samples* ... [The “average”³² could more precisely be some specific parameter, tied to particular properties of the evaluator-observer, the control-causality unit, agent, person etc.: the kind of properties related to cognitive, perceptual, experience-related, functional etc. nature, functioning, capacities etc. thus they have to be defined in a way that is detailed or explicit enough which will allow to be tracked, traced, “debugged”. This is partially done by the persons who have highly developed introspective/meta-cognitive skills.]

*** Beauty of smooth/continuous nature scenery** ... (see the cites from my work ...)

Basal ganglia brain ... cingulate gyrus – limbic system ... prediction of reward... PFC and cing. Match (blog article) reward-basal ganglia ...

[Maybe not only continuous, but having statistical and descriptive properties and features which strongly correlate or are similar to the ones in our bodies and brain and are easier to encode, and/or produce some target amount of predictability/surprise in a set of different levels/ranges/scales.]

...

Minimal Length

...

Maximal Length

...

Shepard's Tone:

Never-ending scale³³ up

Never-ending scale down

[This auditory illusion implies that brain/mind evaluates whether the sound goes up or down in a limited range, within a buffer. At more abstract levels of cognition mind understands that the scale couldn't be infinite, but it can't overcome the lower level data. It is similar with the impossible 3D objects with the visual illusions. See AGI Digest, 2012: “Chairs, Buildings, Caricatures...” [7]]

– **Several cycles of an almost-periodic function**

³² The average is one “easy” value, derived in statistics, memories, without more adjustments and choice and it seems is used. See “Chairs, Buildings, Caricatures, ...”, T.Arnaudov 2012.

³³ <https://www.youtube.com/watch?v=oeMSO6oVH-s> <https://www.youtube.com/watch?v=l6roCzKZ2ls>

//The simplest way is to count the 1s and 0s, and if the slower symbol is more frequent, inverse the values, and send just a header for the inversion + the shorter sound.

Simpler - **needs the least time to be implemented.** ... Measures ...

//...

Classical/instrumental music – low levels of abstraction (see ...) it doesn't call specific memories, and allows the high cortical areas and leaves the prefrontal cortex free for other work.

Lyrics involve higher cortical areas and occupies resources/creates, is more distractive and create more “tension” - requires more **attention**... //breaches

However, on the other hand it may cause physical associations (...)

...

Attention load ... cognitive ugliness, cognitive overload ...

It was just a few years ago³⁴ when dial-up was still common, which is more than obviously very “little”, especially apparent in current incredibly data heavy times.

[However even 3-4 KB/s still allows *quite a lot* of information and media to be transmitted in real time or a short time, even live video, even if low resolution, a frame per second, an image; streaming music et.]

The noise is worse than the narrow bandwidth. Higher frequency and low noise, within the audition capacities, allow for purer “sound texture” with less of noise. ... The lower noise might be good for better compression.

...

Lossless compression

– What's “*acceptable*” [lossless to what code, what observer which observes and evaluates what]

The author N.H. correctly remarks that *lossy* compression is well explored in visual arts. See also [Universe and Mind 4, ? ... Arnaudov, 2004,]

First of all, because ... lossless compression algorithms [in music], and the way this approach works is pretty clear (see below)

– For ones who do play musical instruments, it's obvious that most of the time the **following notes are adjacent, and it's easiest to play adjacent notes, as the virtuoso often do** while playing arpeggios. I.e. the following or precedent semi-tone or a few more steps, besides the consonance requirement, which implies very few bits for a regular note. In case of blues or other improvisations without scale change, all tones are in the same scale, and they are predictable by several runs-through.

– **Higher harmonics** of popular classical instruments – piano, organ reinforce the “pleasure”, i.e. the **matches** (see below) of **every single tone. Every single tone** is “**beautiful**”.

Other instruments, like the electric guitar with humbuckers, played with overdrive and distortion make the sound waves more complex - both harder to analyze and feel those elementary matches, and harder to compress³⁵.* However not everybody likes the sound of

³⁴ As of 2012; I used dial-up Internet at home from late 2000 to April? 2005

³⁵ The sound texture and spectrum of the electric guitar with valve amplifier is “richer”, “warmer” etc.

distorted/overdriven guitar (hard rock/metal), while some love it. There are different degrees of distortion and overdrive. I've hypothesized that this should be because of the specific sound texture.

– Drums and rhythm involve matches of predicted moments of noise or/and discontinuity/sharp changes. More drums and faster drums will cause low compression ratio for a dumb algorithm. The smart algorithm compresses down to “sheet music” and the fact that the rhythm item might be a noise pattern doesn't make it's encoding longer than of a tone, only the first record is longer. Usually music is repetitive, so the patterns are constantly being reminded.

– Sound Buffer and Working memory – should be related to the working memory capacity, which is apparently correlated to the length of sound that can be recorded and kept in the short term memory without repetitions/preparation. Repetitions in music probably extend this period.

The Length of the working memory and the speed of exporting information out from it allow for more complex compositions (see email to Anastasios, Mike Tintner, Jim ...)

– **Lyrics invoke ... associations, making the music more “ordinary”/concrete**

– .. called
.. are probably connected to the heart beating.

* However, that more complex sound pattern make the quality electric guitars sound so pleasurable to the guitarists, the cheap guitars, having bad adapters are called “dull”, “soulless”...

Integral of Beauty Over a range of Infinitesimal steps

Integral of Personality Over a (see [11] “(...) No Intrinsic Integral Self, but an Integral of Infinitesimal Local Selves” and “Analysis of the meaning of a sentence”, 2004 [21]) [time, space, range of explicit sensory data, memories, exact model of the agent/the system-of-causality-control-units/cognition etc....]

Comparison between features of different genres of music

Classical Music	Rock Music	
Piano concerto	Instrumental neoclassical rock	Analysis
	Ygnwie - “Far beyond the sky”	
No drums!	Has Drums	Noise spectrum – hard to compress by lossless computer algorithms, especially if it's overlapped with other sounds – higher frequency spectrum and

		noise (not tonal). Discontinuous. Mind – in high levels it's recognized and predicted as just a beat .
Lack of drums, slow pace - “relaxing”... - pleases many people. Rock and especially metal drums irritate many people – related to Theta rhythm? (see) ...		Discontinuity is “annoying”, it decreases compressibility. Dissonance tones/out of tune are discontinuous/unpredictable .
One-single instrument – a piano...	Electric solo guitar, rhythm guitar, bass, drums, organ	
		Speed of playing Faster playing includes more discontinuity and has higher entropy.
		(Good) Electric guitar with appropriate equipment has more complex sound than a piano , humbuckers, vibrato,
		*** Local compressibility, local memory buffer – compressibility within current memory frame ... recent time Not for the entire piece – there just must be smooth enough “gluing” elements between the minimal segments.
	Modern music uses electric guitar, which with distortion, overdrive has more complex harmonic pattern and requires higher frequency for proper representation, than classical	

	acoustic instruments.	
No voice!		
<p>Choral music – prolonged standing on the same tone, long vowels, slow pace; singing in octaves (whole number periods) – apparently that's more compressible than a song with free lyrics, where there are also many consonants (noise), more text, there are less octaves.</p> <p>Short tonal range promote higher compression.</p>	<p>Pop songs</p> <p>Highly repetitive, lyrics, text amount varies.</p> <p>Includes vocals, drums, guitars, bass, keyboards; folk instruments.</p>	<p>Human mind does not compress losslessly speech – speech is compressed as vowels/consonants, which in embodied perspective in fact is likely to be just matching vocal tract commands (Arnaudov 2004).</p> <p>Lyrics use to be repetitive – for a dumb lossless audio compression algorithm that's not helpful, but humans do predict the text and write repetitions with one sign: (2). The actual compression for humans is higher, because the apparently complex “to the ear” is “simpler to the mind” than pure tonal-instrumental segments.</p>

Naïve Analysis

In the “**Background**”, Schmidhuber's cited with an estimated amount of data that passes through an average human during his life, as $\sim 3 \times 10^9 \times 10^5$, which is states as “the demands of a film, run at reasonable resolution” which are both quite arbitrary measurements*, and the vast storage requirements for this data are

...

“This drive for intrinsic pleasure could culminate in the emergence of music and poetry for compressible sound “

Poetry – only rhymes and rhythm. Sculpture ...

Missing the Sensori-motor grounding leads to wrong interpretation of Information theory³⁶

That's a common problem (...) illustrated in this paper by the statement about an encyclopaedia as containing less information than the same body of text, built of random letters, because the first is more compressible (p.4).

While that it is true in terms of literal bytes, if the data are put in a computer

³⁶ [or in the interpretation of mine]

memory³⁷, the encyclopedia **refers** to and is **grounded** on sensory data - that's why it sounds and is perceived as meaningful, there are **matches with the observer's knowledge and models**, [which actually contain, represent, code, decode, interpret etc. the apparently compressed information which without the evaluator is meaningless; the information is *converted* into another representation which is not taken into account when calculating the total information³⁸] – while a random set of letters doesn't just have higher entropy, it **doesn't match the observer expectations, including ones external to the encyclopedia, which are based on previous experiences. The random letters don't lead to anything** [and if their content doesn't lead to some “wanted”, “useful” consequences in an evaluated period or range] their information content is zero and they don't have to be stored, the evaluator can't and *doesn't remember anything* besides a label.

Often in such superficial analysis, the evaluators don't take into account that the reader of the encyclopedia is 18-20-30-40-50 years old, and don't take into account the complexity of the reader's brain that makes the evaluation, and the complexity of the system that created computers and started to compress data that way. (See also 2001, 2002, 2003, 2004 ,... emails) For Universal measures, in the so called “machine language of Universe”, there are no letters, and no compression, an encyclopedia and the same amount of symbols all have the same amount of information and entropy. [If a specific evaluator-observer is measured, then its complexity should also be included in the calculation and the model. For “completely random noise” for an observer, where the distribution can only be recognized and classified among say a set of a few options after each few samples, like “white noise, pink noise, silence, tone, loud, silent” etc., an actual “meaningful” information for “general observer” could be just the amount required for describing this very set: just a few bits, and the length of the total transmission doesn't matter as the interpretation is reset on each one or few samples and there's no memory.]³⁹ (...)

Integral of the compression

15:41 ч. 29.11.2012 г.

➔ Paper ...

See the PS. for an explanation why my decade-old⁴⁰ insights are not acknowledged in the mainstream publications (yet), however they do include claims that arts and science and technical fields are driven by the same simple systematic cognitive forces, namely: **maximizing prediction and causation accuracy, span and resolution, and creativity as making predictability of the underlying algorithm that has generated the piece of art harder for an external "average" (non-creative) observer.** I.e. the observers cannot see and understand precisely enough (as of their expectation of the precision they should be capable of understand, in order to accept something as "non-creative". That was kind of

³⁷ [and for each bit, byte or code word, observed of itself alone or only at each statistical event, disconnected or impossible to form to a bigger whole and repetition which will imply patterns and compression; just unpredictable from a given evaluator-observer “random distribution”].

³⁸ See also [21][22] Arnaudov 2001, 2025. Efficiency and optimization may actually be a *universal fraud*.

³⁹As of a possible criticism regarding not showing the usual formulas about entropy, surprise etc. – see notes in the end.

⁴⁰ [at the time, 2012]

obvious to me, being a polymath and having no trouble with any kind of cognitive activity, both science, technical or art.

Compression, besides saving cognitive resources as you discuss, is a by-effect of being able to predict, i.e. to find *matches* within inputs, and then encode by some sort of a shorter address, instead of copying literally - in the most basic case. That happens both spatially between a current piece (so it doesn't need detailed analysis/pass thoroughly), and temporal - between past, current and future. Matches mean some sort of repetitions.

My works mention also symmetry as an example of this, it contains self-affirming repetitions, or portions of the input which can be produced by very simple operations over another portion, where very simple means that can be encoded in the shortest possible code. That also goes about music - that it's predictable, the rhythm, the notes in the scale, and we like it because it's predictable.

I used terms like "richness of information" which is required for something that has patterns not to be boring (that's the balance), and the more original authors/artists (or any minds, that goes for science, maths, inventions) do create pieces which are harder to predict by an average observer given the previous data in the piece (compression progress, see the pictures below), than the pieces produced by the mediocre authors. In general the authors have higher prediction capabilities than the art appreciators, but as Schmidhuber has also discussed, the art piece should have a sort of recognizable structure (to be compressed and predictable). Another important factor is of course the cognitive capacity of the art appreciator - a given art piece might be too complex for one, or too simple for another one.

I also agree with your remark regarding that while the compression is related to the cognitive aspect of aesthetics, there are also non-cognitive components of appreciation and of the demonstration of appreciation of a piece of art or of any sensory "piece"/record (a piece of art is just a record that's presented to sensory inputs, even if it's an interactive one). I call those other sources of pleasure "physical", they are related to the "basic drives".

In my model's dichotomy there are two main kinds of "pleasure" or rewards, or motivators, which are working all the way from the very low level up to the highest level, if humans are considered as a whole integrated system (in my theory there's no true integral self). In brain these systems are messed up and often confused (and they are not just two, but more), that's why people use to call "beautiful" some stimuli which are just pleasant.

Of course, there are coincidences of physical and cognitive pleasure, which make the effect stronger, such as a beautiful naked woman, or a beautifully prepared delicious serving, or a beautiful music with a beautiful naked women, doing strip-tease in front of a beautifully prepared delicious servings, around beautiful place on a beautiful beach etc.

In my theory both are about match but there's a slight difference:

- The physical rewards represent a match between what mind or, in my theory, a "causality-control unit" wants to feel and what it actually feels.

(Actually it's related to association with appropriate neurotransmitters, and the negative ones are related to their lack and the presence of other neurotransmitters and hormones, associated with "bad feelings".)

- In the cognitive case, the one which you consider in your work too, in my most concise definition the reward comes from correct prediction - the match between what mind or a virtual smaller-scale functional unit predicts that it will perceive, and the real input that

actually comes later.

I.e. the physical reward has preset "hardwired" values, while cognitive rewards is only about data.

Notice that this process is hierarchical/heterarchical, there are many levels of predictions, with different range and precision/resolution/terms, and digested matches from the lower level are like raw sensory inputs for the higher level.

The compression is actually prediction, it allows to react beforehand and take an advantage over the environment, and it also puts less of a strain to the brain ("releases the tension" as in one of your cites, it's also a cite from works of mine) - that's the cognitive pleasure, I agree with your point.

In my theory, the cognitive displeasure from the "uglyness" is caused by the cognitive overload - the impossibility to predict (compress) future parts of the input, using past, to a certain expected degree, forces brain to work at full power and still being confused. (Again, there are non-cognitive forces for displeasure, which are associations/conditions to physical experiences - disgust, bad smells, fear (adrenaline/cortisol), these are gut feelings, something Damasio has discussed)

9/12/2012

Pop-music, concerts

Wrongly found ...

The public is not moved by the *music* or by the particular *performer*, but by the levels of dopamine, adrenaline etc.

A: Jimmy Hendrix ... the best guitarists ...

T: One of the best in his time, there were better guitarists.

X: Pfff, Something playing fast or ... is not a great musician. It's just someone who plays well. It's important to make people feel emotions. I may enjoy listening to something very simple. I don't care that he's ... Solo that doesn't sound good ... [I've heard this opinion personally.]

X: I go to кyфeя, ... [~ rock and roll, to have fun by demonstrating it, scream, shake head ...]

T: ...

That "kuffeene" is about the euphoria – "dopamine", ... feeling, it's not the [aesthetical, cognitive, "complex" part of art]

– Why "The Rolling Stones" or "The Beatles" were among the greatest rock bands? Because they were the best musicians, wrote the best music?

No, they were **British**. They were the most popular in one of the most **powerful countries** in the world, which by the time had the most powerful media, helped by another most powerful country – **USA**, which spoke the same language.

All the "best" bands in rock and pop music use to be from the major English-speaking countries: UK, USA, Australia, Canada. And I'm sorry, but that's not because the performance from the other countries are less talented.

[**Note 26.5.2025**: One ones made a provocative remark in an Internet community on a topic about “Beatles”, that they were like “chalga” in a forum and he was vigourously attacked and misunderstood. “Chalga” is a term which in Bulgaria is used for a range of pop-folk or folk-like music from the Balkan region and the near countries such as Turkey. For the “highly encultured” listeners, fans of the pop, rock and in general **western** music, it is of “low culture”, often overly sexual etc. In fact the difference of the western, popular music is in the instruments, rhythm, some of the melodies, language etc., but the messages are often the same. The disco from the 80s and early 90s, especially the “sexual” one of artists like Samantha Fox and Sabrina is similar to the 1990s-2000s “pop-folk” in Bulgaria. However some “aboriginal” people, singing something **in English**, or playing it with particular instruments etc. makes it of “high culture”, while they see their own culture as “one of peasants”, “archaic”, “primitive” etc. and they are disgusted by it. This phenomenon is discussed among others in the book:

* **“What Man Needs? If you play by the rules, you’ll lose like the fools! Part I”**, Todor Arnaudov, 2014 (published in Bulgarian:

* **Какво му трябва на човек? Играеш ли по правилата, ще загубиш играта! Част I**, Тодор Арнаудов, сп. Разумир бр. 1]

...

Appendix

[**More notes and a “Rant” about the injustice regarding the non-funded researchers who preceded the works of the official academic publications but don’t get acknowledgment and support**]

... made in 2003's interdisciplinary work [Arnaudov 2003], ...

Generalizing cognitive hierarchies, also known as sensori-motor generalizing, which is proclaimed by Jeff Hawkins, Boris Kazachenko, Todor Arnaudov, ... DeSTINm, ... What the author of that faulty novel paper vaguely call “*complex to the ear, but simple to the mind*” is related to what the sensori-motor generalizing school calls “higher level of abstraction” .

While there are literally matches to the work of mine, I wrote mine when I was an 18 year old high-school student, and did it very quickly like a joke, “by-the-way”, without referring to piles of other works – it is not needed, the beauty of music and art and science is in art and music and science and in our brains, it's always available. And I am a polymath and the linkage art-science has been always obvious to me, unlike for the average nerdy science-type, or the “arty” musical type, who sees science are profoundly boring.

Now that I revise that funded and “highly academic” paper, which restates stuff that's stated years earlier, and just adds a few lines to a bunch of other papers, I see that my generalizations and hypotheses, and respectively those of the Australian scholar need to be specified with much more care and detail. ... Cognitive and Physycal Pleasure.

About the Author and Experiment Settings and Prerequisites [2012]

Artist, ... [amateur] “musician”, ... researchers, ... It does matter, compared to an “ordinary” researcher, who sees art as “mystery”, because they can't draw a hand or a face, or can't play by ear 5 consecutive tones on a keyboard or a piano. No, that's not a mystery – just the ones who cannot do it ... lack the appropriate capacities.

To the author the match between art and science is more than obvious. It was explained in his early works and is demonstrated by the nature of his “polymathicity”. ... Academia funding

How much a normal researcher cost in Australia, UK, or USA? \$30-40000 a year net salary minimum? Plus conferences, plus money to buy articles and journals, plus grants to hire other people. Plus the expenses for the cited researcher's, which are the main basis for such “contributive” works.

What's the efficacy of that system, if a schoolboy was 7-8 years ahead, didn't have to use none of those references, because pure observations were fairly enough – it's all obvious.

And what's the fairness of that system, when it's not supposed to acknowledge people who produced similar results with no funding, no acknowledgement, no support, so many years earlier, and are apparently vastly superior in their overall cognitive capacity?

You are sick, guys! Hopefully the thinking machines are coming, and when a 5-years old PC will become a better researcher than most of those ingenious contributors to science, those unjustified piles of money for doing pseudo contributions will be over. © + ...

[Note, 26.5.2025: It is not intended to offend anyone *personally*, the funded researchers are doing their job – however researchers like me should also be acknowledged and be supported – the “systems” should find a way – and we are actually more efficient, but we don't “feed the system” and the ones who perhaps really profit from it. The prediction of the **“5-years old PC that's a better researcher”** (if it works stand-alone) or even decades old one, connected to the AI services, is somewhat a reality in the last years. See also a related prediction work from 2013 about the Creativity. See also “The First AGI Strategy ...” and the concept of the “Singularity of Tosh” [2] regarding the efficiency and the publications from 2013, not long after the writing of this work in late 2012, such as “Issues in AGIRI AGI email list ...” [25]]

[Note 2: If you are a *self-propelled, self-driven* researcher even without getting grants, out of an institution, you'll get paid **only** if you provide *real products*, which are better than the funded and incorporated competition, for which people, customers, donators *are willing to pay for*. On the other hand, an researchers in institutes would get thousands of dollars a month + grants, even just for theoretical work or one requiring a lot of other investments before being practical; precisely for pedantry such as adding cites and inventing meaningless measures that will pass a review process, will have cosmic budget to buy articles and subscribe to journals, even if the work contributes ideas which were there a decade earlier, or if it doesn't contribute nothing, but is just accepted by a bunch of other institutionalized researchers who mutually keep each other within the system.

Another specific case for “more rant” about the unjust and *inefficient* distribution to resources, where the true pioneers receive nothing and 20 years later newcomer “visionaries” take all, is covered in the book about the first AGI/AI strategy and the “Bulgarian

Prophecies”, published at SIGI-2025. [2] (...)]

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Jack of All Trades, Master of All Trades and Вседържец (Vsehduhrzhets), it may eventually cover also Pravetz-8D (Oric Atmos), another 6502-based PC. “Vsy” is the AGI infrastructure of the Sacred Computer <https://github.com/Twenkid/Vsy-Jack-Of-All-Trades-AGI-Bulgarian-Internet-Archive-And-Search-Engine> (The main project was announced on 10.9.2022). The Vsy8bit already had several “milestone” initial developments such as managing to interop the 6502 and Z80 without CP/M in pure machine code on 24.5.2025. The project from the Vsy8bit are still not published but possibly some first applications will be presented soon, such as VRT-2: Video in Real Time 2 (an accelerated and improved version of the original from late 1998); examples for the 6502-Z80 inter-operation etc. <https://github.com/Twenkid/Vsy-8bit> (private as of 10-6-2025)

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