

DYNAMICKÁ VIAC POHĽADOVÁ VIZUALIZÁCIA KLASICKEJ HUDBY S VYUŽITÍM ANALYTICKÝCH METADÁT

MAXIMILIÁN M. KROŠLÁK

ŠKOLITEĽ: DOC RNDR. ANDREJ FERKO, PHD.

VIZUALIZÁCIA

- TECHNIKA GRAFICKÉHO ZOBRAZENIA INFORMÁCIE ALEBO DÁT
- TRANSFORMUJE SYMBOLICKÚ NOTÁCIU NA GEOMETRICKÚ A FAREBNÚ
- SLUŽI AKO KOGNITÍVNY ZOSILŇOVAČ PRE SCHOPNOŠŤ ĽUDSKÉHO VIZUÁLNEHO SYSTÉMU SPRACOVAŤ A ODVODIŤ VÝZNAMY Z VIZUÁLNYCH VZOROV
- ĽUDSKÝ MOZOG VIE EFEKTÍVNE SPRACOVÁVAŤ VIZUÁLNE INFORMÁCIE

TYPY VIZUALIZÁCIÍ

- STATICKÉ - GRAFY, TABUĽKY
- DYNAMICKÉ – MAPA TEPLoty, VETRA

VIZUALIZÁCIA HUDBY

- SYNESTÉZIA – JAV VNÍMANIA PODNETU ZMYSLOM, NA KTORÝ PODNET NEPÔSOBÍ
- MAPOVANIE NÔT NA FARBY

The Color of Sound

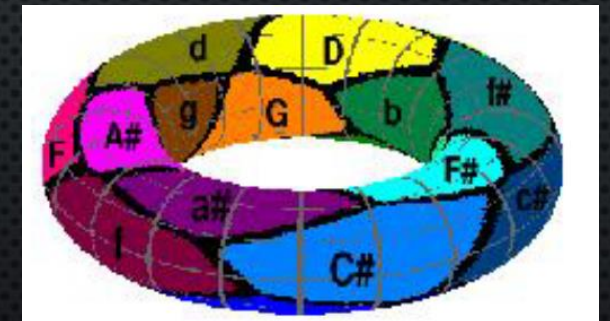
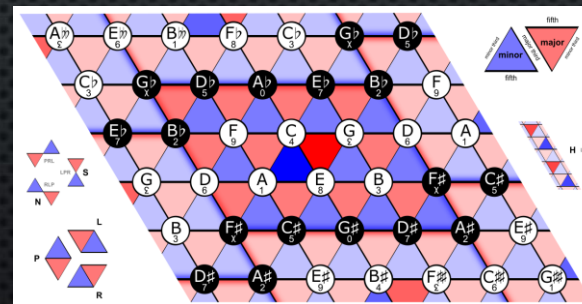
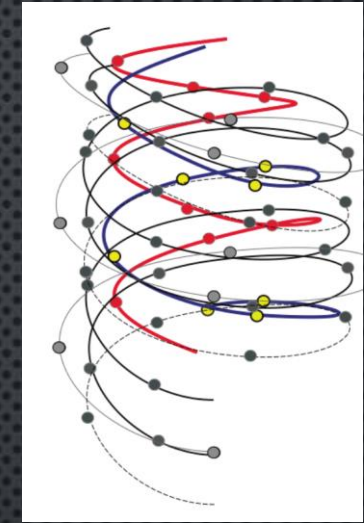
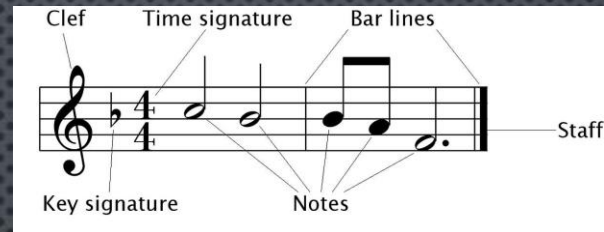
| Sound | | Frequency (Hz) | 349.2 | 370.0 | 392.0 | 415.3 | 440.0 | 466.2 | 493.9 | 523.2 | 554.4 | 587.3 | 622.2 | 659.3 | 698.5 | |
|------------|--|-----------------|----------------------|--|----------------------|--|----------------------|--|----------------------|----------------------|--|----------------------|--|----------------------|----------------------|------------------------------|
| | | Wavelength (cm) | 98.88 | 93.33 | 88.09 | 83.15 | 78.48 | 74.07 | 69.92 | 65.99 | 62.29 | 58.79 | 55.49 | 52.38 | 49.44 | |
| | | | F₄ | F[#] G_b | G₄ | G[#] A_b | A₄ | A[#] B_b | B₄ | C₅ | C[#] D_b | D₅ | D[#] E_b | E₅ | F₅ | F_{4&5}** |
| | | | | | | | | | | | | | | | | |
| Light | | Frequency (THz) | 384.0 | 406.8 | 431.0 | 456.6 | 483.8 | 512.5 | 543.0 | 575.3 | 609.5 | 645.8 | 684.2 | 724.9 | 768.0 | |
| | | Wavelength (nm) | 780.8 | 736.9 | 695.6 | 656.5 | 619.7 | 584.9 | 552.1 | 521.1 | 491.8 | 464.2 | 438.2 | 413.6 | 390.4 | |
| RGB | | Dec/Hex | Red 82/52 | 116/74 | 179/b3 | 238/ee | 255/ff | 255/ff | 153/99 | 40/28 | 0/00 | 0/00 | 5/05 | 69/45 | 87/57 | 85/55 |
| | | | Green 0/00 | 0/00 | 0/00 | 0/00 | 99/63 | 236/ec | 255/ff | 255/ff | 255/ff | 124/7c | 0/00 | 0/00 | 0/00 | 0/00 |
| | | | Blue 0/00 | 0/00 | 0/00 | 0/00 | 0/00 | 0/00 | 0/00 | 0/00 | 232/e8 | 255/ff | 255/ff | 234/ea | 158/9e | 79/4f |
| CMY | | Dec | Cyan 173 | 139 | 76 | 17 | 0 | 0 | 102 | 215 | 255 | 255 | 250 | 186 | 168 | 170 |
| | | | Magenta 255 | 255 | 255 | 255 | 156 | 19 | 0 | 0 | 0 | 131 | 255 | 255 | 255 | 255 |
| | | | Yellow 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 23 | 0 | 0 | 21 | 97 | 176 |
| CMYK | | Dec% | Cyan 53 | 40 | 11 | 1 | 0 | 3 | 54 | 80 | 69 | 98 | 99 | 99 | 92 | 73 |
| | | | Magenta 98 | 100 | 100 | 100 | 82 | 8 | 0 | 0 | 0 | 64 | 96 | 95 | 94 | 100 |
| | | | Yellow 96 | 98 | 96 | 95 | 96 | 94 | 98 | 100 | 42 | 0 | 0 | 0 | 0 | 20 |
| | | | Black 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| HSB (HSV) | | Degrees | Hue 0 | 0 | 0 | 0 | 23 | 56 | 84 | 111 | 175 | 211 | 241 | 258 | 273 | 304 |
| | | Dec% | Sat. 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | | Brightness 32 | 45 | 70 | 93 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 92 | 62 | 33 |
| YIQ (NTSC) | | Dec | Luma 25 | 35 | 54 | 71 | 134 | 215 | 195 | 162 | 176 | 102 | 31 | 47 | 44 | 34 |
| | | | In-phase 124 | 135 | 153 | 171 | 162 | 144 | 111 | 77 | 28 | 42 | 60 | 83 | 100 | 113 |
| | | | Quadrature 109 | 112 | 119 | 125 | 101 | 65 | 49 | 38 | 70 | 107 | 140 | 144 | 134 | 121 |

**The F_{4&5} column provides a combination of the F₄ and F₅ colors. This is useful when a cyclic display of colors is needed, to avoid a jump in color between F and F#.

This chart was developed by Nicolas Melendez and Clint Goss. See www.Flutopedia.com/sound_color.htm for more info. Updated: August 20, 2016

ČO VIEME VIZUALIZOVAŤ V HUDBE

- NOTY
- VÝŠKY
- TEMPO
- HARMÓNIA (VZŤAHY MEDZI TÓNMI)
- AKORDY
- TÓNY
- ...

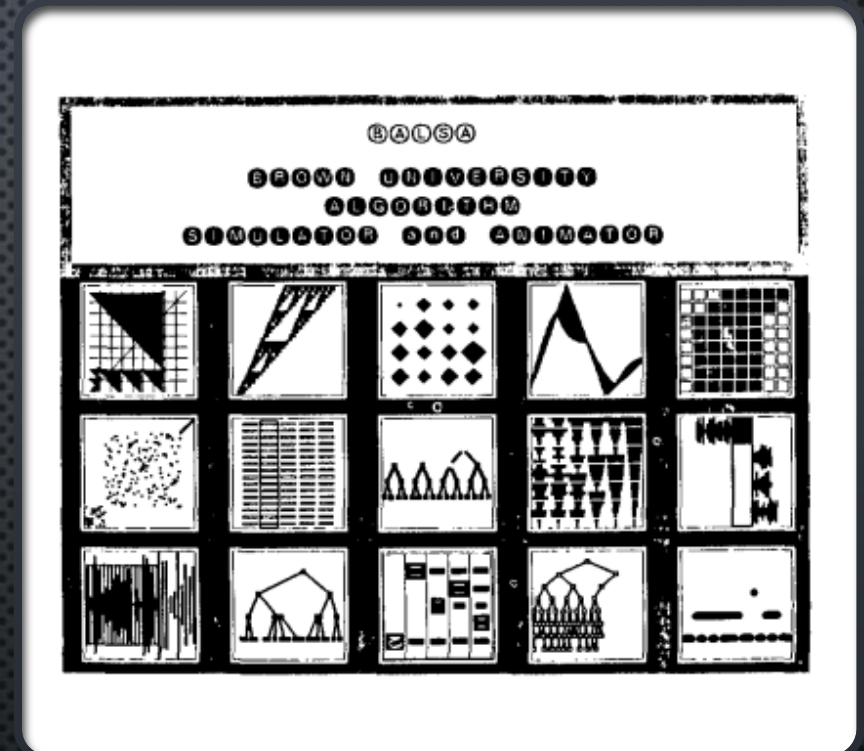


MIDI

- MUSICAL INSTRUMENT DIGITAL INTERFACE
- KÓDOVANIE HUDBY
- ZJEDNOTIL KOMUNIKÁCIE RÔZNYCH DIGITÁLNYCH HUDOBNÝCH NÁSTROJOV
- SÚBOR NEOBSAHUJE AUDIO ALE MIDI EVENT-Y
- NOTE ON/ OFF, KANÁL, NOTA, INTENZITA, TEMPO

BROWN

- Balsa (Brown Algorithm Simulator and Animator)
- Viac pohľadová vizualizácia algoritmov
- Používateľské rozhranie



BLENDER

- SOFTWARE NA TVORBU 3D GRAFIKY, ANIMÁCIÍ, MODELOVANIE, ...
- OPEN-SOURCE



ANIMATION NODES

- ADD-ON
- PROGRAMOVANIE ZALOŽENÉ NA UZLOCH (NODE-BASED PROGRAMMING)
- UZOL – FUNKCIONALITA
- SPOJENÉ HRANOU – TOK DÁT MEDZI UZLAMI

VSTUP A VÝSTUP

- VSTUP:
 - .MID SÚBOR
 - KLAVÍR
- VÝSTUP:
 - VIZUALIZÁCIA V BLENDER

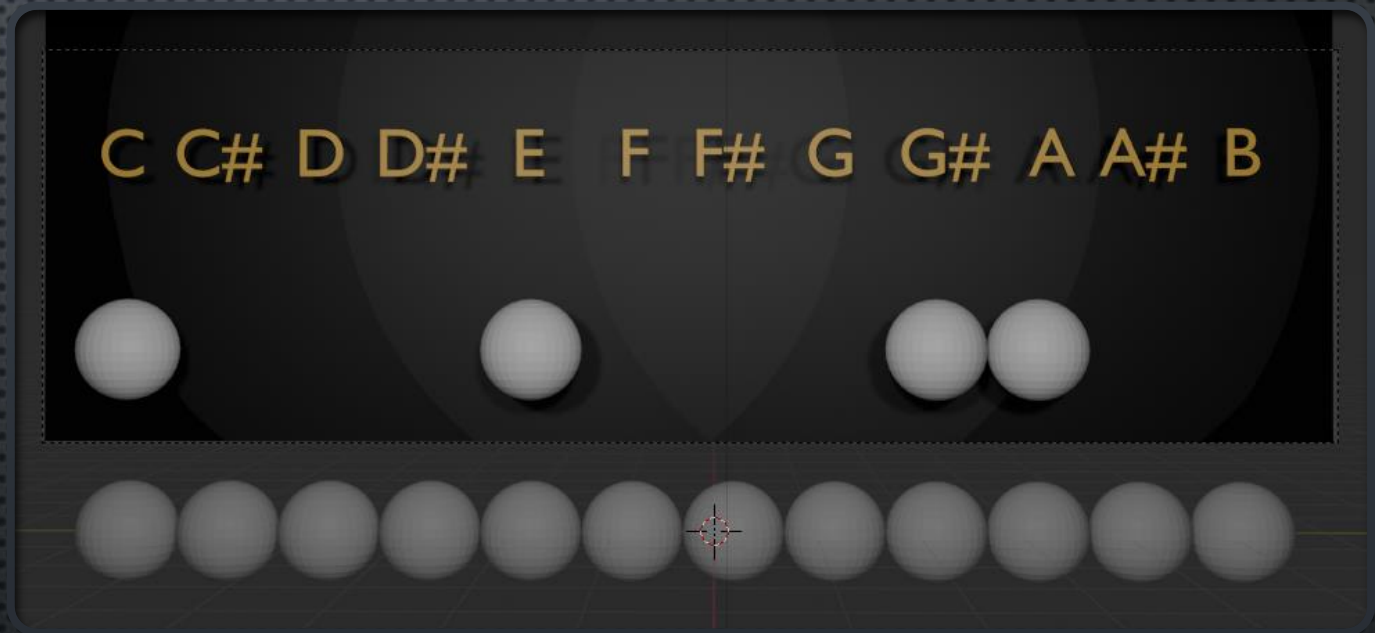
MIDI KEYBOARD

- IMPLEMENTOVANÉ POMOCOU ANIMATION NODES
- 128 KLÁVES (MIDI KÓDOVANIE)



NOTY

- ANIMATION NOTES
- BLENDER PYTHON



MIDI SÚBOR

- PYTHON

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Track 0: Track 0
Track 1: Für Elise
Note 76 | velocity 71 | tempo: 960 | time: 0.86 seconds | frame: 20 => Midi message: (note_on channel=0 note=76 velocity=71 time=960)
Note 75 | velocity 38 | tempo: 0 | time: 1.07 seconds | frame: 25 => Midi message: (note_on channel=0 note=75 velocity=38 time=0)
Note 76 | velocity 57 | tempo: 0 | time: 1.29 seconds | frame: 30 => Midi message: (note_on channel=0 note=76 velocity=57 time=0)
Note 75 | velocity 70 | tempo: 0 | time: 1.50 seconds | frame: 36 => Midi message: (note_on channel=0 note=75 velocity=70 time=0)
Note 76 | velocity 76 | tempo: 0 | time: 1.71 seconds | frame: 41 => Midi message: (note_on channel=0 note=76 velocity=76 time=0)
Note 71 | velocity 76 | tempo: 0 | time: 1.93 seconds | frame: 46 => Midi message: (note_on channel=0 note=71 velocity=76 time=0)
Note 74 | velocity 76 | tempo: 0 | time: 2.14 seconds | frame: 51 => Midi message: (note_on channel=0 note=74 velocity=76 time=0)
Note 72 | velocity 83 | tempo: 0 | time: 2.36 seconds | frame: 56 => Midi message: (note_on channel=0 note=72 velocity=83 time=0)
Note 69 | velocity 89 | tempo: 0 | time: 2.57 seconds | frame: 61 => Midi message: (note_on channel=0 note=69 velocity=89 time=0)
Note 45 | velocity 64 | tempo: 0 | time: 2.57 seconds | frame: 61 => Midi message: (note_on channel=0 note=45 velocity=64 time=0)
Note 52 | velocity 64 | tempo: 0 | time: 2.79 seconds | frame: 66 => Midi message: (note_on channel=0 note=52 velocity=64 time=0)
Note 57 | velocity 70 | tempo: 0 | time: 3.00 seconds | frame: 72 => Midi message: (note_on channel=0 note=57 velocity=70 time=0)
Note 60 | velocity 76 | tempo: 0 | time: 3.21 seconds | frame: 77 => Midi message: (note_on channel=0 note=60 velocity=76 time=0)
Note 64 | velocity 76 | tempo: 0 | time: 3.43 seconds | frame: 82 => Midi message: (note_on channel=0 note=64 velocity=76 time=0)
Note 69 | velocity 76 | tempo: 0 | time: 3.64 seconds | frame: 87 => Midi message: (note_on channel=0 note=69 velocity=76 time=0)
Note 71 | velocity 83 | tempo: 0 | time: 3.86 seconds | frame: 92 => Midi message: (note_on channel=0 note=71 velocity=83 time=0)
Note 40 | velocity 64 | tempo: 0 | time: 3.86 seconds | frame: 92 => Midi message: (note_on channel=0 note=40 velocity=64 time=0)
Note 52 | velocity 64 | tempo: 0 | time: 4.07 seconds | frame: 97 => Midi message: (note_on channel=0 note=52 velocity=64 time=0)
Note 56 | velocity 70 | tempo: 0 | time: 4.29 seconds | frame: 102 => Midi message: (note_on channel=0 note=56 velocity=70 time=0)
Note 64 | velocity 76 | tempo: 0 | time: 4.50 seconds | frame: 108 => Midi message: (note_on channel=0 note=64 velocity=76 time=0)
Note 68 | velocity 76 | tempo: 0 | time: 4.71 seconds | frame: 113 => Midi message: (note_on channel=0 note=68 velocity=76 time=0)
Note 71 | velocity 76 | tempo: 0 | time: 4.93 seconds | frame: 118 => Midi message: (note_on channel=0 note=71 velocity=76 time=0)
Note 72 | velocity 83 | tempo: 0 | time: 5.14 seconds | frame: 123 => Midi message: (note_on channel=0 note=72 velocity=83 time=0)
Note 45 | velocity 64 | tempo: 0 | time: 5.14 seconds | frame: 123 => Midi message: (note_on channel=0 note=45 velocity=64 time=0)
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PLÁNY DO BUDÚCNA

- IMPLEMENTOVAŤ DO VIAC POHĽADOVOSTI
- SPRAVIŤ MIDI ANALYZÁTOR
- PREROBIŤ HOTOVÉ VIZUALIZÁCIE POMOCOU BLENDER PYTHON
- DOIMPLEMENTOVAŤ SPOMENUTÉ VIZUALIZÁCIE



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Track 0: Track 0
Track 1: Für Elise
Note 76 | velocity 71 | tempo: 0 | time: 0.86 seconds | frame: 20 => Midi message: (note_on channel=0 note=76 velocity=71 time=960)
Note 75 | velocity 38 | tempo: 0 | time: 1.07 seconds | frame: 25 => Midi message: (note_on channel=0 note=75 velocity=38 time=0)
Note 76 | velocity 57 | tempo: 0 | time: 1.29 seconds | frame: 30 => Midi message: (note_on channel=0 note=76 velocity=57 time=0)
Note 75 | velocity 70 | tempo: 0 | time: 1.58 seconds | frame: 36 => Midi message: (note_on channel=0 note=75 velocity=70 time=0)
Note 76 | velocity 76 | tempo: 0 | time: 1.71 seconds | frame: 41 => Midi message: (note_on channel=0 note=76 velocity=76 time=0)
Note 71 | velocity 76 | tempo: 0 | time: 1.93 seconds | frame: 46 => Midi message: (note_on channel=0 note=71 velocity=76 time=0)
Note 74 | velocity 76 | tempo: 0 | time: 2.14 seconds | frame: 51 => Midi message: (note_on channel=0 note=74 velocity=76 time=0)
Note 72 | velocity 83 | tempo: 0 | time: 2.36 seconds | frame: 56 => Midi message: (note_on channel=0 note=72 velocity=83 time=0)
Note 69 | velocity 69 | tempo: 0 | time: 2.57 seconds | frame: 61 => Midi message: (note_on channel=0 note=69 velocity=69 time=0)
Note 45 | velocity 64 | tempo: 0 | time: 2.97 seconds | frame: 61 => Midi message: (note_on channel=0 note=45 velocity=64 time=0)
Note 52 | velocity 64 | tempo: 0 | time: 2.79 seconds | frame: 66 => Midi message: (note_on channel=0 note=52 velocity=64 time=0)
Note 57 | velocity 70 | tempo: 0 | time: 3.08 seconds | frame: 72 => Midi message: (note_on channel=0 note=57 velocity=70 time=0)
Note 68 | velocity 76 | tempo: 0 | time: 3.21 seconds | frame: 77 => Midi message: (note_on channel=0 note=68 velocity=76 time=0)
Note 64 | velocity 76 | tempo: 0 | time: 3.43 seconds | frame: 82 => Midi message: (note_on channel=0 note=64 velocity=76 time=0)
Note 71 | velocity 83 | tempo: 0 | time: 3.86 seconds | frame: 92 => Midi message: (note_on channel=0 note=71 velocity=83 time=0)
Note 48 | velocity 64 | tempo: 0 | time: 3.86 seconds | frame: 92 => Midi message: (note_on channel=0 note=48 velocity=64 time=0)
Note 52 | velocity 64 | tempo: 0 | time: 4.07 seconds | frame: 97 => Midi message: (note_on channel=0 note=52 velocity=64 time=0)
Note 56 | velocity 70 | tempo: 0 | time: 4.29 seconds | frame: 102 => Midi message: (note_on channel=0 note=56 velocity=70 time=0)
Note 64 | velocity 76 | tempo: 0 | time: 4.58 seconds | frame: 108 => Midi message: (note_on channel=0 note=64 velocity=76 time=0)
Note 68 | velocity 76 | tempo: 0 | time: 4.71 seconds | frame: 113 => Midi message: (note_on channel=0 note=68 velocity=76 time=0)
Note 71 | velocity 76 | tempo: 0 | time: 4.93 seconds | frame: 118 => Midi message: (note_on channel=0 note=71 velocity=76 time=0)
Note 72 | velocity 83 | tempo: 0 | time: 5.14 seconds | frame: 123 => Midi message: (note_on channel=0 note=72 velocity=83 time=0)
Note 45 | velocity 64 | tempo: 0 | time: 5.14 seconds | frame: 123 => Midi message: (note_on channel=0 note=45 velocity=64 time=0)

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