# Caressed by Music

Bruno Laeng RITMO February 2024

# Themes and Questions

1) Touch-at-a-distance?
2) We listen with the ears?
3) Skin-deep Pleasures?
4) Personal Rhythms?
5) Caressed by Music?

# TOUCH AT A DISTANCE

Sound is touch at a distance

**R. Murray Schafer**
(1933 -2021)
Canadian composer, music educator, known for his *World Soundscape Project* and book *The Tuning of the World* (1977).


**Chemical Senses:**
- Smell
- Taste

**Mechanical Senses:**
- Touch
- Hearing

Light Sense
- **Vision**

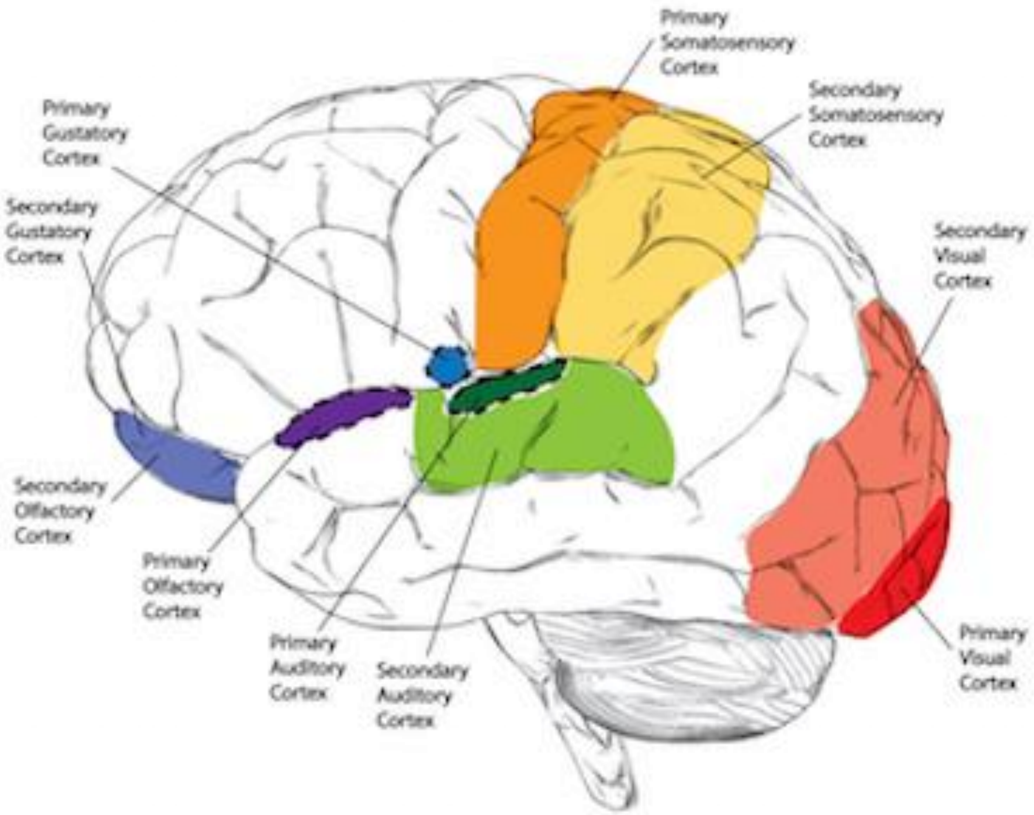
# The organs of touch and hearing have an *ancestral* relationship

In invertebrates (e.g., caterpillars), hairs on the body surface swing to a specific sonar-frequency, effectively resonating to the sound of buzzing wasps (a natural enemy)

# The senses of touch or hearing have an *intimate* relationship

Tactile vibrations activate the human auditory cortex

Auditory frequency is, in turn, represented in somatosensory cortex



# Undetectable very-low frequency sound increases dancing at a live concert

Daniel J. Cameron[1,*], Dobromir Dotov[1,2], Erica Flaten[1], Daniel Bosnyak[2], Michael J. Hove[3], and Laurel J. Trainor[1,2,4]

Current Biology (2022)
Magazine

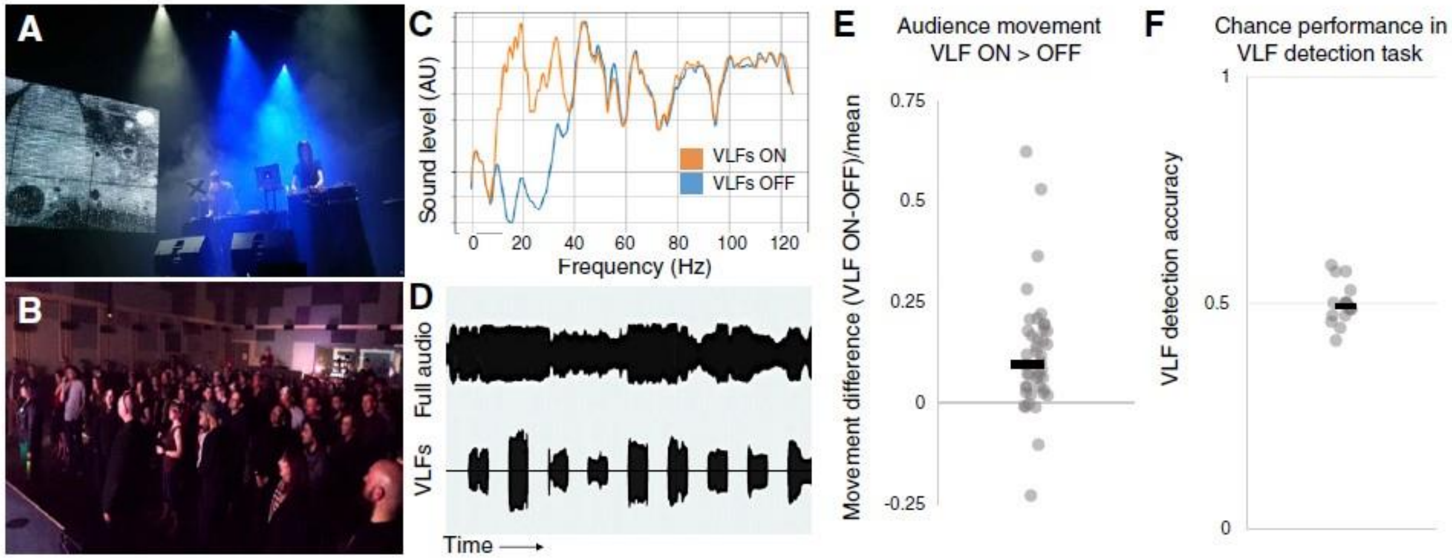



**Figure 1. Audience members at an electronic music performance moved more when very-low frequencies were present vs. absent.**
(A) Orphx performing at the LIVELab. (B) Audience during the concert. (C) Spectral power in concert audio during VLF ON (orange) and OFF (blue). (D) Waveforms of the concert audio (top) and the VLFs (bottom) from the 55-minute period of data collection. (E) Differences in audience participants' normalized movement (VLF ON – OFF) and group mean (black horizontal bar). (F) Participant performance in the VLF detection experiment.

**Evelyn Glennie** (born 1965) is a Scottish percussionist. Glennie has been profoundly deaf since the age of 12, having started to lose her hearing at the age of 8

This does not inhibit at all her ability to perform…

WE LISTEN WITH THE EARS… AND WITH THE SKIN AND BONES…

AND WITH THE EYES TOO

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# Substituting facial movements in singers changes the sounds of musical intervals

Bruno Laeng[1,2]✉, Sarjo Kuyateh[1,2] & Tejaswinee Kelkar[1,3]

Cross-modal integration is ubiquitous within perception and, in humans, the McGurk effect demonstrates that seeing a person articulating speech can change what we hear into a new auditory percept. It remains unclear whether cross-modal integration of sight and sound generalizes to other visible vocal articulations like those made by singers. We surmise that perceptual integrative effects should involve music deeply, since there is ample indeterminacy and variability in its auditory signals. We show that switching videos of sung musical intervals changes systematically the estimated distance between two notes of a musical interval so that pairing the video of a smaller sung interval to a relatively larger auditory led to compression effects on rated intervals, whereas the reverse led to a stretching effect. In addition, after seeing a visually switched video of an equally-tempered sung interval and then hearing the same interval played on the piano, the two intervals were judged often different though they differed only in instrument. These findings reveal spontaneous, cross-modal, integration of vocal sounds and clearly indicate that strong integration of sound and sight can occur beyond the articulations of natural speech.

See P5

Hear M9

# SKIN-DEEP PLEASURES


# DISPLEASURES

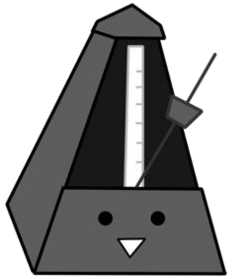
# PERSONAL RHYTHMS

# idiosyncratic timing preferences

Individuals have idiosyncratic stroke-speed preferences for tactile stimulation, as when being caressed on the skin by someone else

People typically rate as the most pleasant the stroking touch velocities between 1 and 10 cm/s

Stroking at these velocities maximally activates a class of nerve fibers in our hairy skin: the CT fibers



# idiosyncratic timing preferences

Asking to set a preferred tempo (*not too slow, not too fast*) on a metronome, most people choose it within the range of 500 and 700 ms (or 86-120 bpm)

Remarkably, individuals prefer a *musical tempo* that is similar to the preferred timing for common repeated actions (e.g., tapping, walking), which appear to peak around 100-120 bpm

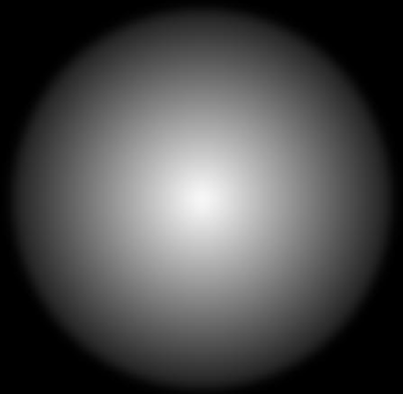
Yet, there are clear inter-individual variations

Wilhelm Stern's

Spontaneous Motor Tempo

Paul Fraisse's

Spontaneous Perceptual Tempo



The **Spontaneous Motor Tempo** and the **Spontaneous Perceptual Tempo** tend to have comparable rates in the same individual

Devin McAuley (2010): Tempo and rhythm.
*Springer Handbook of Auditory Research.*

# Polymodal Coupling

We find regularities between timing patterns across the sensory-motor modalities

Note that these correspondences may not necessarily be expressed - as in some of the previous examples - in absolute synchrony in oscillation (≈ 1:1)

(because sensory systems may have inherently different rates of processing)

They can be coupled in terms of their relative paces

(e.g., a tendency to prefer a relatively *slow* or *fast* pace, within the range of each modality)

# CARESSED BY MUSIC


Uta Sailer
Manuela Zucknick

Our main expectation was that each individual had a specific 'internal' tempo driving 'the pulse' of all modality-specific 'timing pattern generators'

Thus, a key hypothesis is: *If* an individual's internal tempo ticks fast, *then* it will be coupled to a fast pace in all sensory modalities

If it ticks *slow*… this would be matched by slow paces across all sensory modalities

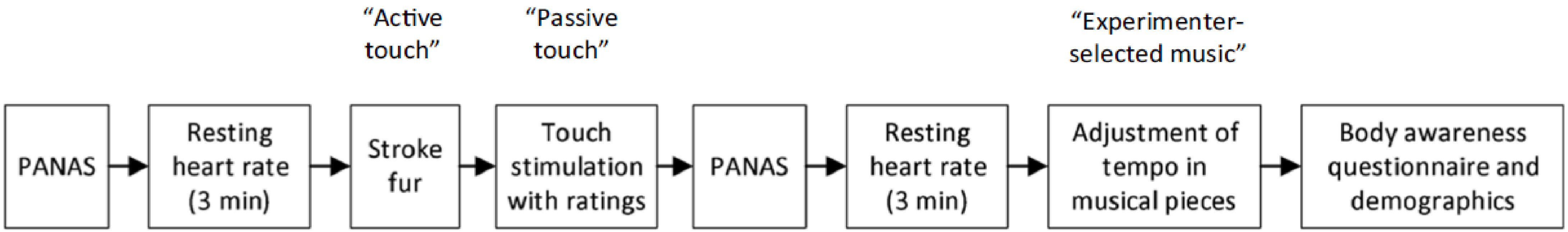
Such a relationship should be strong for modalities that share ancestral biological mechanisms

# We recruited 50 participants (19-33 y.o.)

(regular people, no musicians)

Prior to the experiment, all participants provided titles (and internet links) to 5 musical pieces that they particularly liked to listen to in daily living

*No other instructions were given*

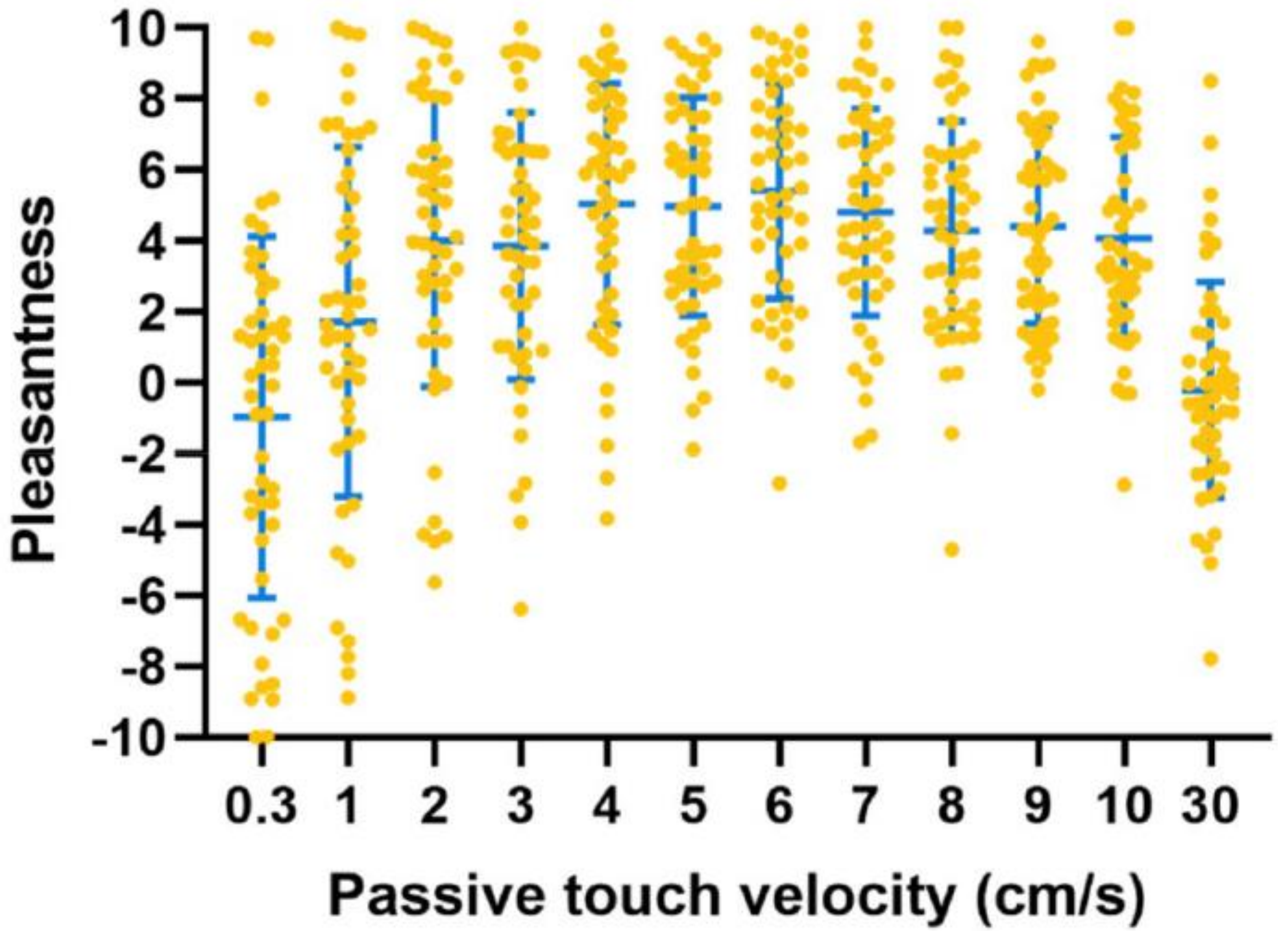



Order of tasks and measures collected during lab visit in study 1.

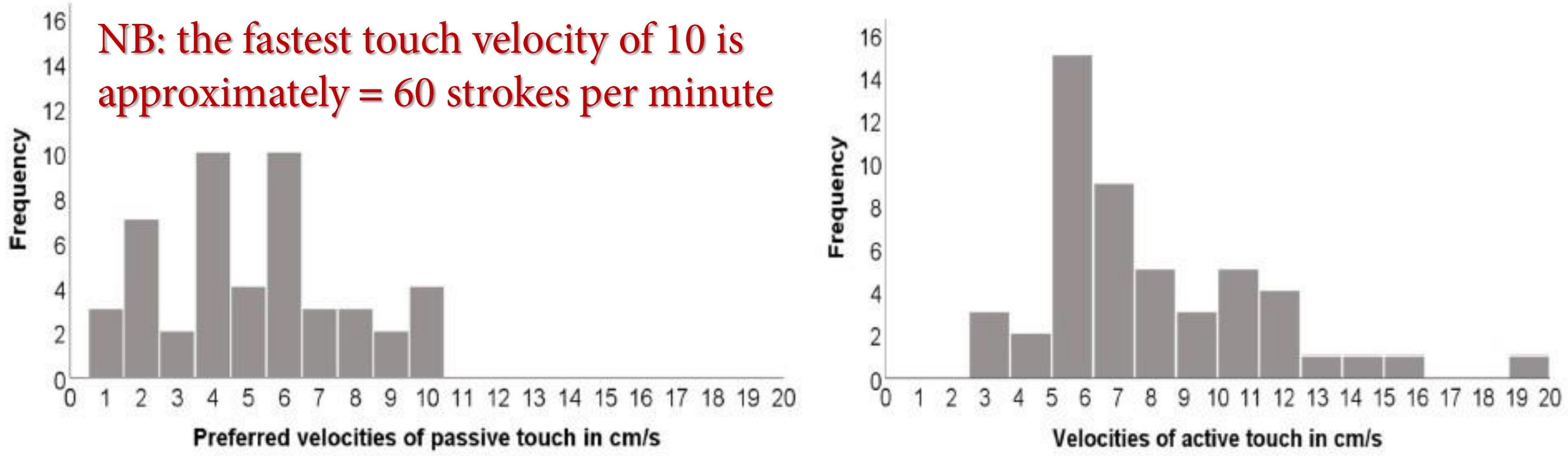
# Slowest stroking velocity: 0.3 cm x sec

# Fastest stroking velocity: 30 cm x sec

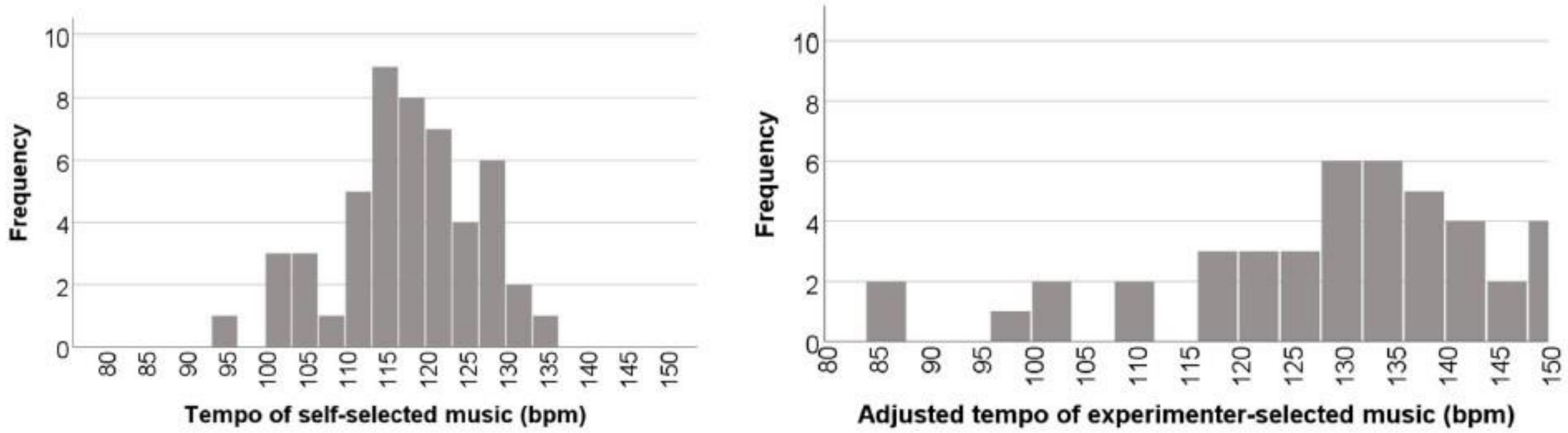
# A medium-range stroking velocity: 10 cm x sec

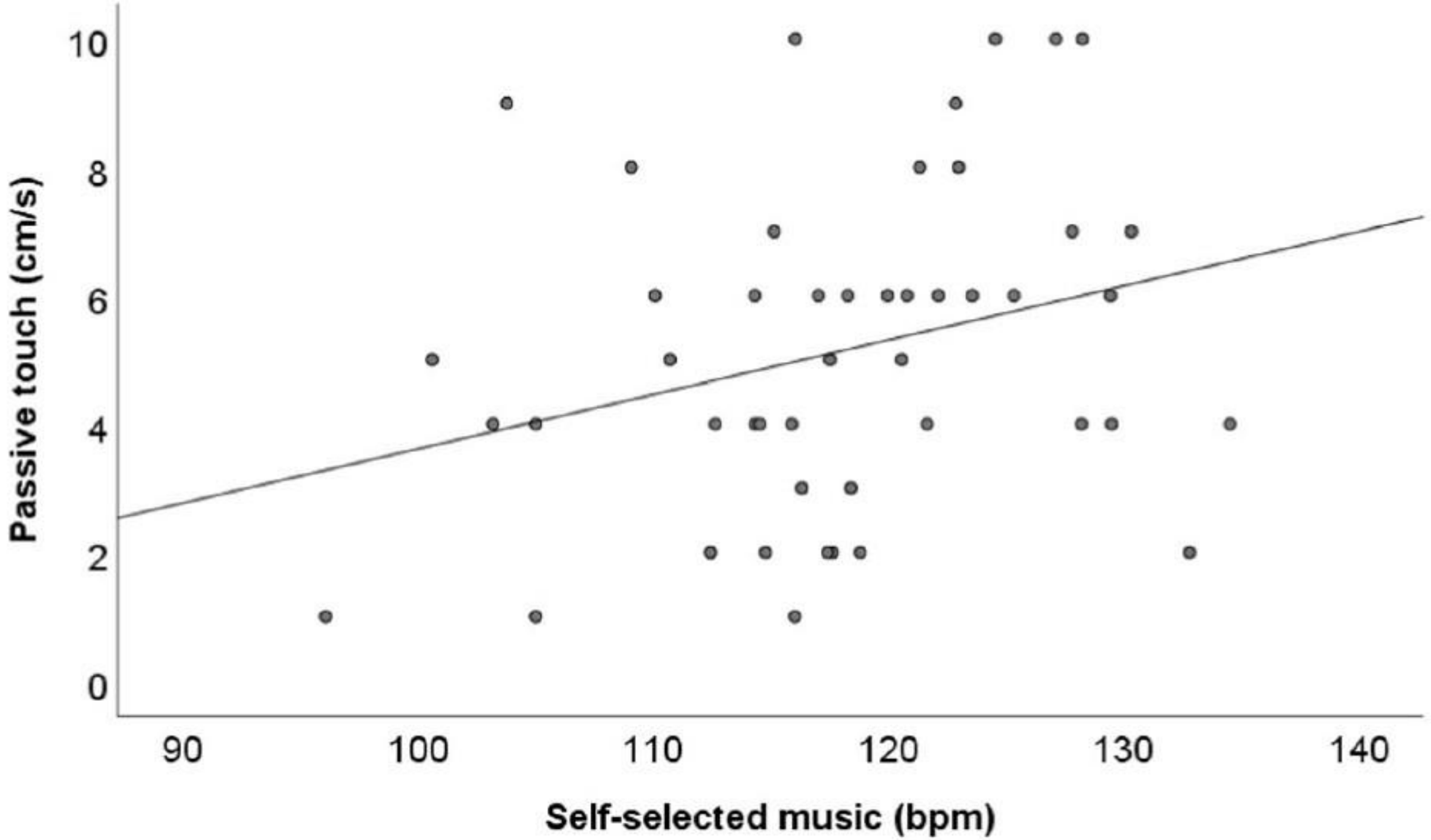

Pleasantness ratings for different touch velocities (passive touch). Higher values indicate higher pleasantness. Each orange dot represents the mean ratings of one participant per velocity. The blue bars indicate mean and standard deviation across participants.




Distributions of preferred velocities of touch (left: passive touch; right: active touch).




Distributions of preferred musical tempos (left: self-selected music; right: experimenter-selected music).

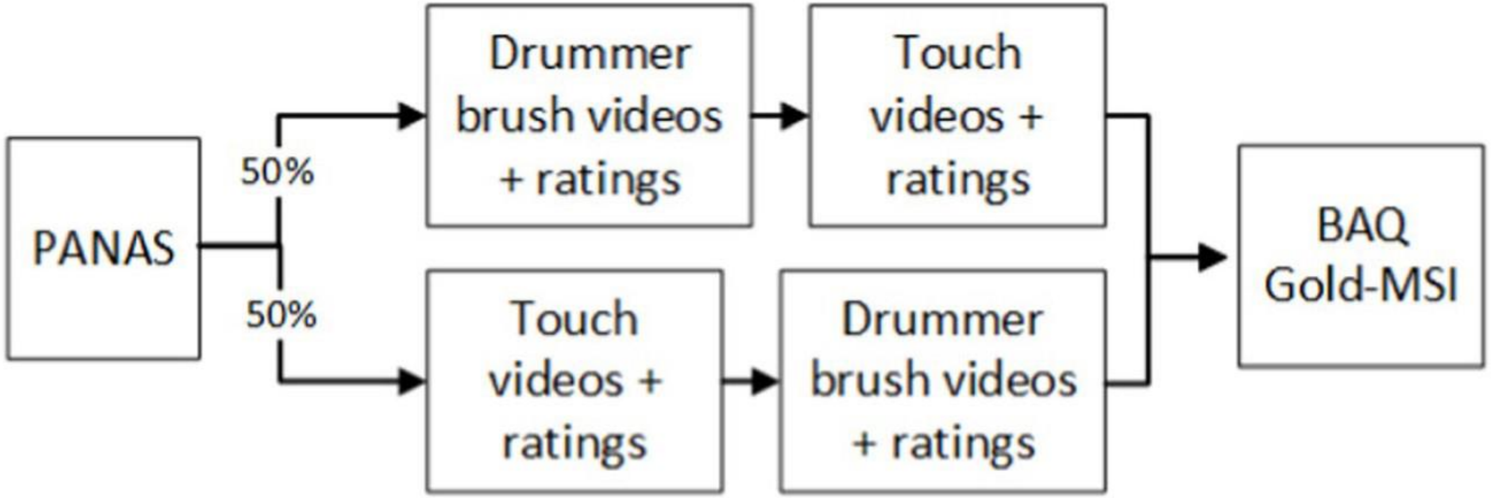



Passive touch and self-selected music correlated moderately with each other

***r* = 0.31, *N* = 48, *p* = 0.03**

# Experiment 2: "The legacy of COVID"

## An online (Prolific) experiment (N= 200) with videos of vicarious caressing *versus* musical brushing



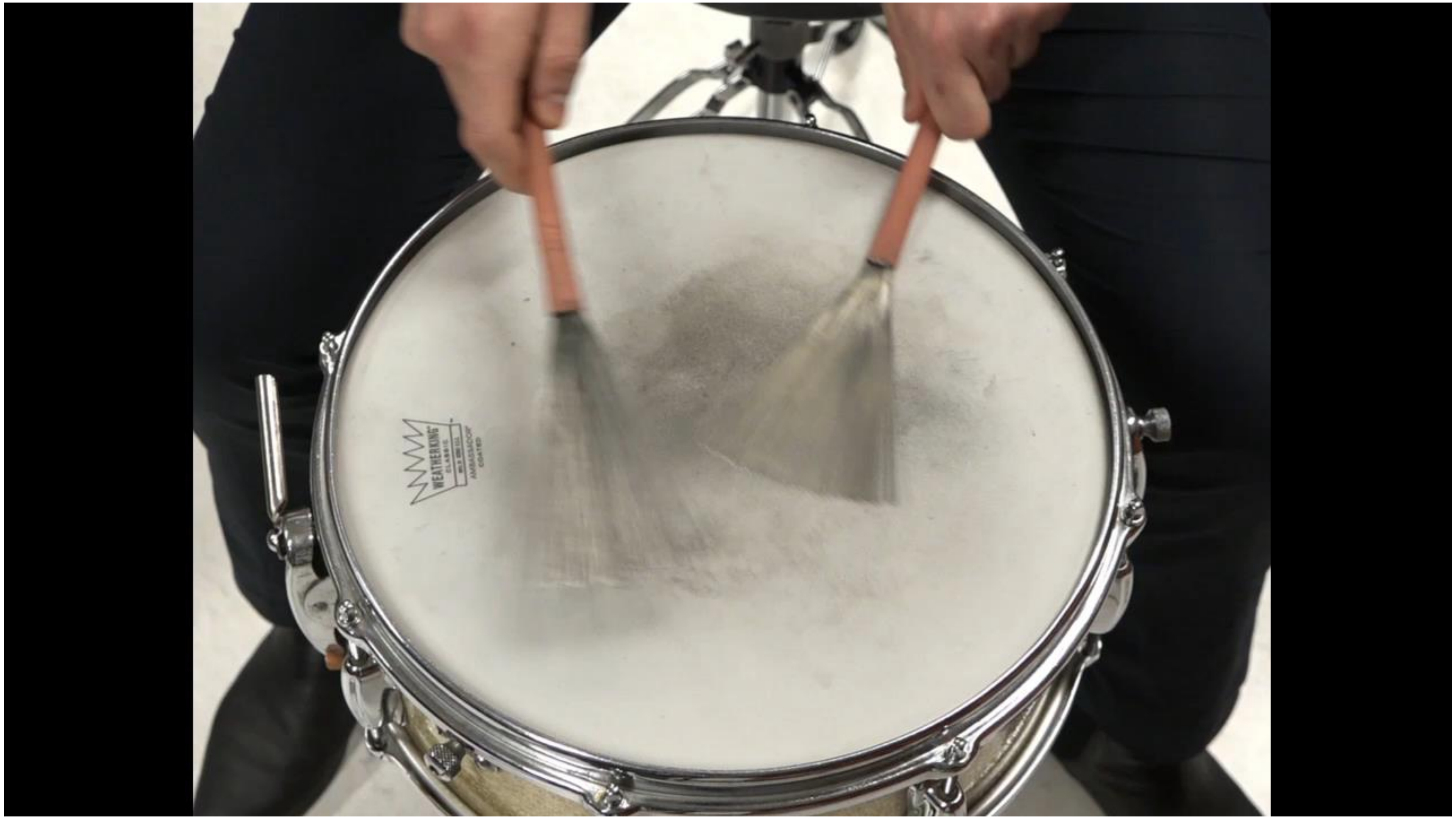

Order of tasks and measures in experiment 2.

# Online participants watched videos of someone being "brushed"

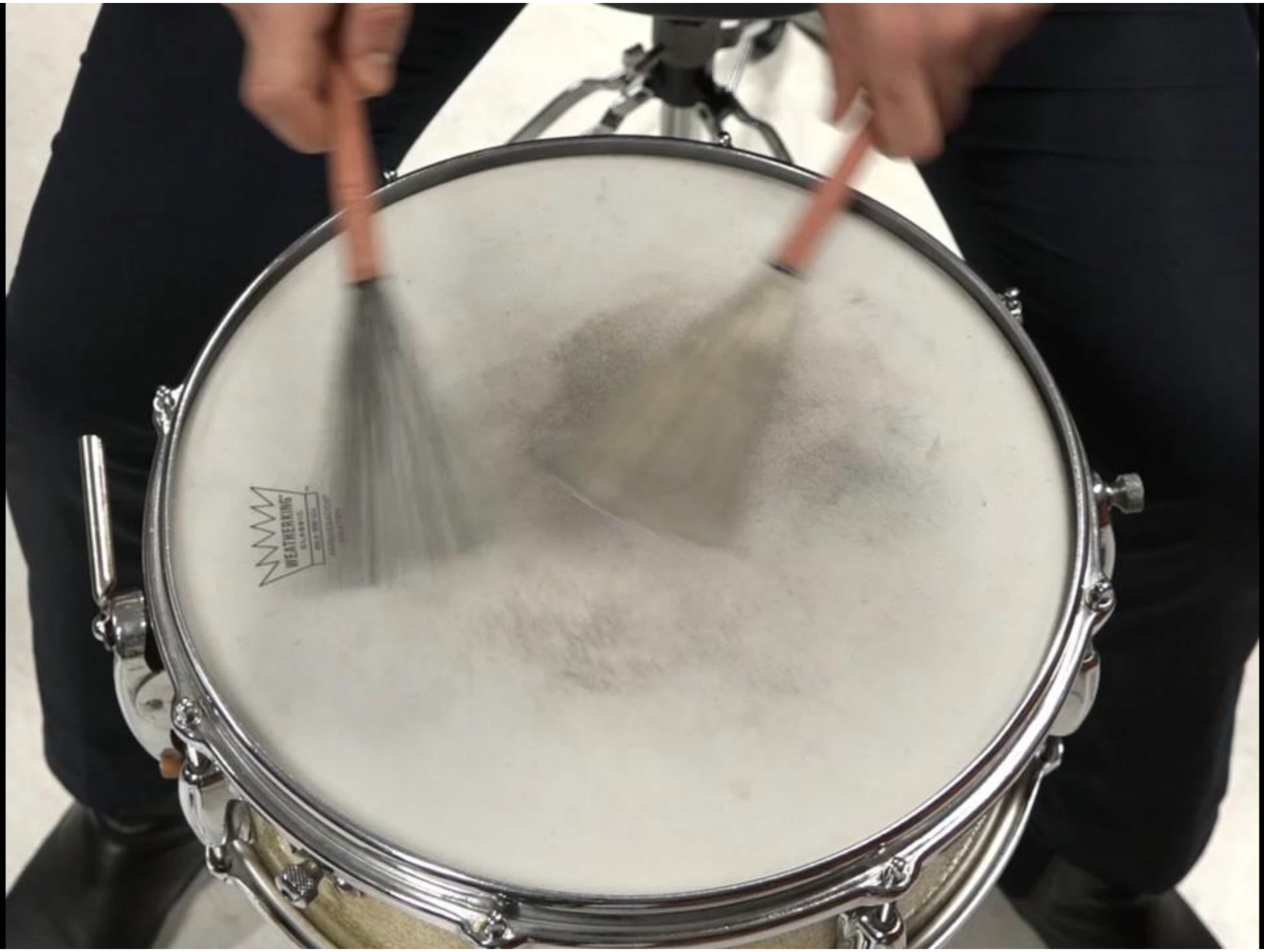
Participants also watched videos of a **snare drum** being "brushed"


Dag Markhus

# Slowest brushing velocity: 96 bpm



# Fastest brushing velocity: 136 bpm



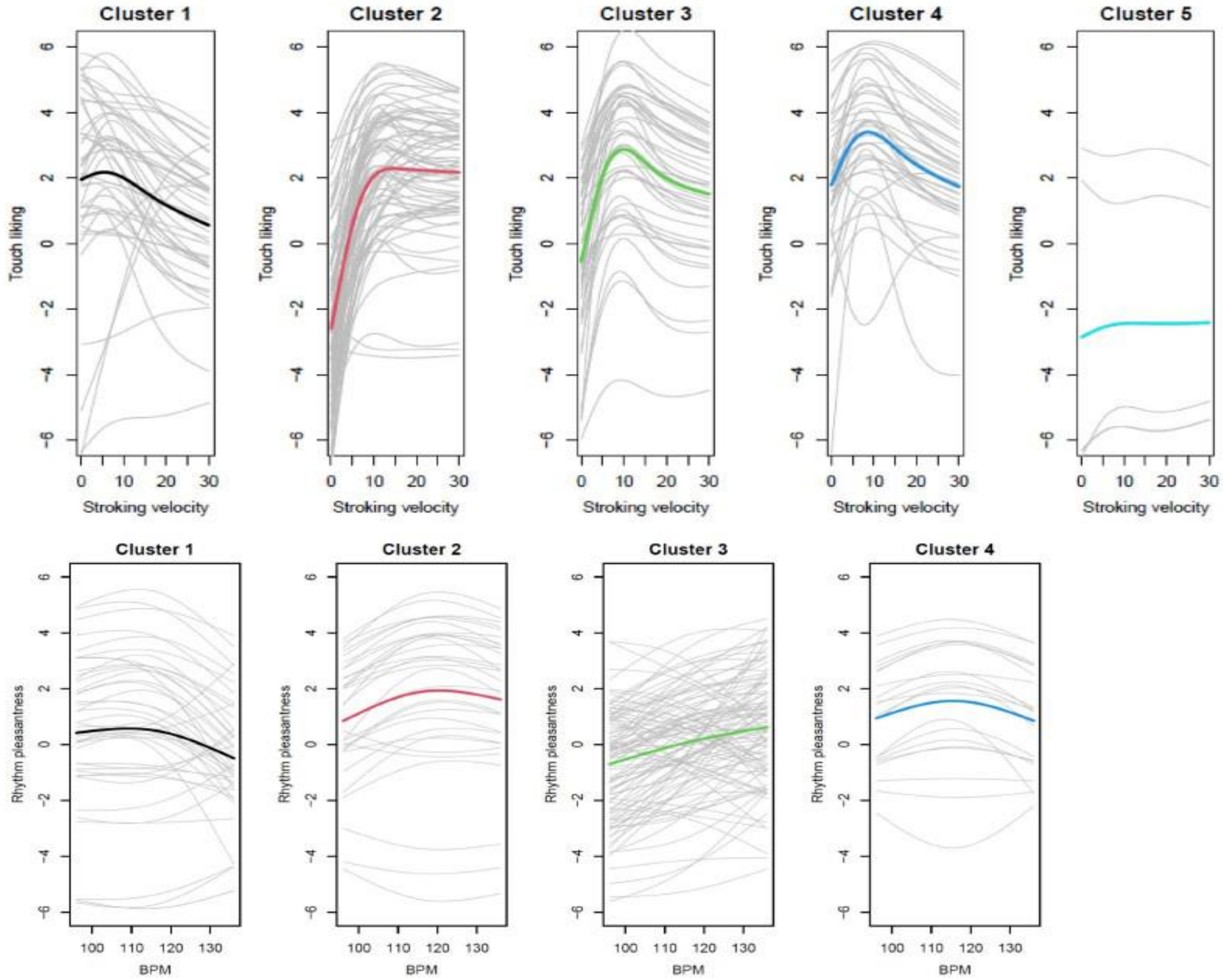
# An intermediate brushing velocity: 115 bpm


The results of the second experiment
were shockingly complex

To determine if there were regularities, i.e. clusters of participants with similar preferences (curve shapes), Manuela Z. performed several *hierarchical cluster analyses*

Touch

Sound

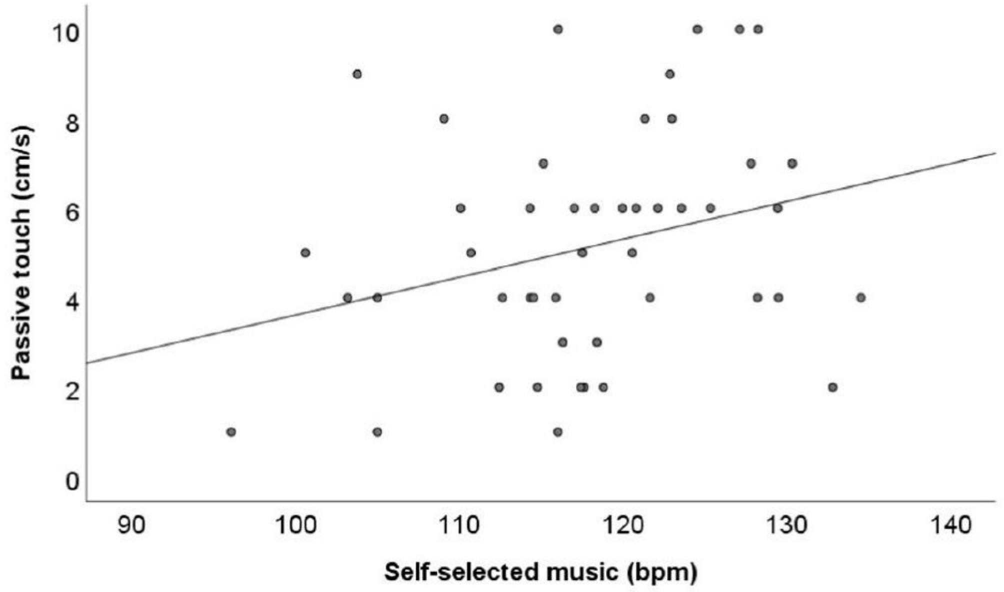



Clustering identified five different curve forms for touch ratings (upper) and two different curve forms for beat ratings (lower).

# FINALE

Preferences for touch and music <u>can be related</u>

However, the relationship seems dependent on being stimulated in a certain way…




It seems that touch must be <u>received</u> on own skin… and music must be chosen personally and likely <u>liked</u>…