TNM113 - PROCEDURELL LJUDDESIGN FÖR ANVÄNDARGRÄNSSNITT

SONIFIERING

UTMANINGAR FÖR DEN

VISUELLA PERCEPTIONEN

(ABB)

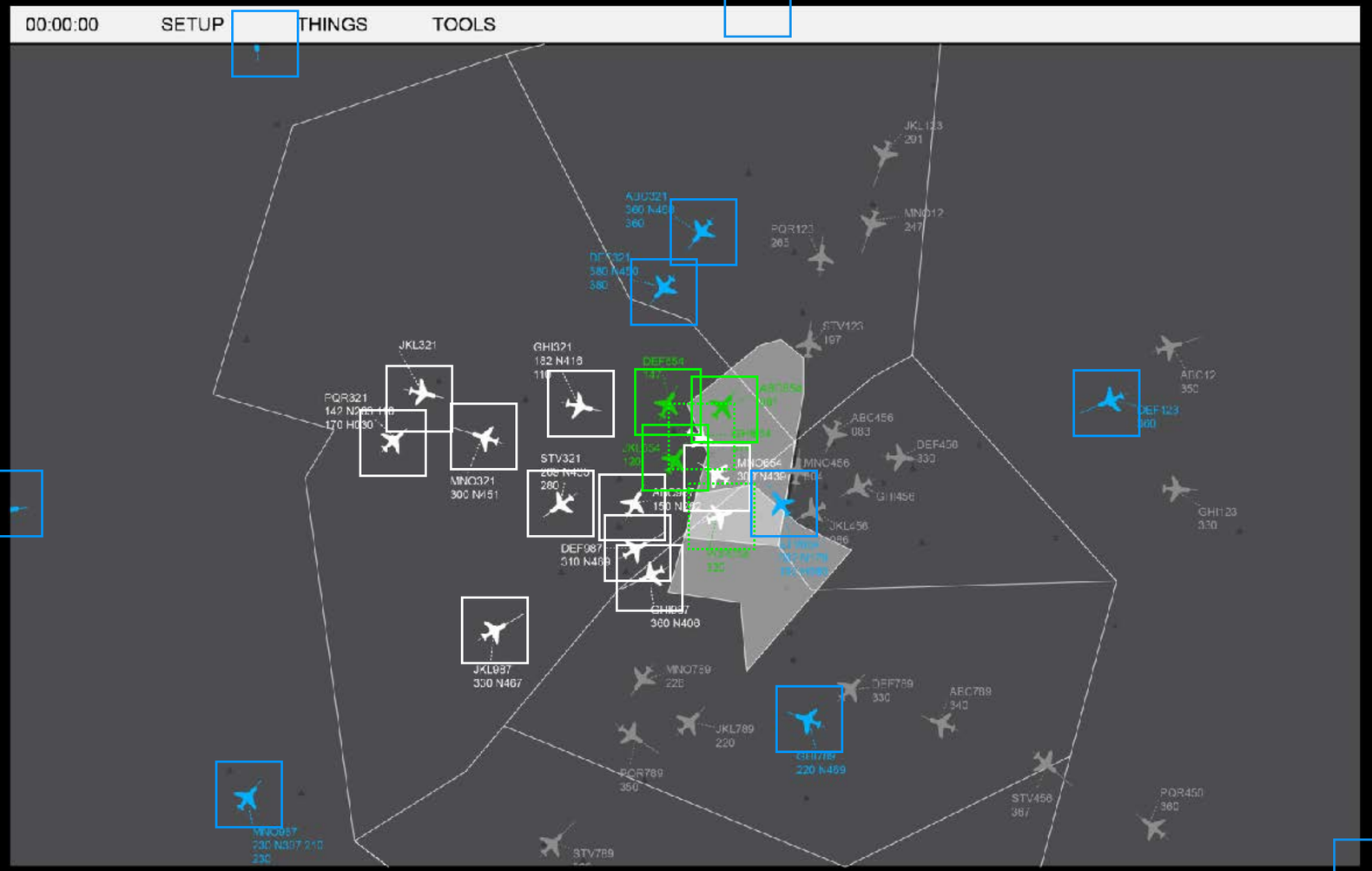
UTMANINGAR FÖR DEN

VISUELLA PERCEPTIONEN

(LFV)

UTMANINGAR FÖR DEN

VISUELLA PERCEPTIONEN



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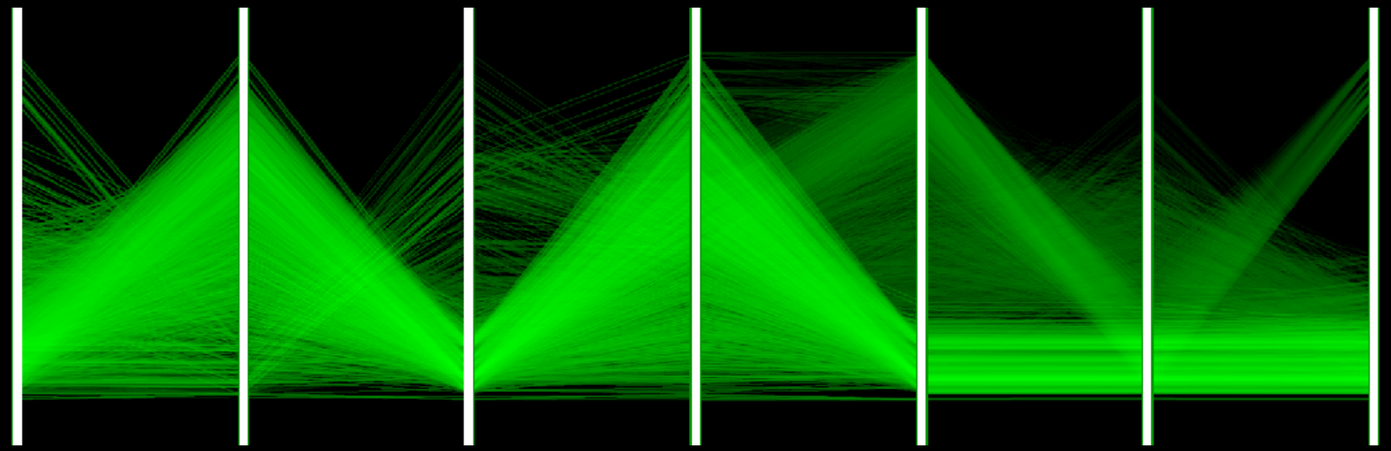
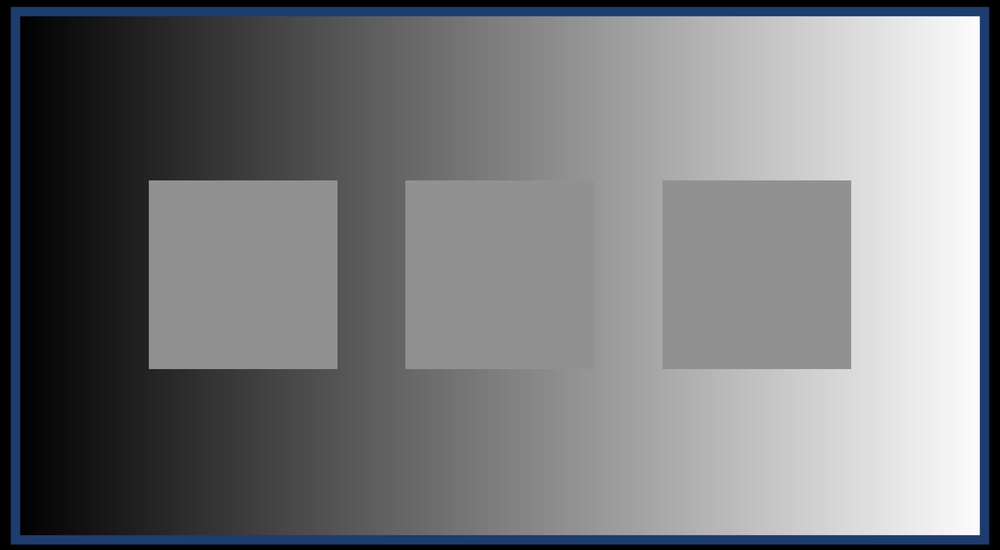


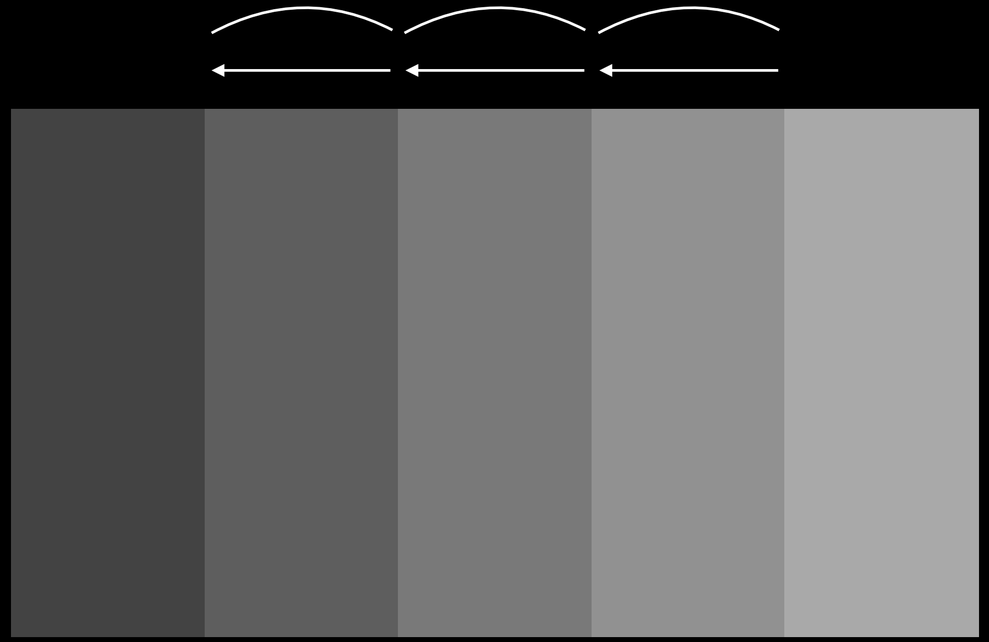
UTMANINGAR FÖR DEN VISUELLA PERCEPTIONEN

BRIGHTNESS CONTRAST



UTMANINGAR FÖR DEN VISUELLA PERCEPTIONEN

MACH BAND



VAD ÄR

SONIFIERING?

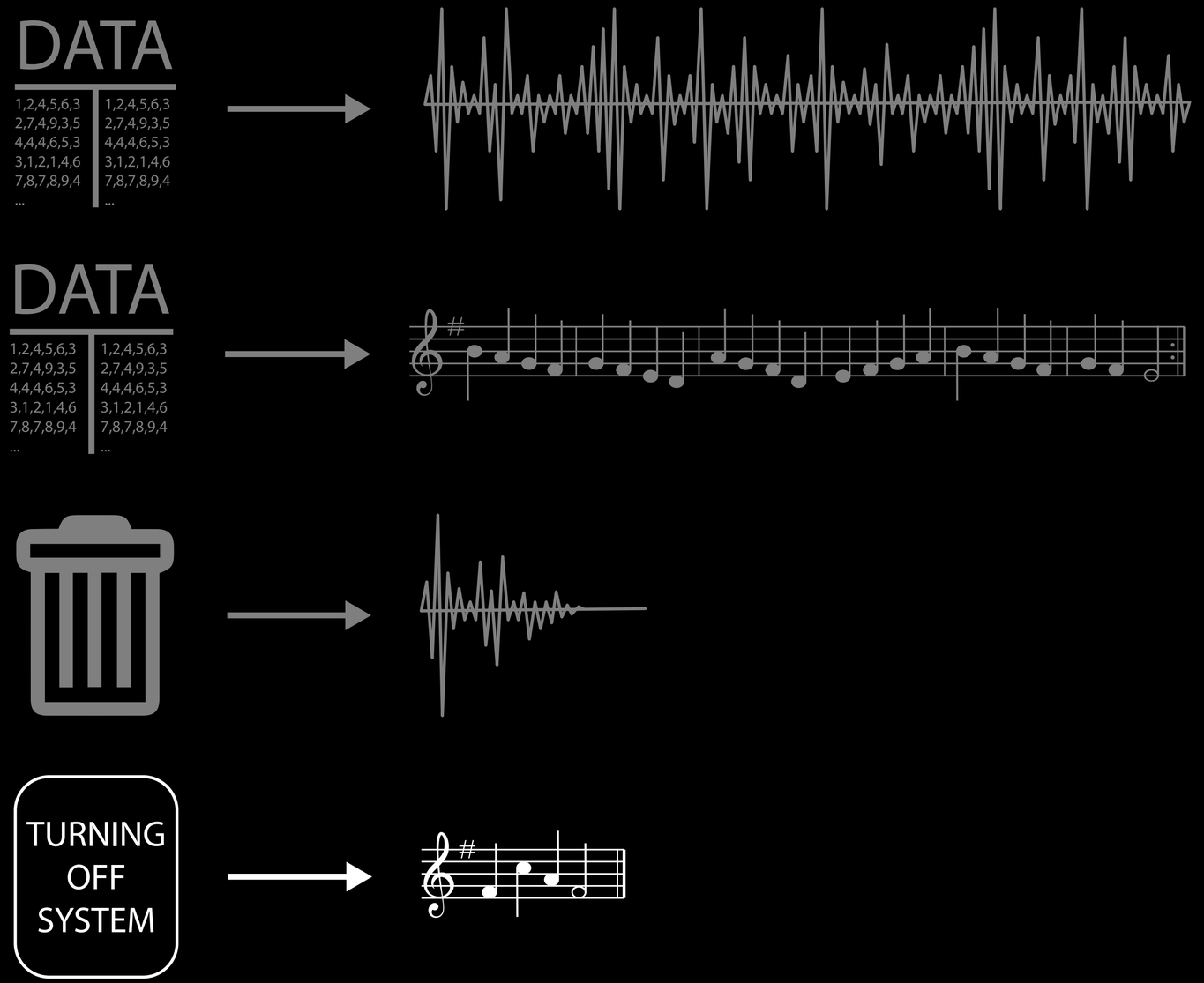
- Sonifiering innebär att man lägger till ljud till någonting
- En till modalitet läggs till
- Som ger mer information
- För att
  - underlätta det visuella
  - förbättra förståelse
  - visa nya mönster i data
  - förbättra upplevelsen

(LFV)

OLIKA TYPER AV

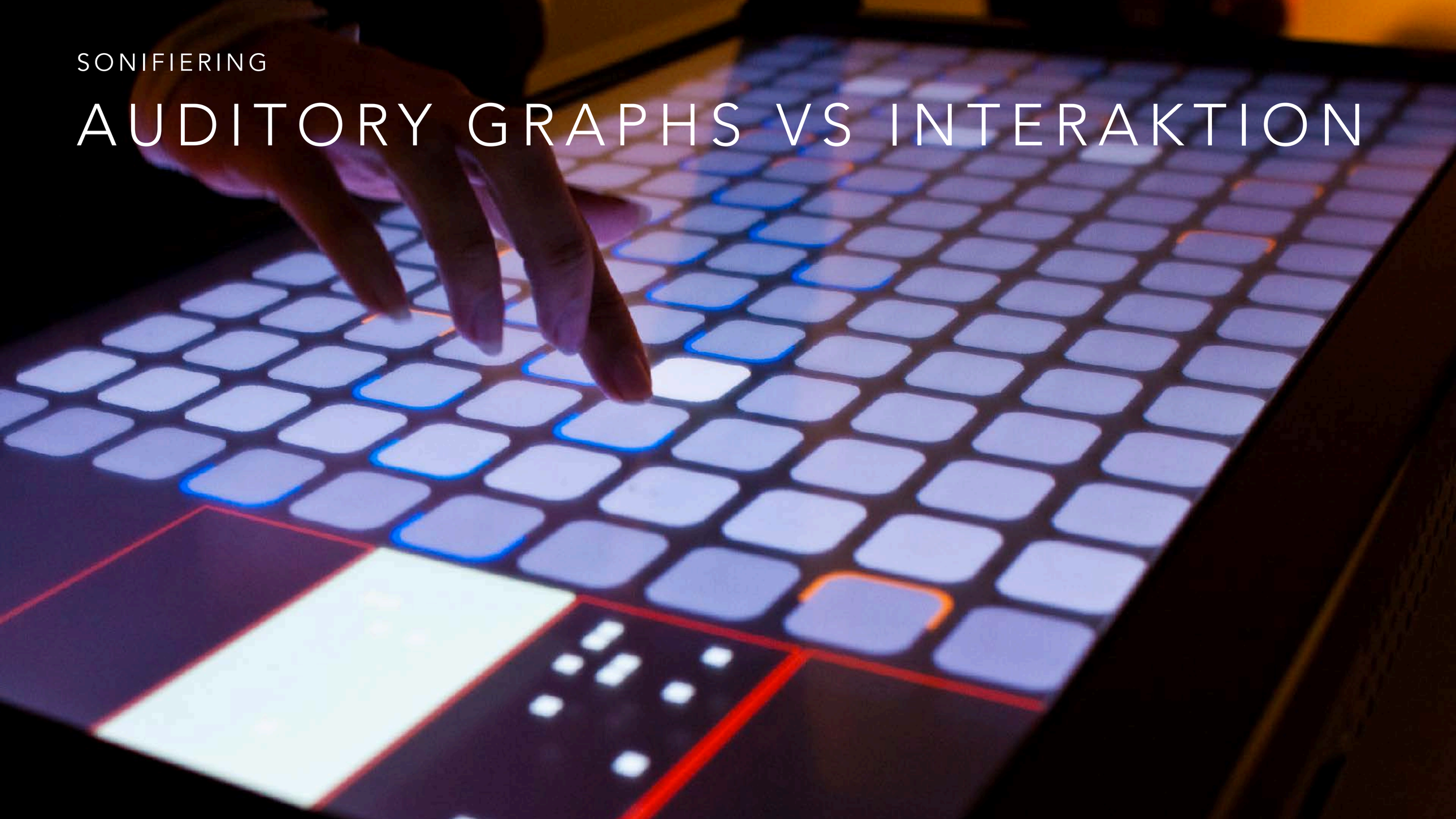
SONIFIERING

- Audification
- Parametermappad
- Musikalisk sonifiering
- Auditory icons
- Earcons



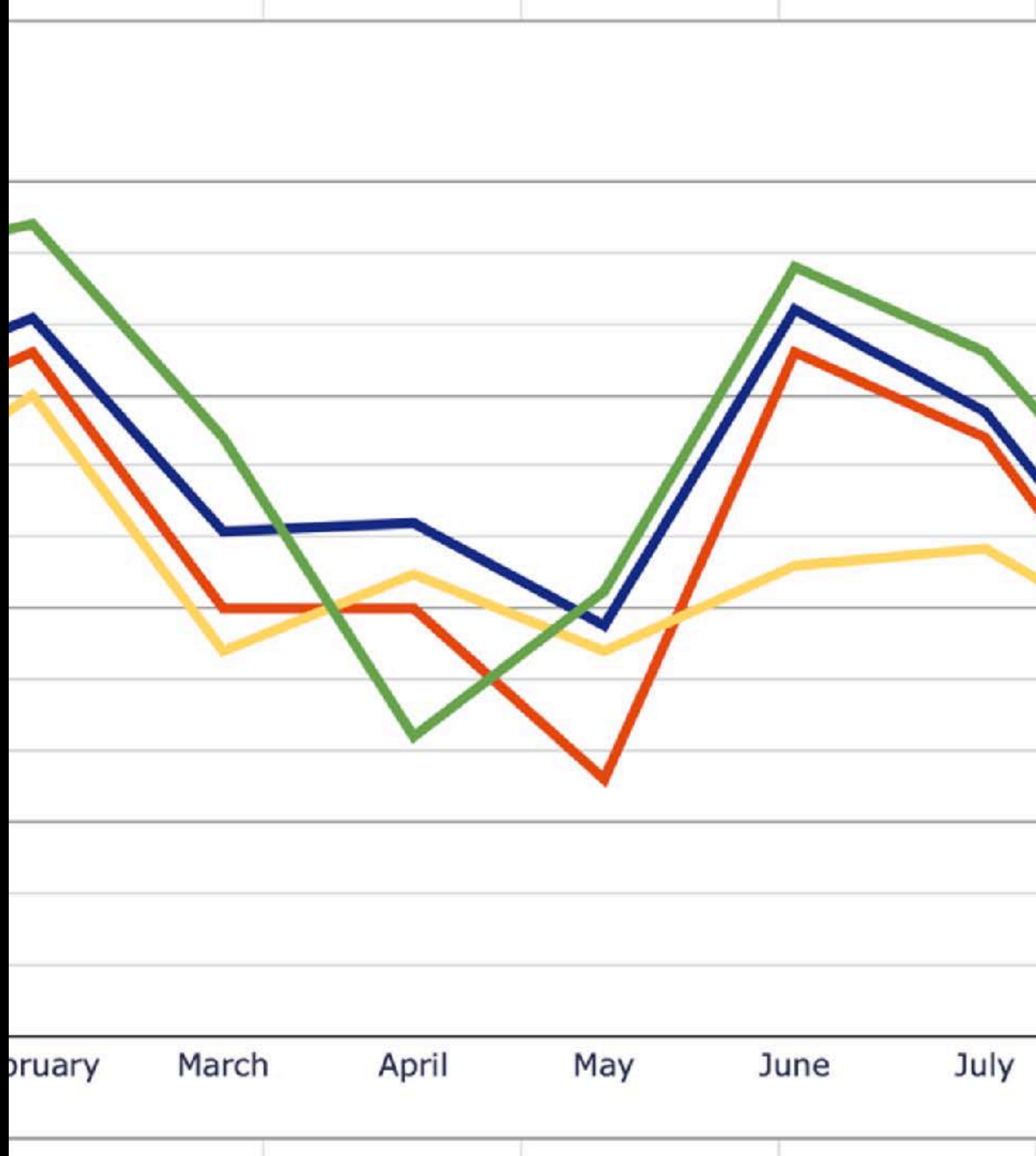
SONIFIERING

AUDITORY GRAPHS VS INTERAKTION



EN AUDITORY GRAPH

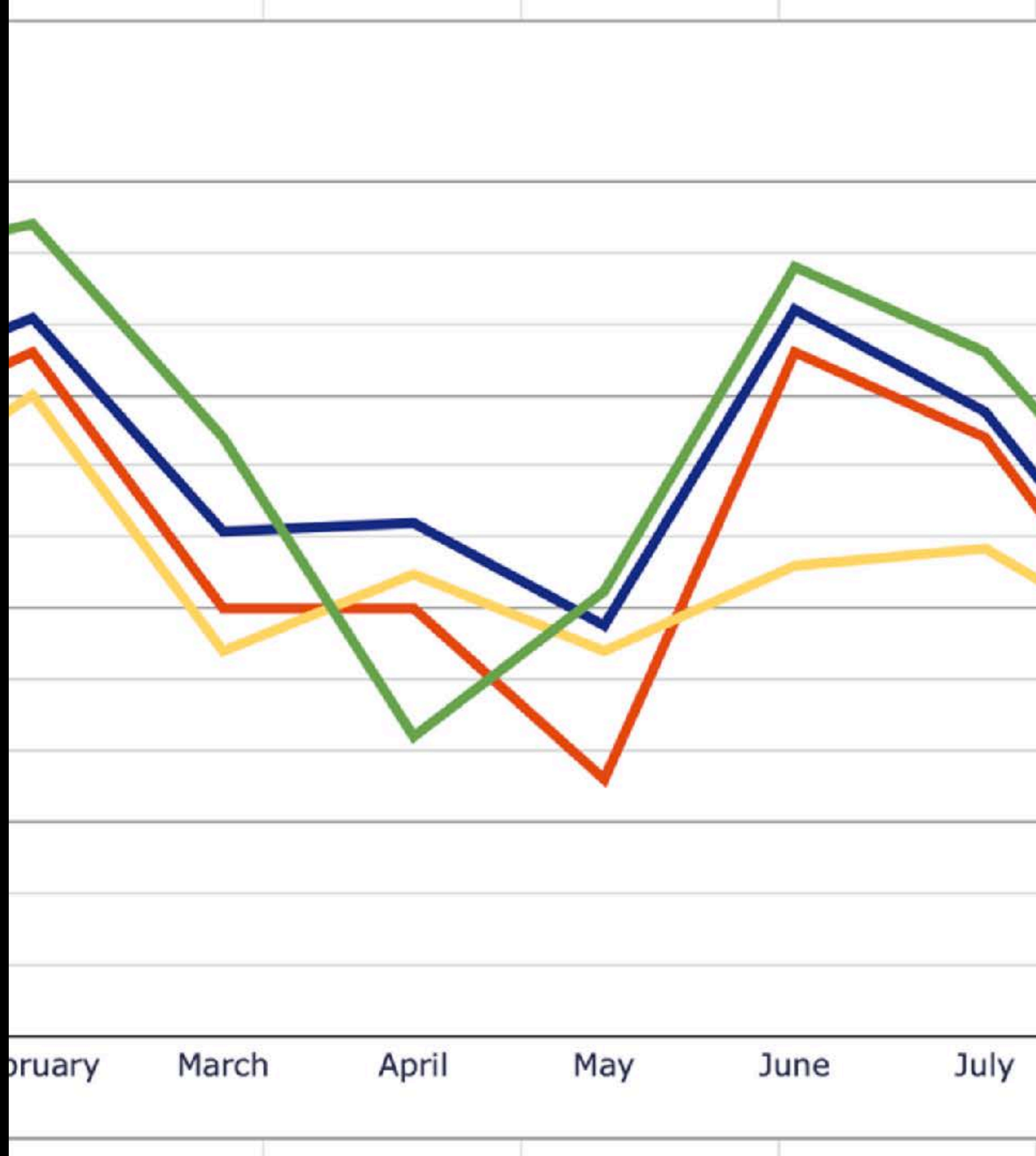
- Är linjär uppspelning av data
- Tänk en linjegraf som spelas upp från start till slut
- Detta kan göras med eller utan visuell information
- Jämförelser av data blir svåra
- Värden behövs hållas i minnet
- Därför behövs ofta interaktion



INTERAKTION

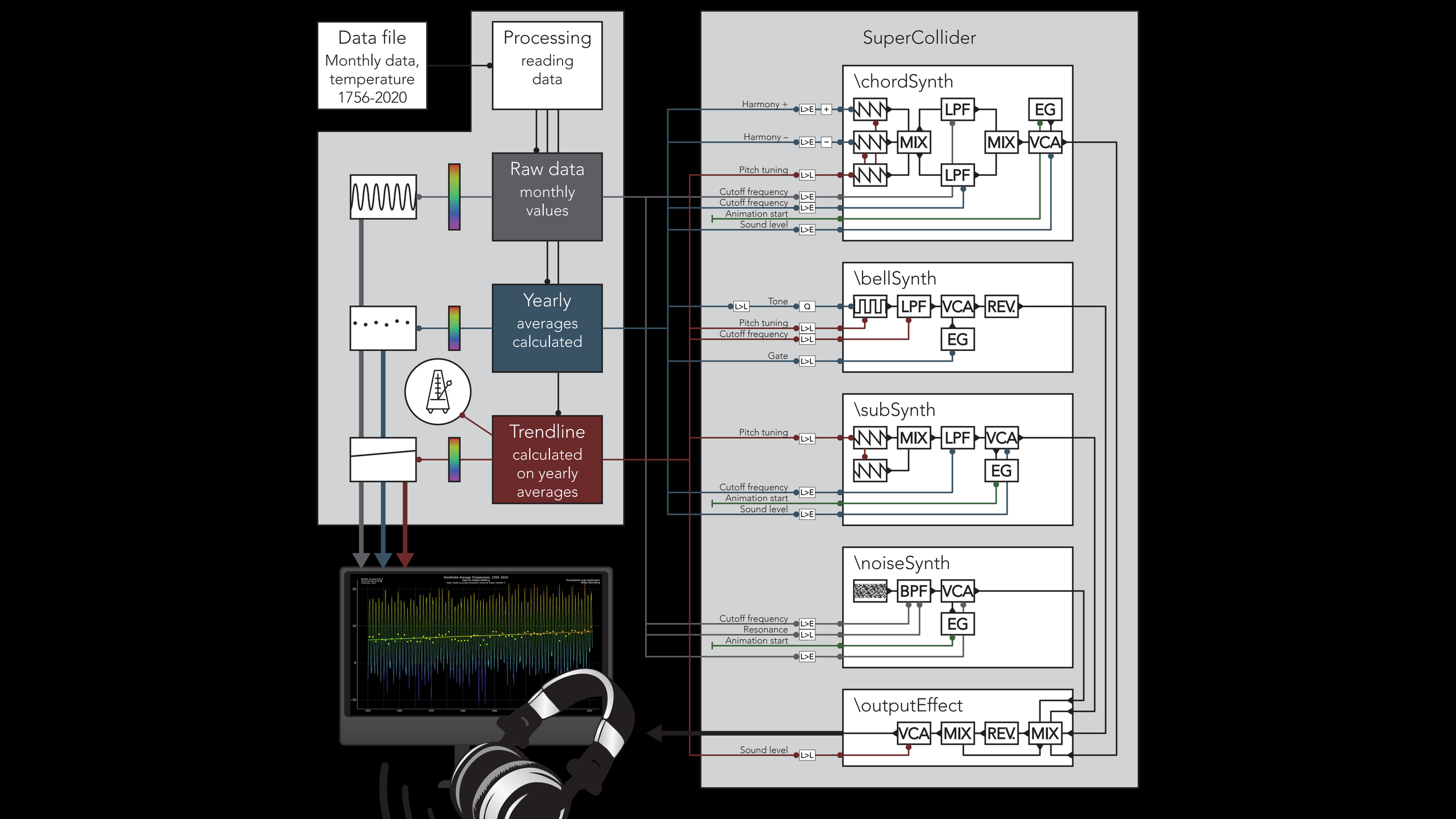
- En visualisering kan läsas/skannas icke-linjärt
- Datapunkter kan hoppas över
- För att interaktion ska funka behövs något visuellt att koppla mot
- Eller något taktilt

Hunt & Hermann (2004) The importance of interaction in sonification



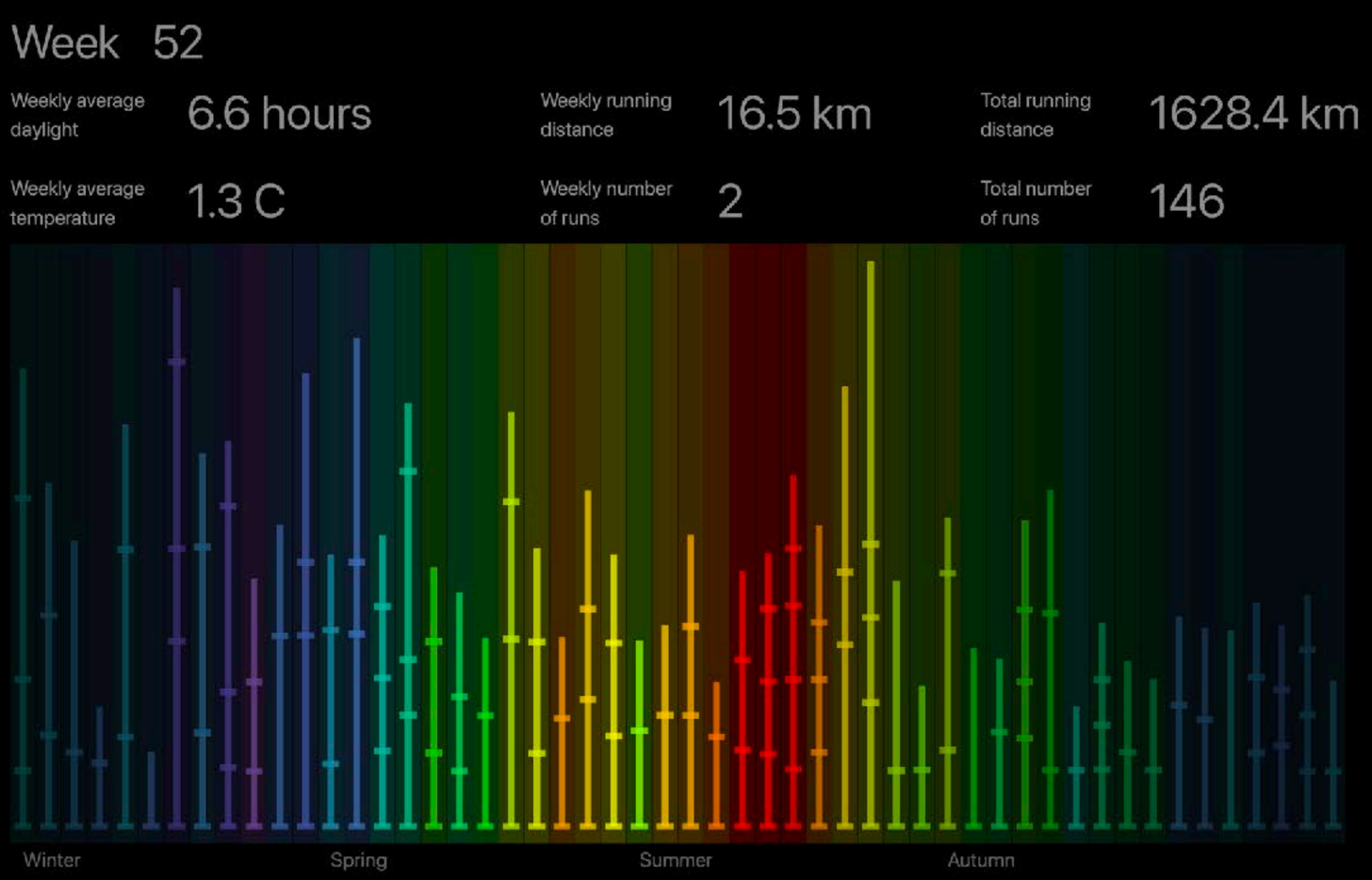
AUDITORY GRAPH

ETT EXEMPEL


Data file
Monthly data, temperature 1756-2020
Processing
reading data
Raw data
monthly values
Yearly
averages calculated
Trendline
calculated on yearly averages
SuperCollider
\chordSynth
Harmony +
Harmony –
Pitch tuning
Cutoff frequency
Cutoff frequency
Animation start
Sound level
L>E
L>L
+
–
LPF
MIX
MIX
EG
VCA
LPF
\bellSynth
Tone
Q
Pitch tuning
Cutoff frequency
Gate
LPF
VCA
REV.
EG
\subSynth
Pitch tuning
Cutoff frequency
Animation start
Sound level
MIX
LPF
VCA
EG
\noiseSynth
Cutoff frequency
Resonance
Animation start
BPF
VCA
EG
\outputEffect
Sound level
VCA
MIX
REV.
MIX

AUDITORY GRAPH

ETT TILL EXEMPEL

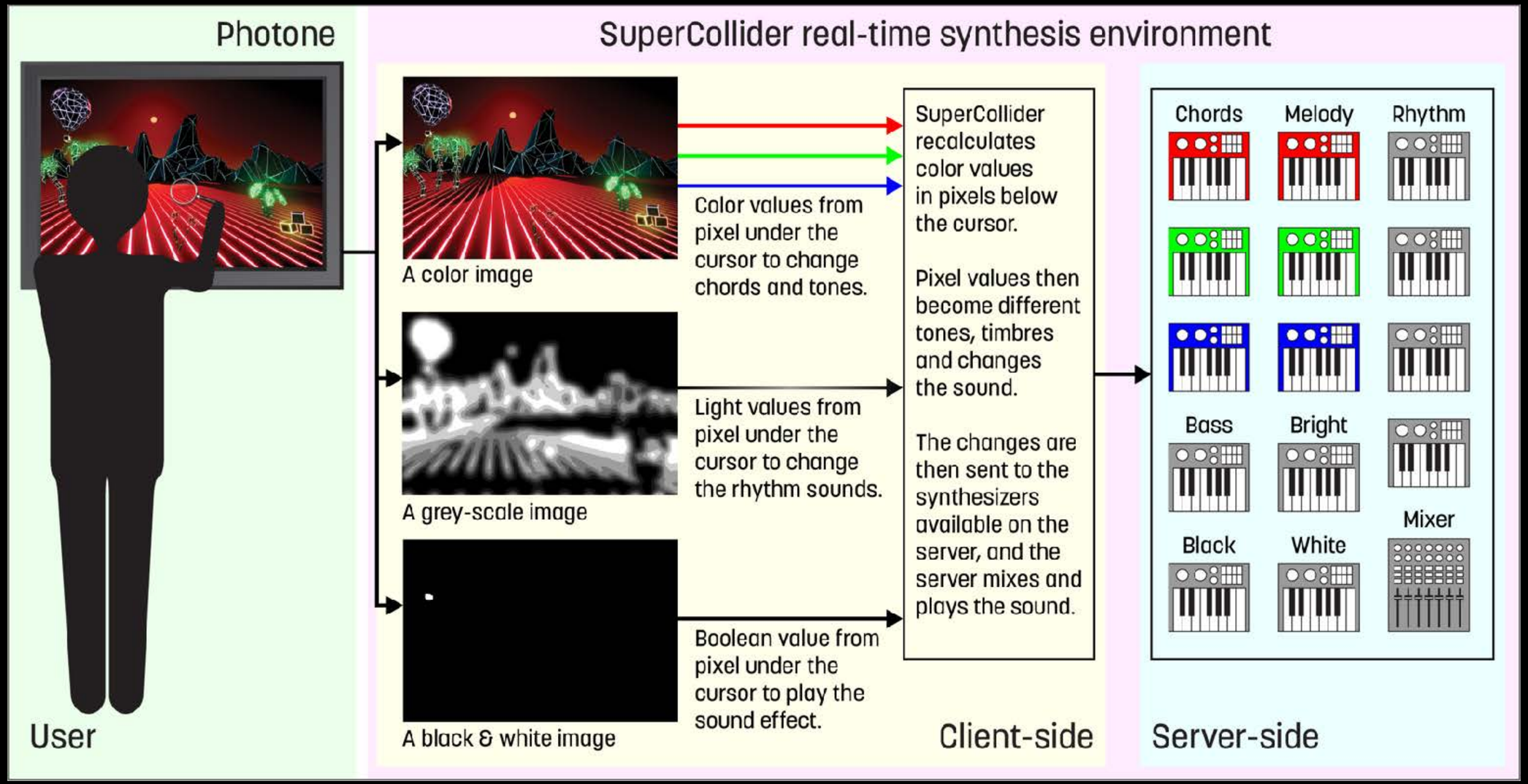


INTERAKTIV SONIFIERING

ETT EXEMPEL

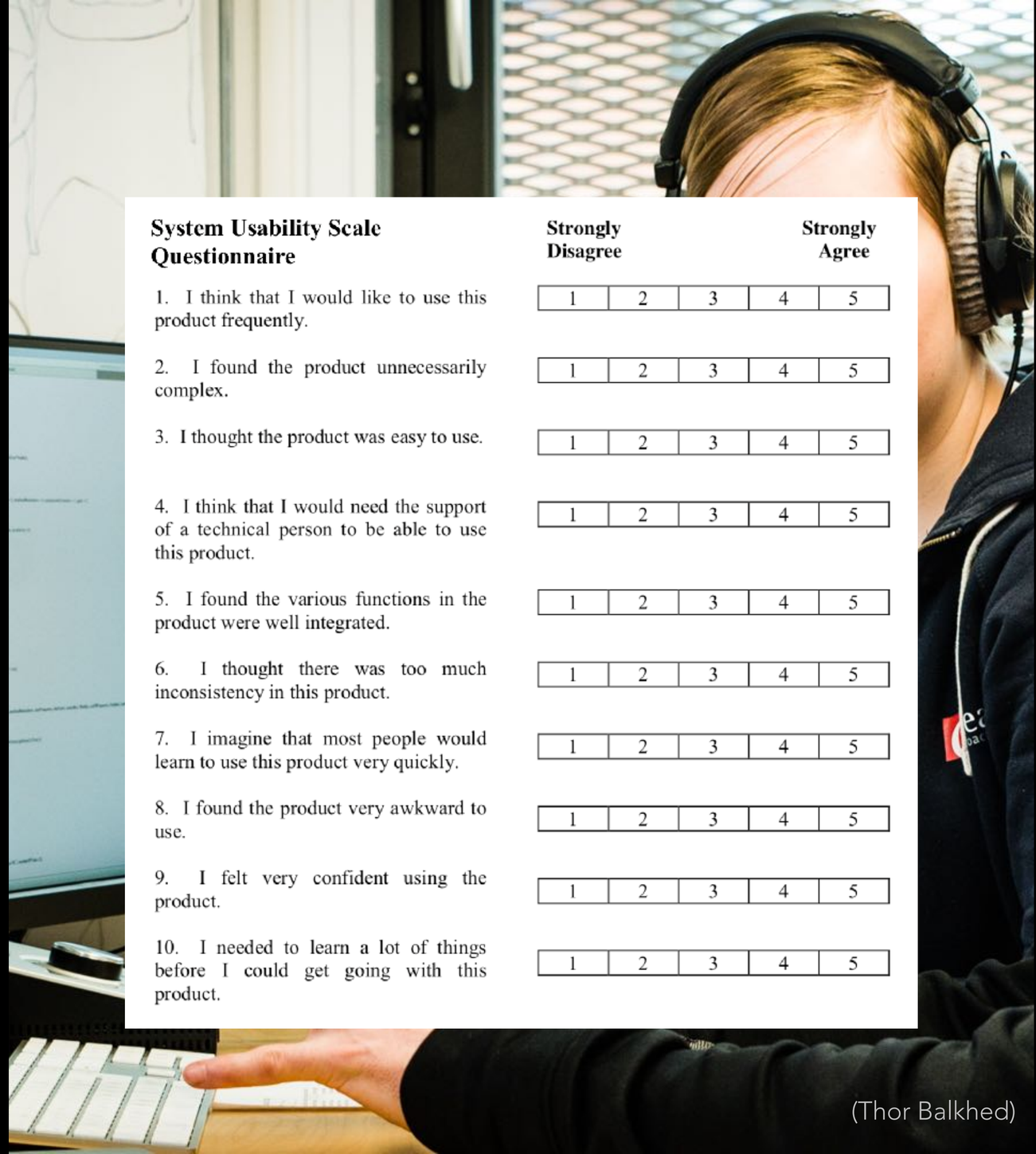
INTERAKTIV SONIFIERING

ETT TILL EXEMPEL



UTVÄRDERING

- Kvantitativa mått
  - Reaktionstid/svarstid
  - Noggrannhet/poäng
- Kvalitativa mått
  - System Usability Scale (SUS)
    Brooke, J. 1986.



System Usability Scale Questionnaire	Strongly Disagree				Strongly Agree
1. I think that I would like to use this product frequently.	1	2	3	4	5
2. I found the product unnecessarily complex.	1	2	3	4	5
3. I thought the product was easy to use.	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this product.	1	2	3	4	5
5. I found the various functions in the product were well integrated.	1	2	3	4	5
6. I thought there was too much inconsistency in this product.	1	2	3	4	5
7. I imagine that most people would learn to use this product very quickly.	1	2	3	4	5
8. I found the product very awkward to use.	1	2	3	4	5
9. I felt very confident using the product.	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this product.	1	2	3	4	5

(Thor Balkhed)

UTVÄRDERING

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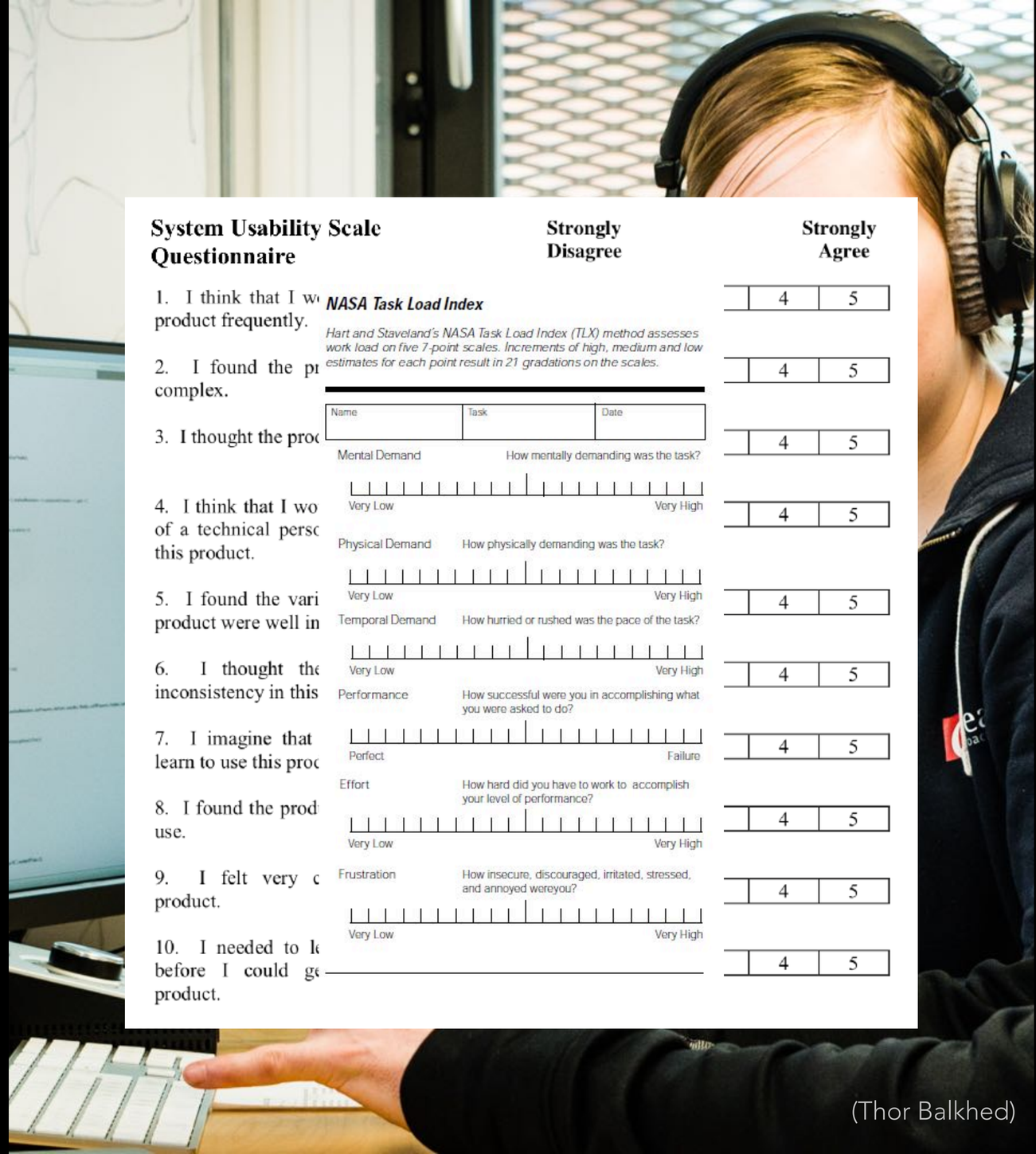
    Brooke, J. 1986.
  - NASA Task Load Index
    NASA, 1986.



(Thor Balkhed)

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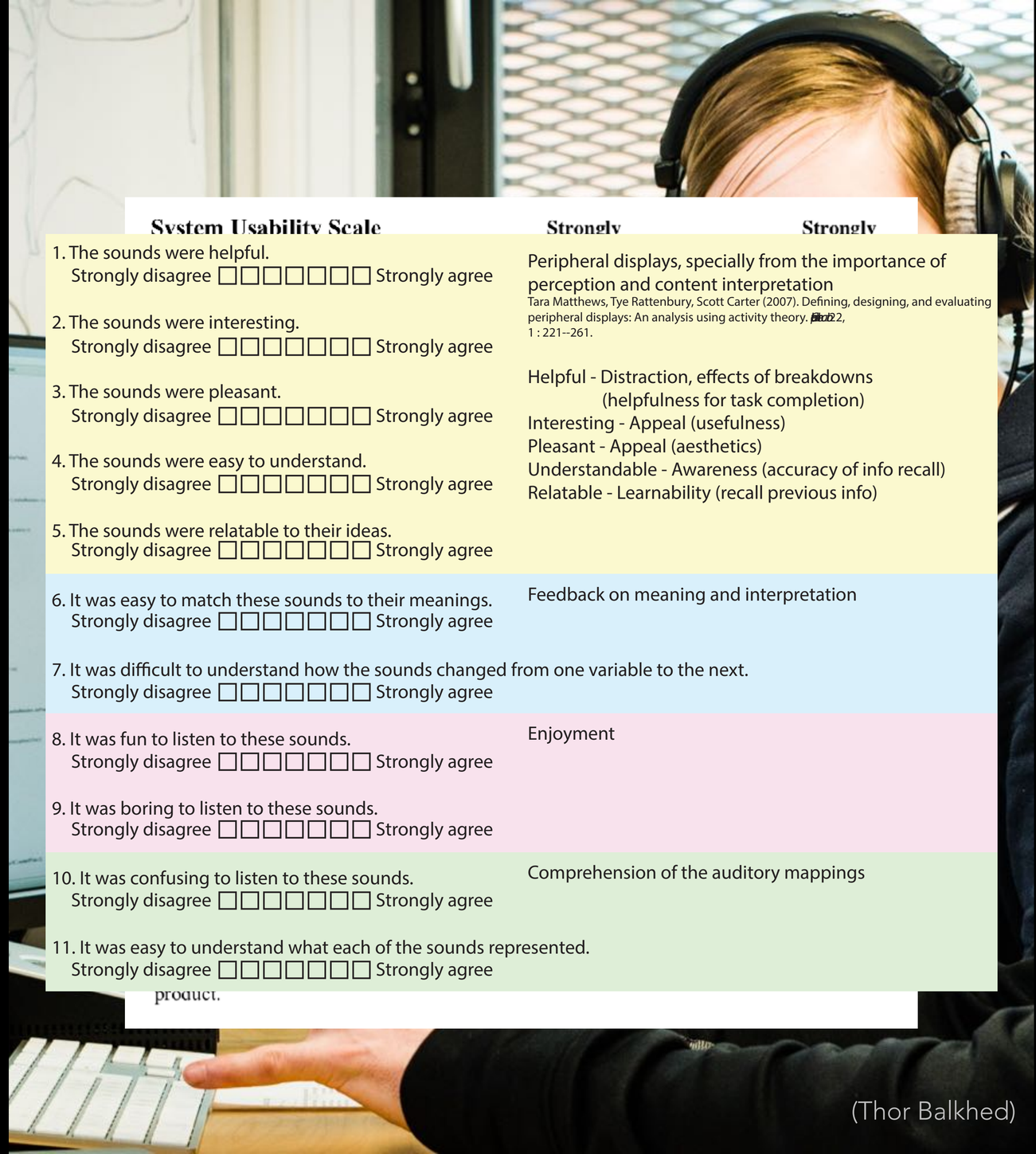
    Brooke, J. 1986.
  - NASA Task Load Index
    NASA, 1986.
  - BUZZ: Audio User Experience Scale
    Tomlinson, et al, 2018.

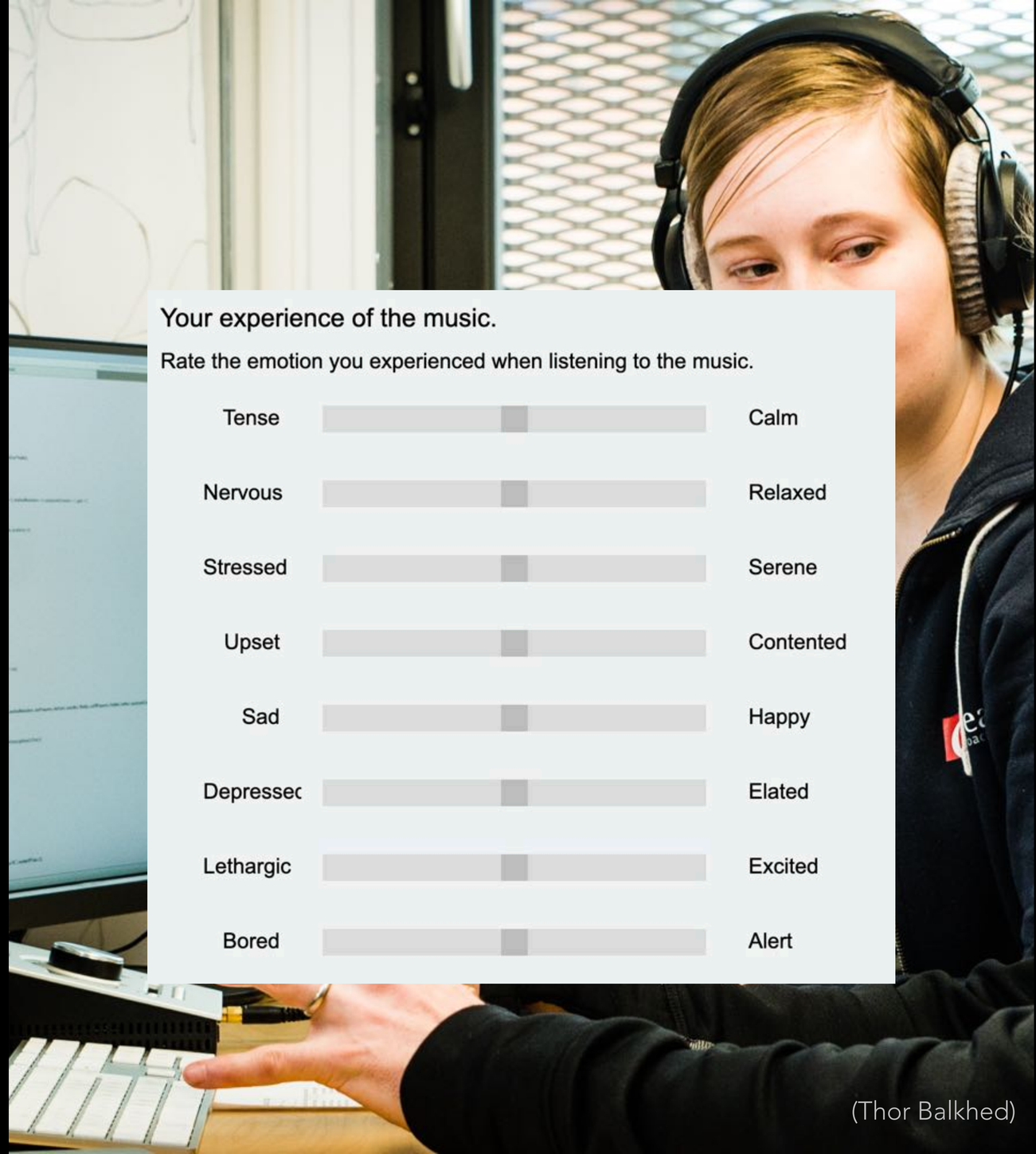


(Thor Balkhed)

UTVÄRDERING

- Utöka befintliga enkäter
- Circumplex model of affect

  Russell, J. A., 1980.
- Mixed methods…



(Thor Balkhed)

PARAMETERMAPPAD SONIFIERING

LITE OM MIN FORSKING

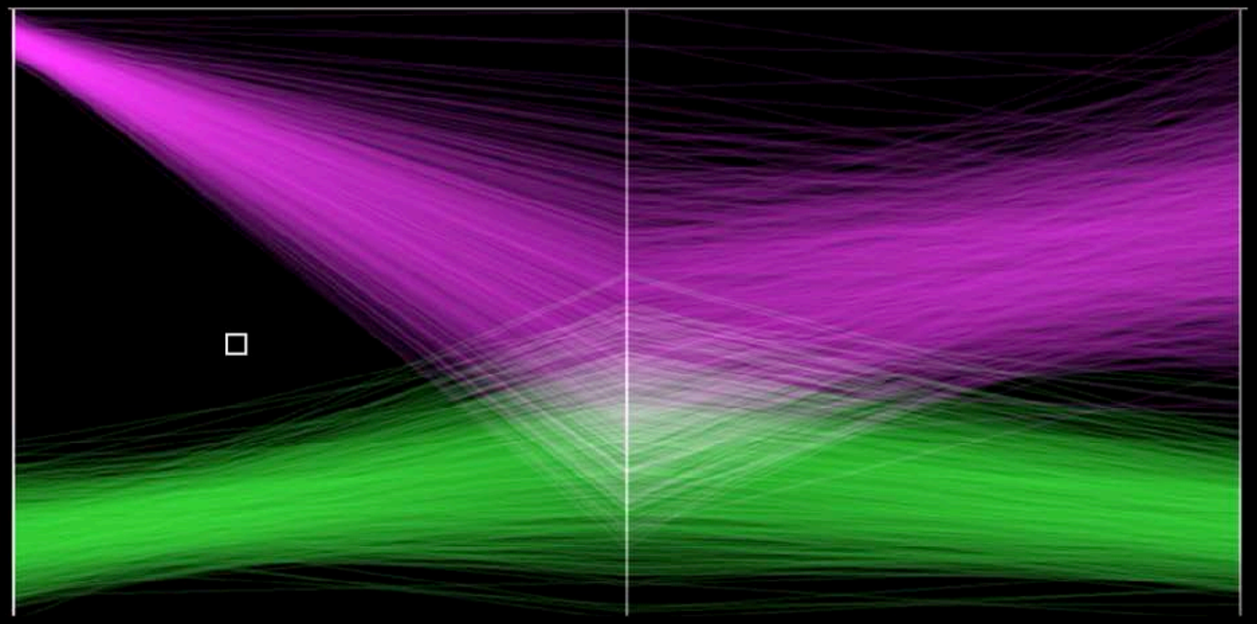
INTERACTIVE SONIFICATION

FOR DENSE DATA DISPLAYS

- Density level -> amplitude

- Sound design
  - pitch
  - rhythm

SONIFICATION IN PARALLEL COORDINATES

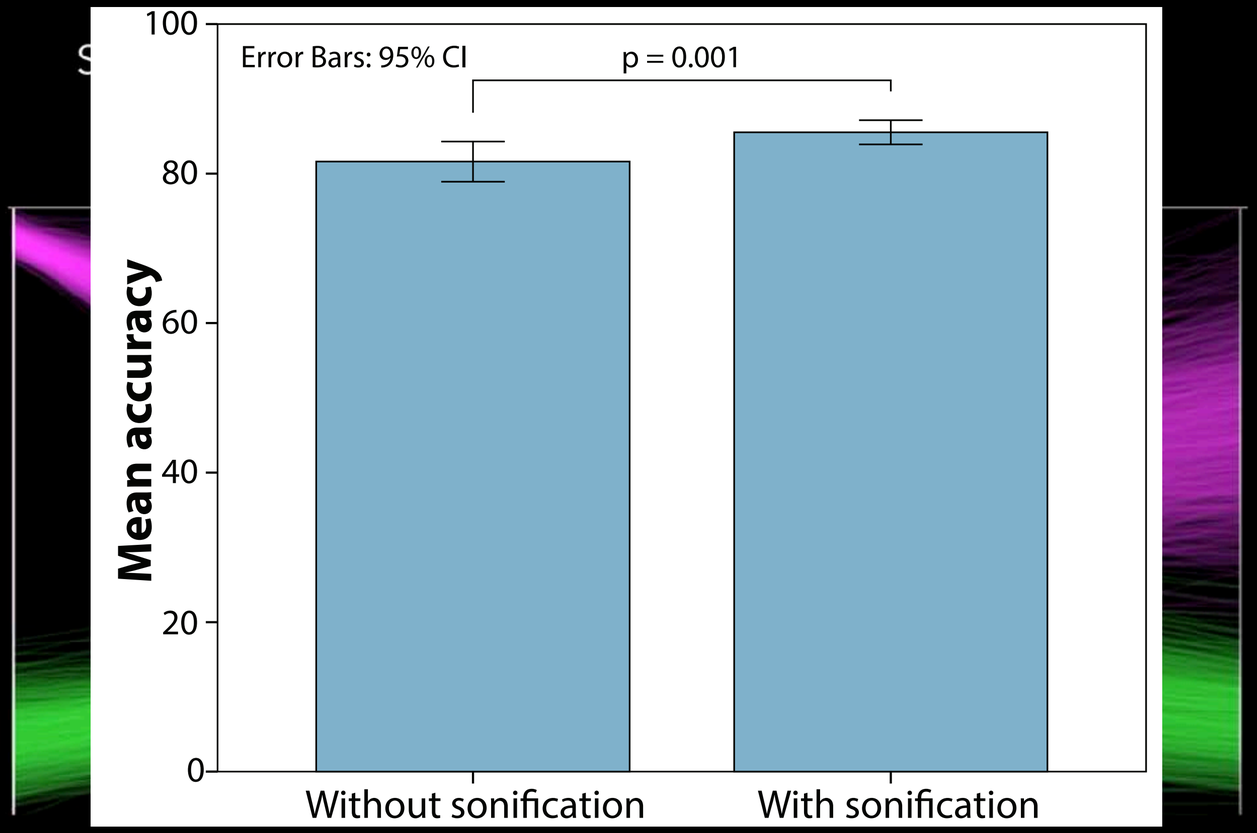


Rönnberg, N., Johansson, J. (2016). Interactive Sonification for Visual Dense Data Displays.
In Proc. of the 5th Interactive Sonification Workshop (ISon 2016), CITEC, Bielefeld University, Germany, December 16, 2016.

INTERACTIVE SONIFICATION

FOR DENSE DATA DISPLAYS

- Density level -> amplitude
- Sound design
  - pitch
  - rhythm
- Improved accuracy & longer response time



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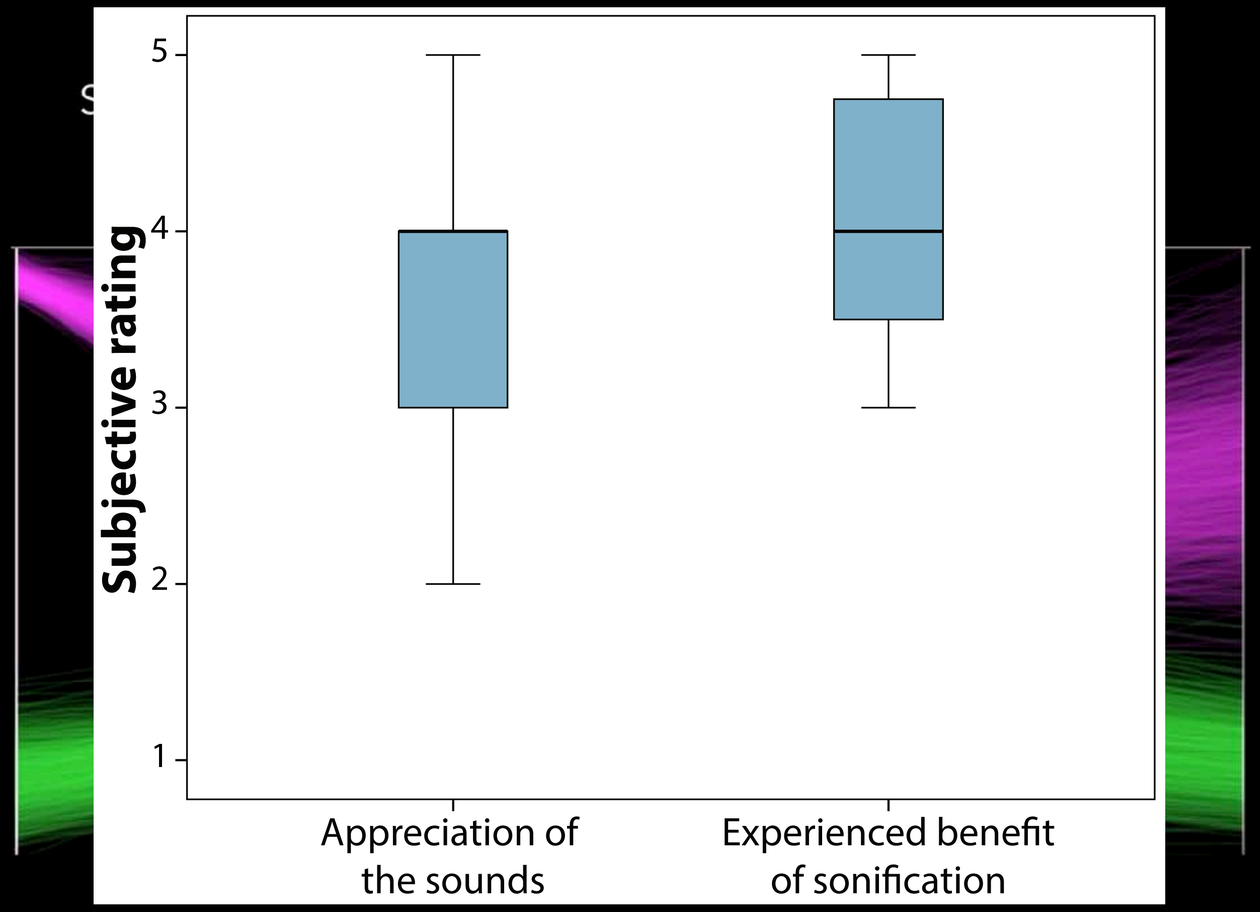
INTERACTIVE SONIFICATION

FOR DENSE DATA DISPLAYS

- Density level -> amplitude
- Sound design
  - pitch
  - rhythm
- Improved accuracy & longer response time
- Experienced benefit



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SONIFYING THE PERIPHERY

SUPPORTING THE FORMATION OF GESTALT IN AIR TRAFFIC CONTROL

- Inbound & exiting aircraft -> different sounds

- Sound design
  - pitch
  - rhythm

SONIFICATION SKETCH

ONE INBOUND AIRCRAFT

THIS IS A DEMO OF THE SONIFICATION. WITH REDUCED AMOUNT OF INFORMATION, ANONYMISED JX, AND PLAYED FASTER THAN REAL TIME.

Rönnberg, N., Lundberg, J., Löwgren, J. (2016). Sonifying the Periphery: Supporting the Formation of Gestalt in Air Traffic Control.
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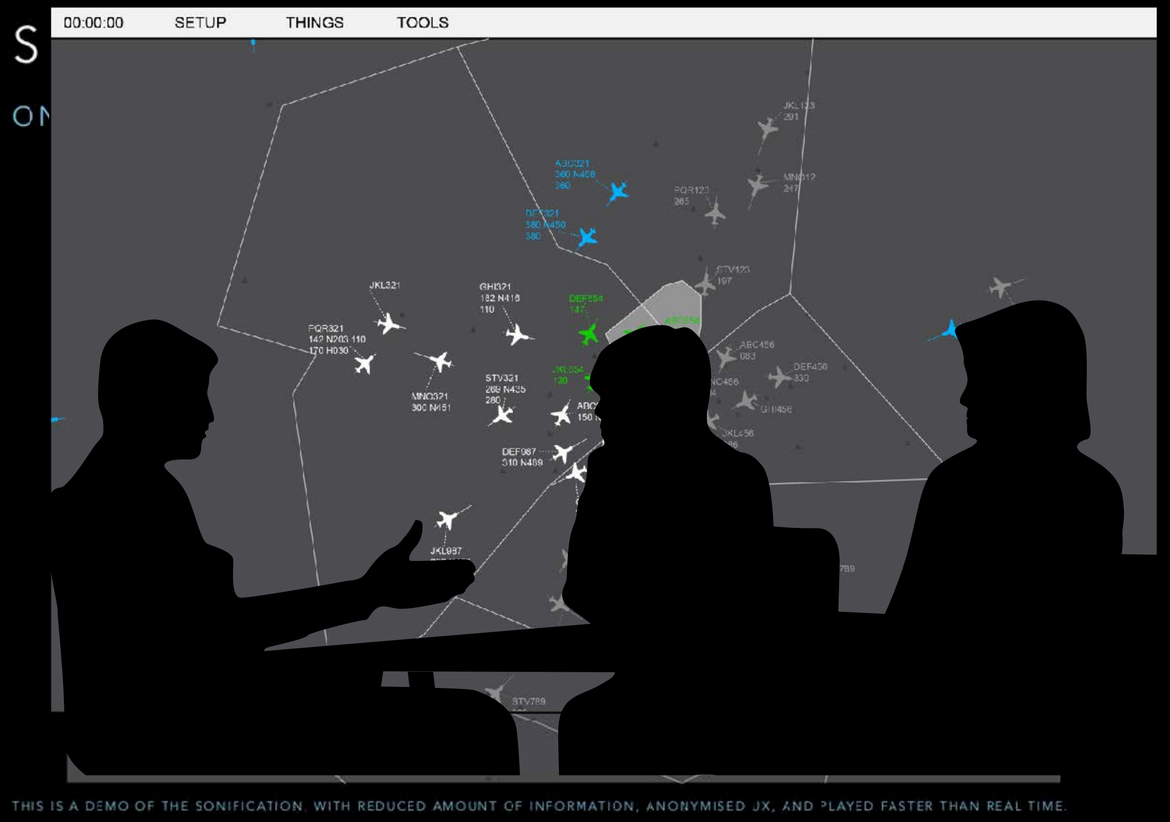
SONIFYING THE PERIPHERY

SUPPORTING THE FORMATION OF GESTALT IN AIR TRAFFIC CONTROL

- Inbound & exiting aircraft -> different sounds
- Sound design
  - pitch
  - rhythm
- Provided peripheral info,
  but not a complete gestalt
- Experienced benefit for
  some traffic loads



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SONIFICATION SUPPORTS

PERCEPTION OF BRIGHTNESS CONTRAST

- Brightness level ->
  - amplitude
  - timbre
  - amplitude & timbre

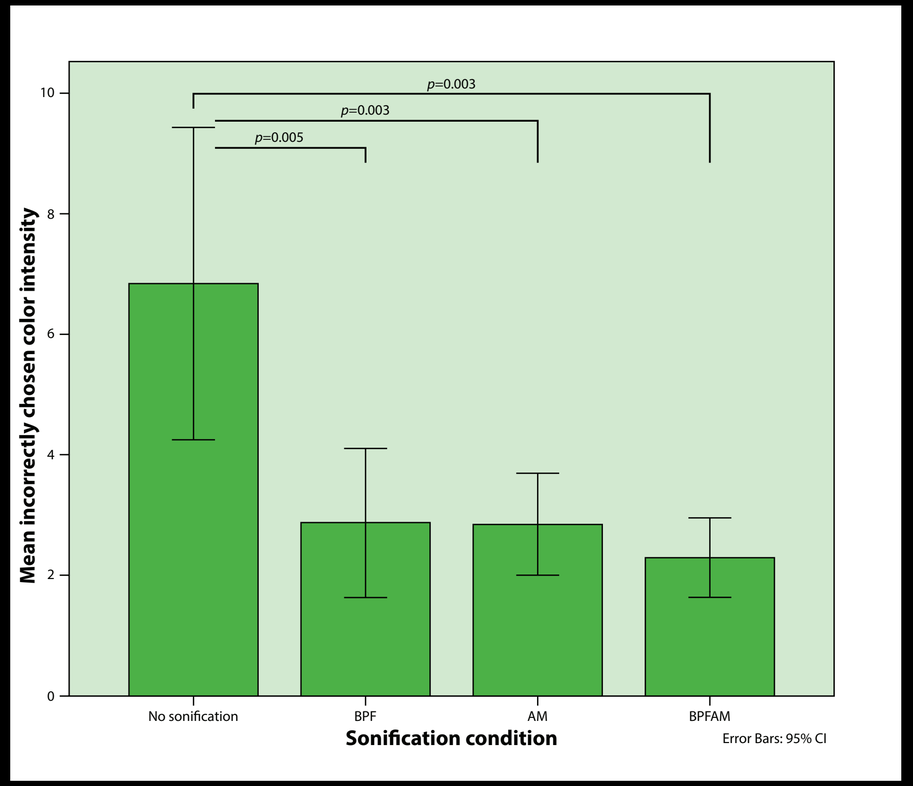
Rönnberg, N. (2019). Sonification supports perception of brightness contrast. Journal on Multimodal User Interfaces, pp. 1–9, 7, 2019.

SONIFICATION SUPPORTS

PERCEPTION OF BRIGHTNESS CONTRAST

- Brightness level ->
  - amplitude
  - timbre
  - amplitude & timbre

- Higher accuracy with sonification



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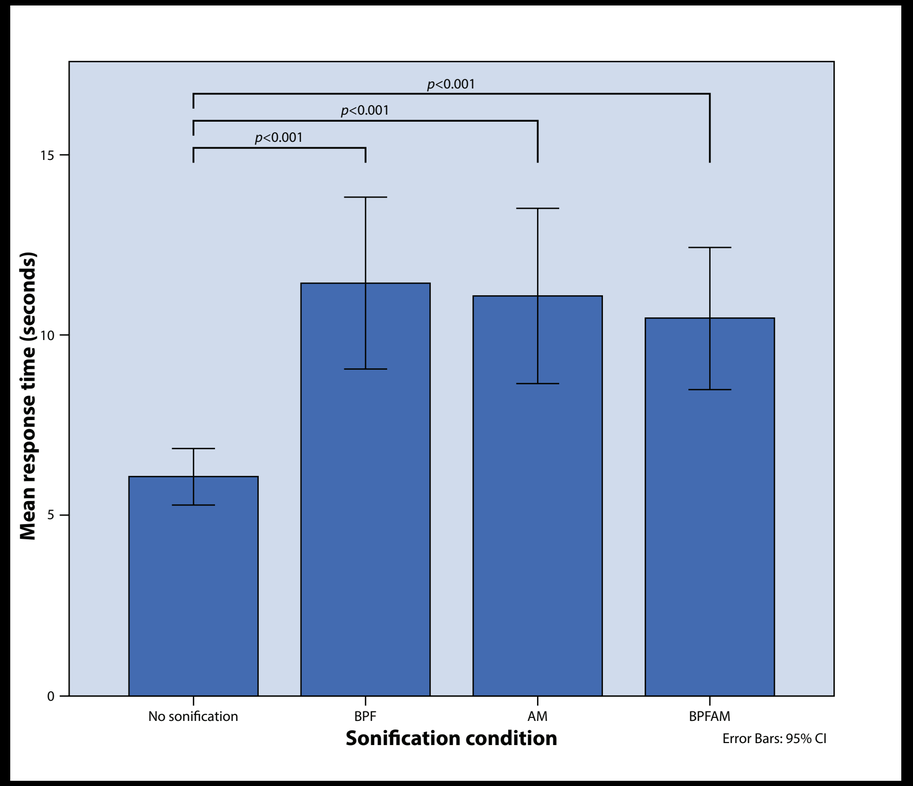
SONIFICATION SUPPORTS

PERCEPTION OF BRIGHTNESS CONTRAST

- Brightness level ->
  - amplitude
  - timbre
  - amplitude & timbre

- Higher accuracy with sonification

- Longer response times



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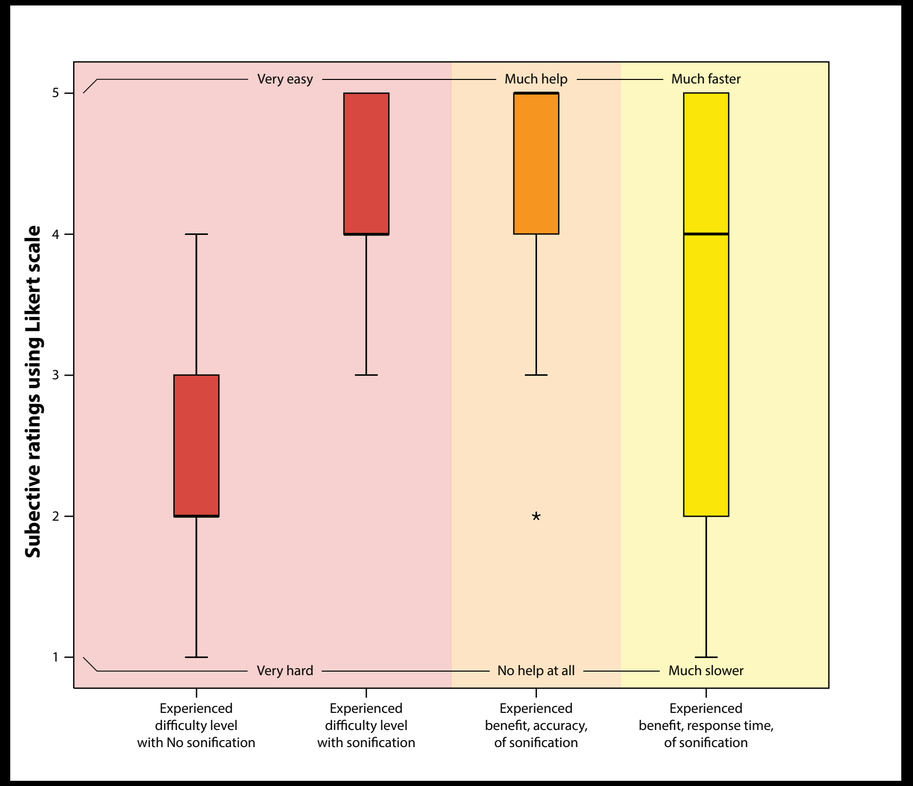
SONIFICATION SUPPORTS

PERCEPTION OF BRIGHTNESS CONTRAST

- Brightness level ->
  - amplitude
  - timbre
  - amplitude & timbre
- Higher accuracy with sonification
- Longer response times
- Subjective ratings



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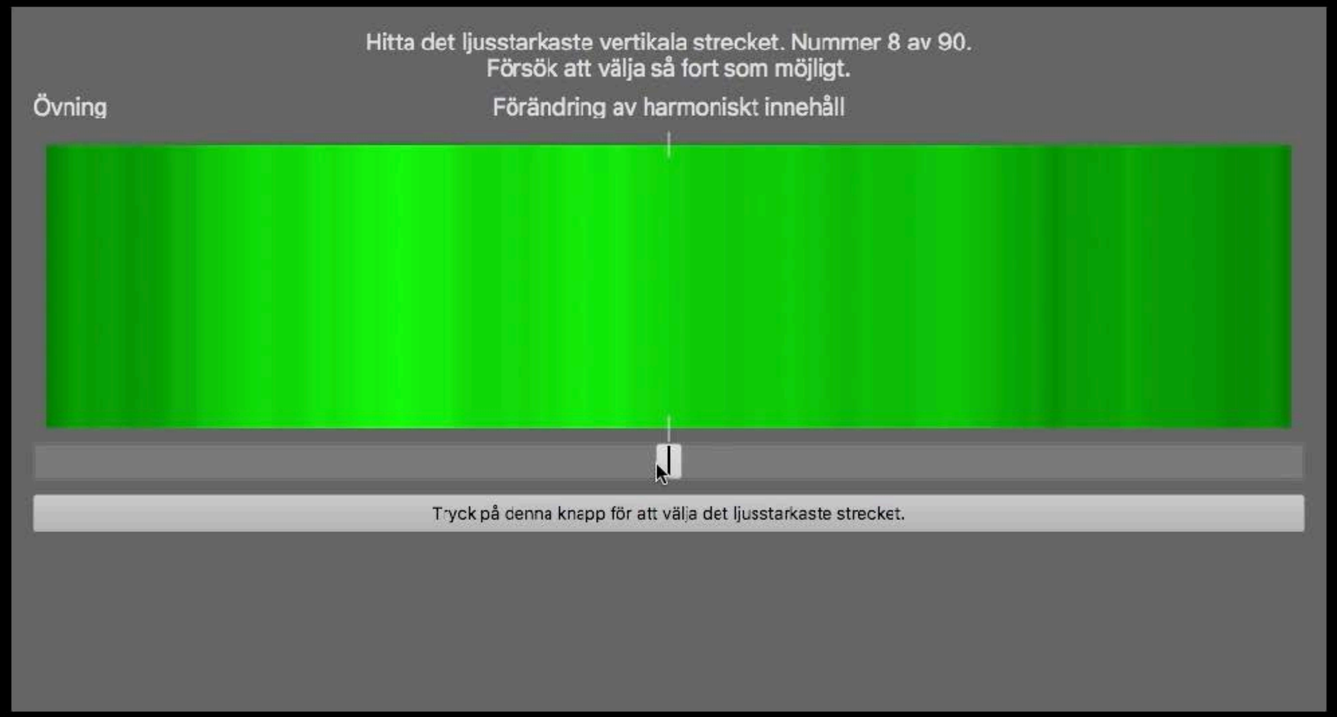
MUSICAL SONIFICATION

SUPPORTS VISUAL DISCRIMINATION OF COLOR INTENSITY

- Brightness level ->
  - amplitude & timbre
  - pitch
  - harmony



Rönnberg, N. (2019). Musical sonification supports visual discrimination of color intensity. Behaviour & Information Technology, 38, 10, pp. 1028–1037, 2019.

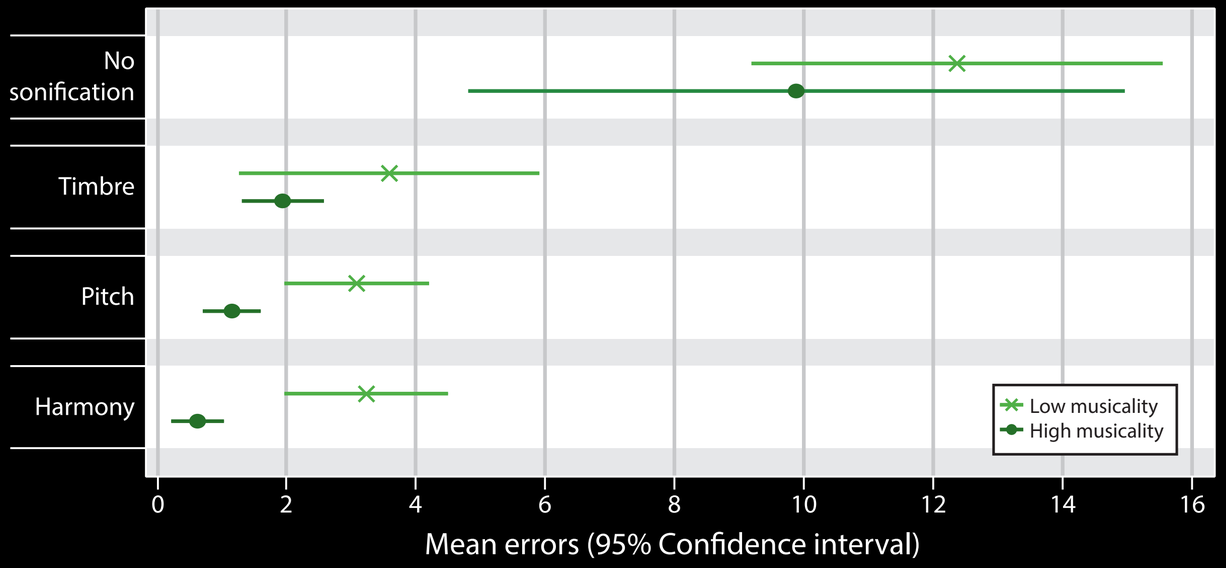
MUSICAL SONIFICATION

SUPPORTS VISUAL DISCRIMINATION OF COLOR INTENSITY

- Brightness level ->
  - amplitude & timbre
  - pitch
  - harmony

- Higher accuracy with sonification & effect of musicality

- Longer response times



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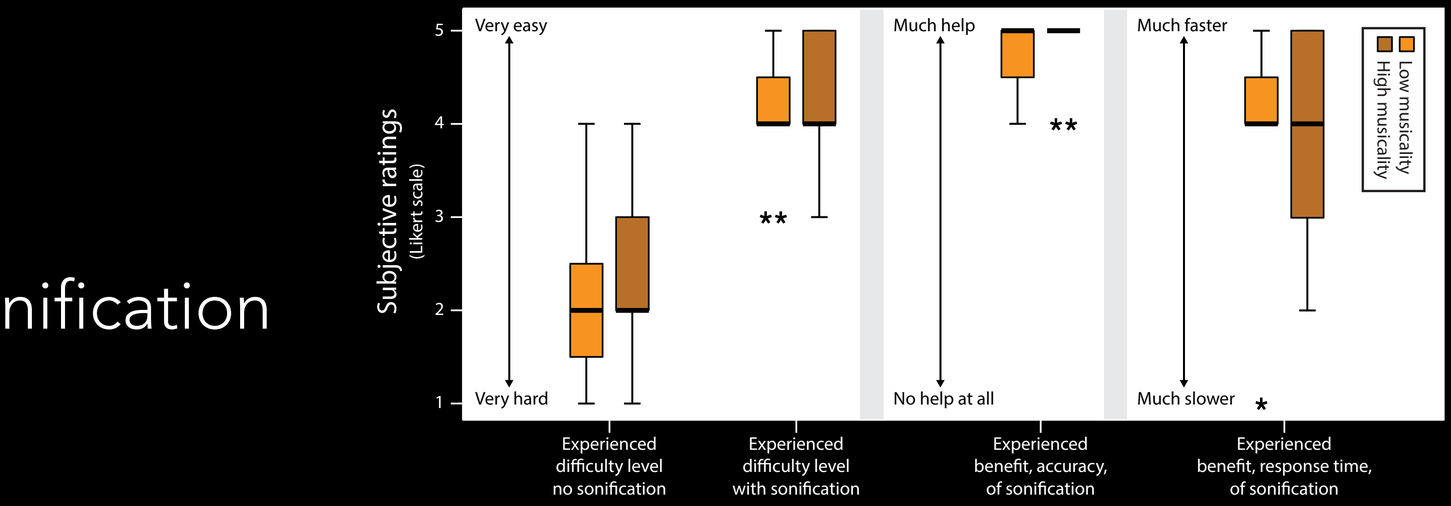

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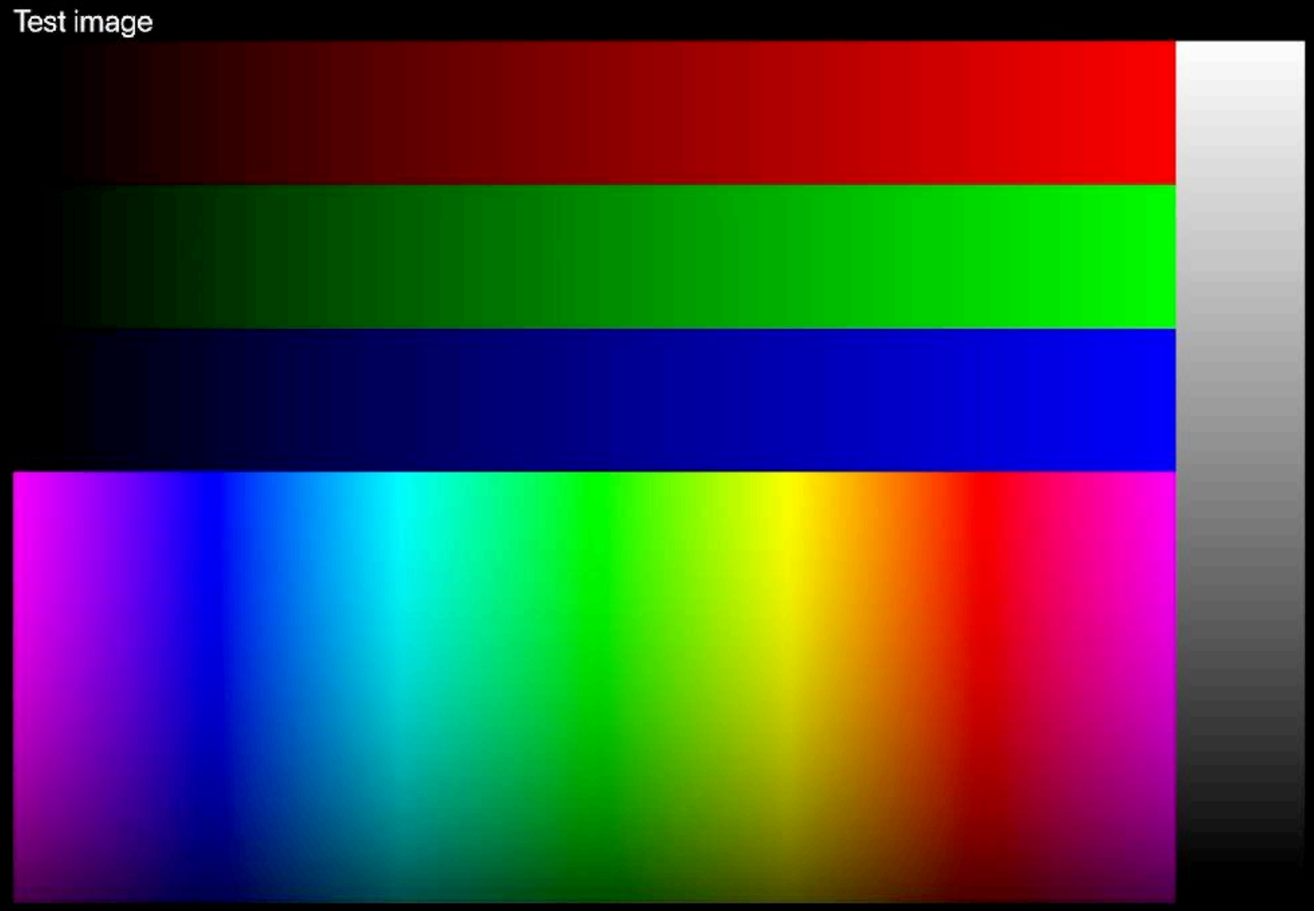
PHOTONE

EXPLORING MODAL SYNERGY IN PHOTOGRAPHIC IMAGES AND MUSIC

- Color values (RGB) -> sonification

- Sound design
  - pitch
  - harmonies
  - melodic movements
  - timbre
  - amplitude
  - rhythm



Rönnberg, N., Löwgren, J. (2018). Photone: Exploring modal synergy in photographic images and music. ICAD2018.
Rönnberg, N., Löwgren, J. (2019). Traces of Modal Synergy. Studying Interactive Musical Sonification of Images in General-Audience Use. ICAD2019.

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- Color values (RGB) -> sonification

- Sound design
  - pitch
  - harmonies
  - melodic movements
  - timbre
  - amplitude
  - rhythm

- Interactive sonic art installation

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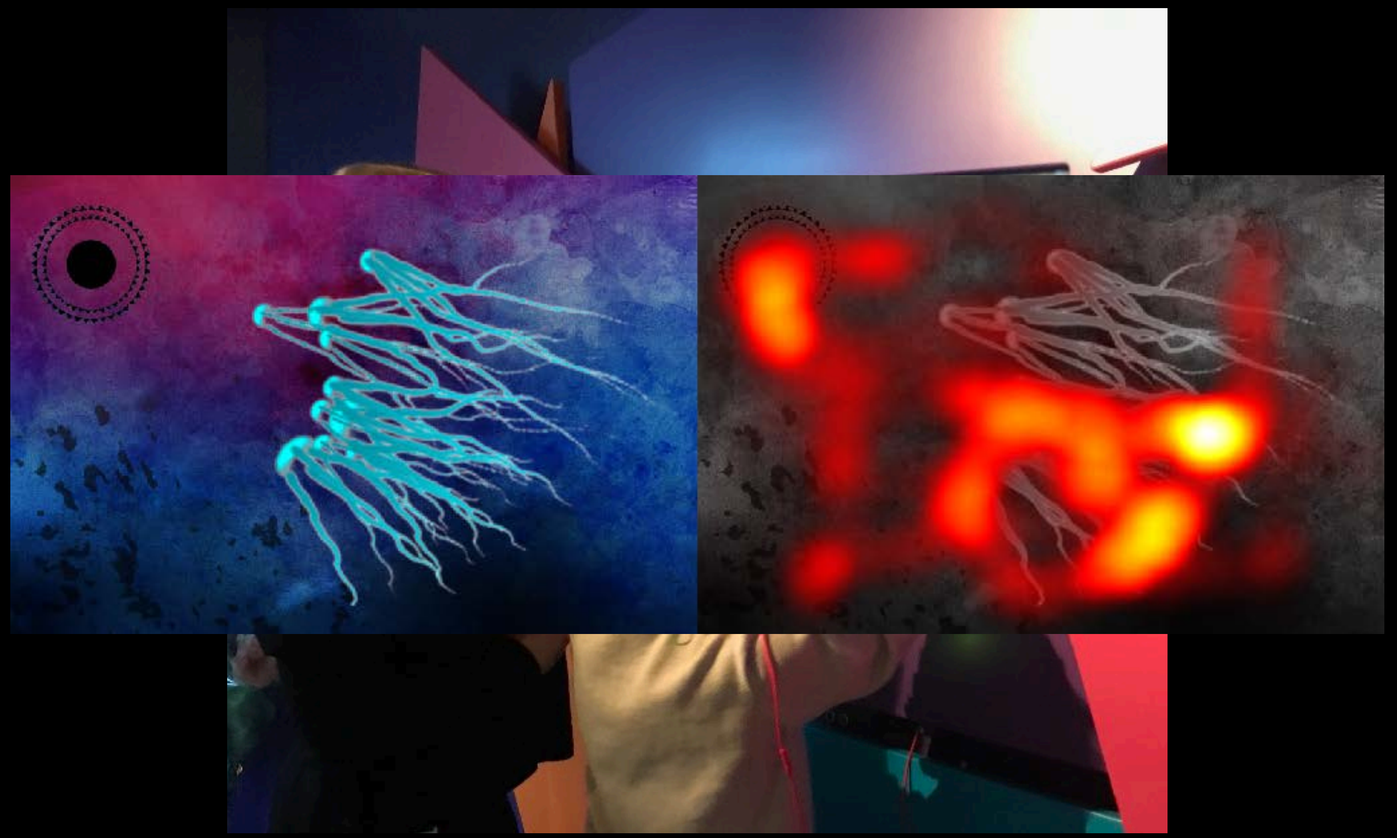
Rönnberg, N., Löwgren, J. (2019). Traces of Modal Synergy. Studying Interactive Musical Sonification of Images in General-Audience Use. ICAD2019.

PHOTONE

EXPLORING MODAL SYNERGY IN PHOTOGRAPHIC IMAGES AND MUSIC

- Color values (RGB) -> sonification
- Sound design
  - pitch
  - harmonies
  - melodic movements
  - timbre
  - amplitude
  - rhythm
- Interactive sonic art installation
- Traces of modal synergy



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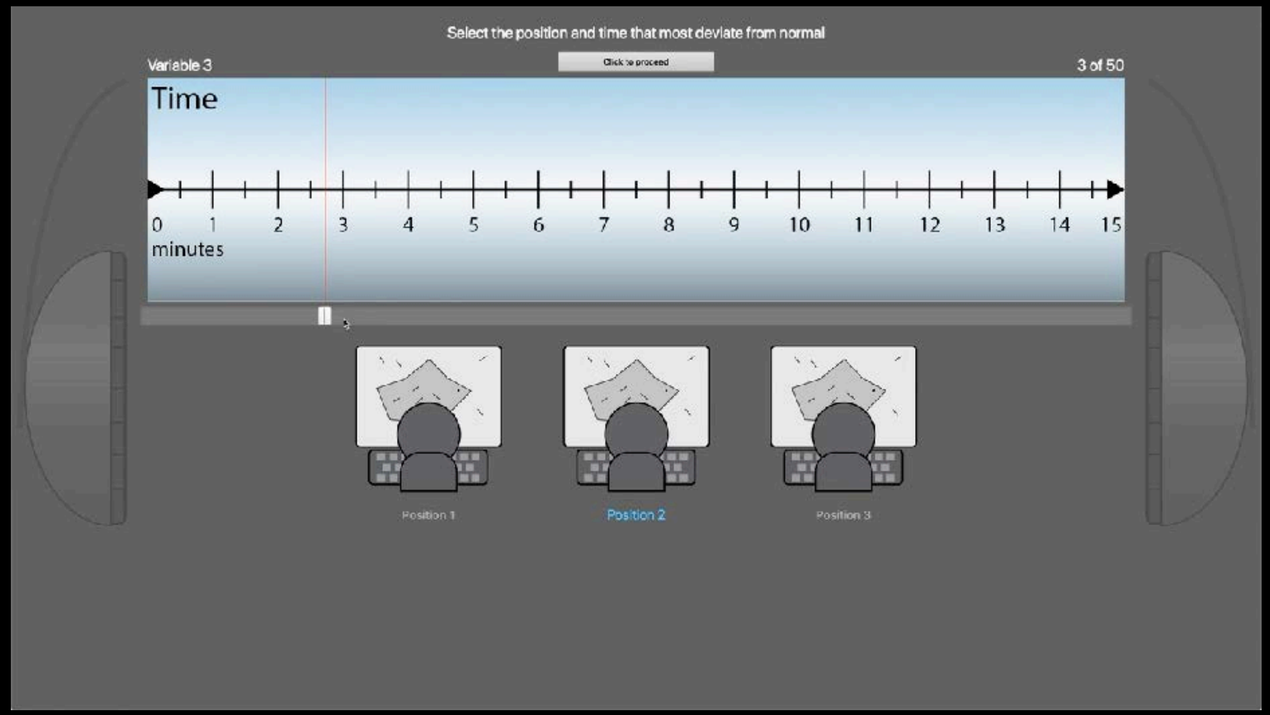
TOWARDS INTERACTIVE SONIFICATION

FOR MONITORING OF DYNAMIC PROCESSES

- Data value ->
  - harmony
  - timbre
  - vibrato
  - tempo
  - pitch & positions

- High performance, no difference

- Subjective ratings, no difference



Rönnberg, N. (2019). Towards interactive sonification for monitoring of dynamic processes. In Proc. of the Nordic Sound and Music Computing Conference 2019 (NSMC2019) and the Interactive Sonification Workshop 2019 (ISON2019), KTH Royal Institute of Technology, Stockholm, Sweden

TOWARDS INTERACTIVE SONIFICATION

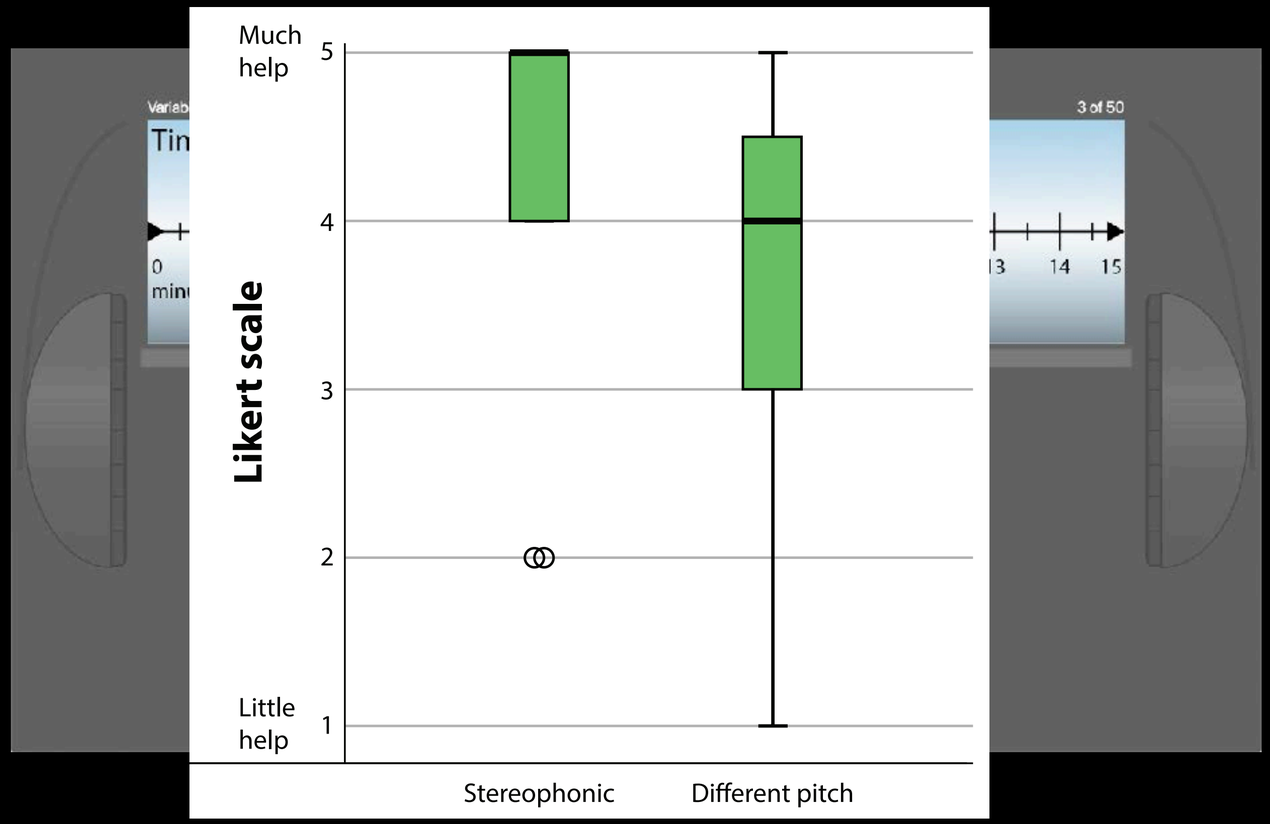
FOR MONITORING OF DYNAMIC PROCESSES

- Data value ->
  - harmony
  - timbre
  - vibrato
  - tempo
  - pitch & positions

- High performance, no difference

- Subjective ratings, no difference

- Stereophonic > pitch



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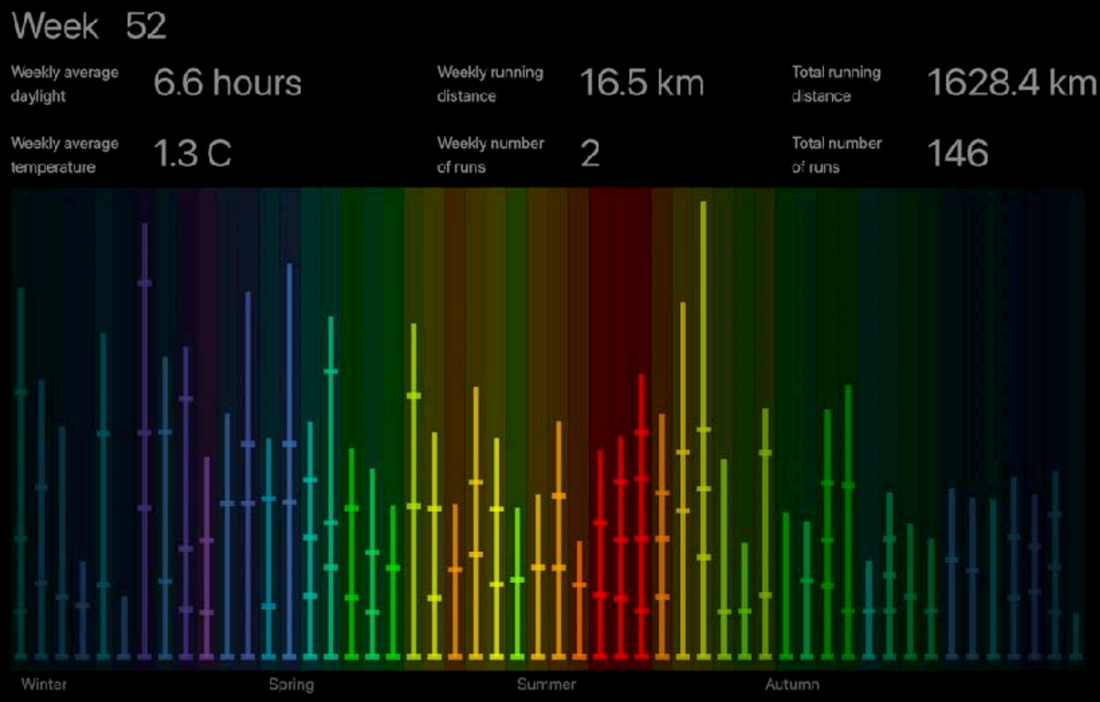
THE SOUND OF RUNNING

AN EVALUATION OF DATA SONIFICATION AND EMOTIONAL EXPRESSION

- Data values ->
  - timbre
  - amplitude
  - tempo
  - auditory icons

- Audio only, text, visualization



Rönnberg, N. (202?). The sound of running - an evaluation of data sonification and emotional expression

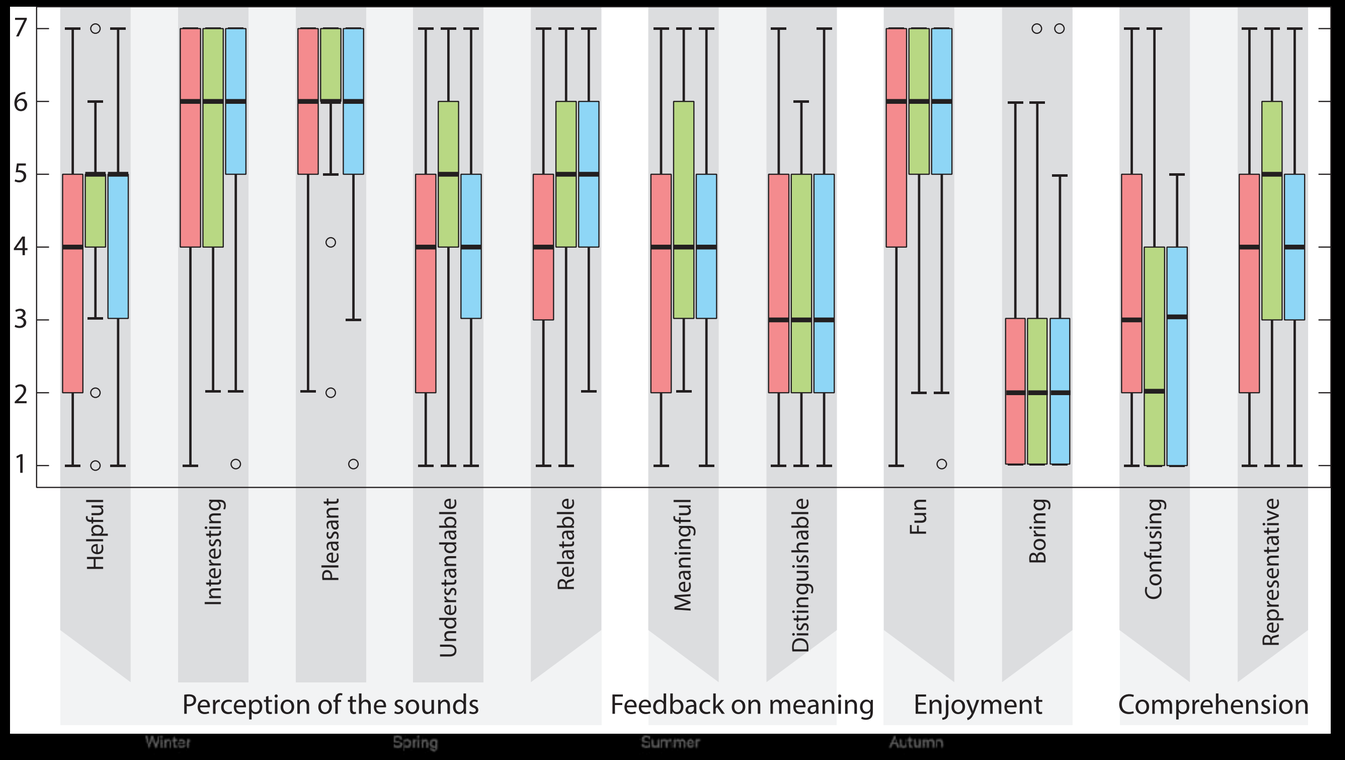
THE SOUND OF RUNNING

AN EVALUATION OF DATA SONIFICATION AND EMOTIONAL EXPRESSION

- Data values ->
  - timbre
  - amplitude
  - tempo
  - auditory icons

- Audio only, text, visualization

- Results BUZZ



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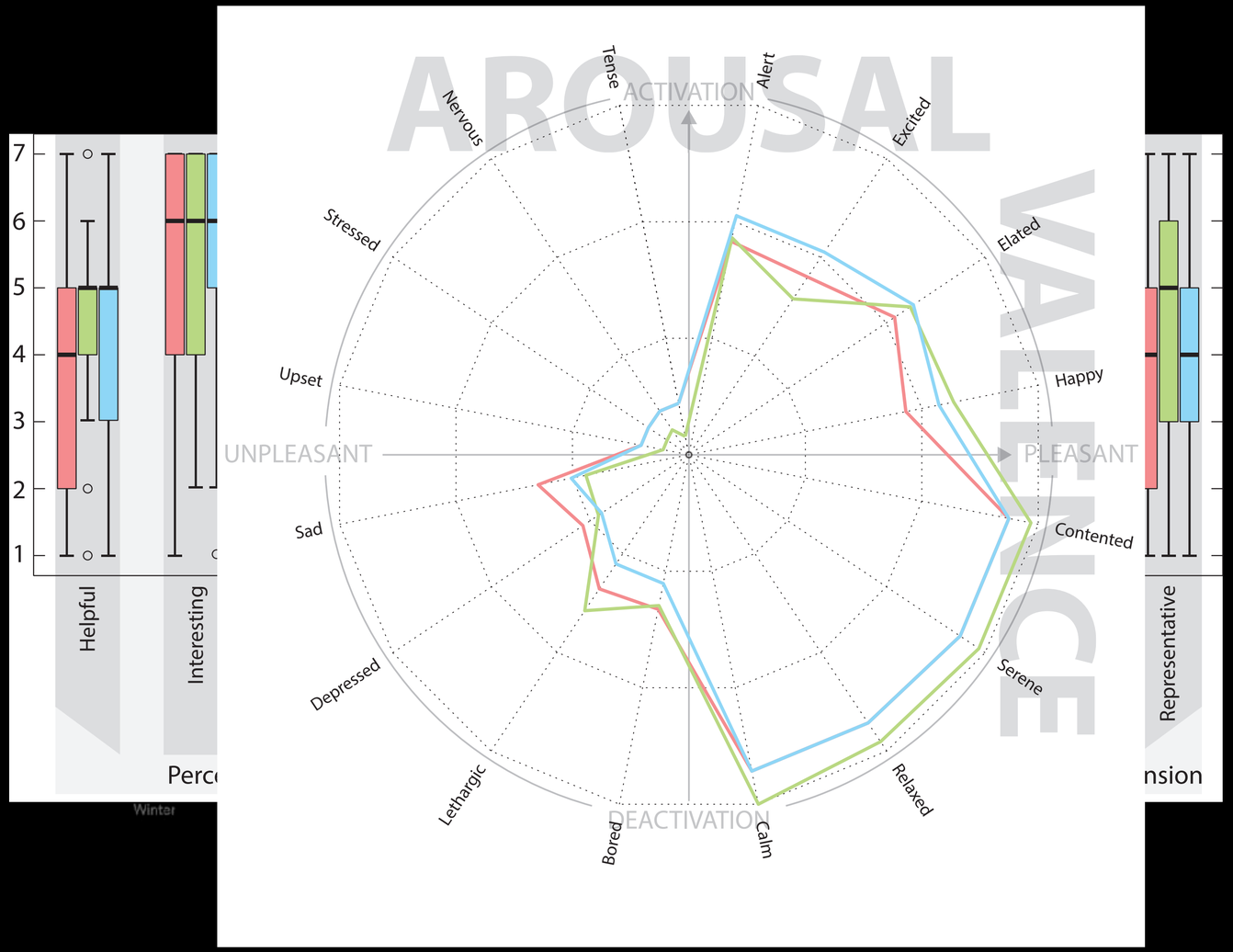
THE SOUND OF RUNNING

AN EVALUATION OF DATA SONIFICATION AND EMOTIONAL EXPRESSION

- Data values ->
  - timbre
  - amplitude
  - tempo
  - auditory icons
- Audio only, text, visualization
- Results BUZZ
- Results emotions



Rönnberg, N. (202?). The sound of running - an evaluation of data sonification and emotional expression

SOME OF MY RESEARCH

WHAT I/WE HAVE FOUND SO FAR...

- Sonification can support the visual perception…
- Sonification can be designed to be experienced as interesting or pleasant…
- Sonification takes longer time…

RESEARCH IDEAS
FOR THE FUTURE

- Explore and develop more evaluation strategies
- Sonification in public spaces for learning, awareness, ticket-to-talk, …
- Sonification for monitoring and control, e.g. Air-traffic control, …
- Sonification for supporting visualization, e.g. OpenSpace, Scientific visualization, …
- Continue exploring musical parameters/parameter mapping