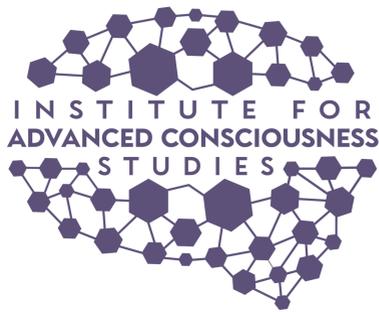


# Neurophysiological Signatures and Prosocial Effects of Augmented Aesthetic Chills

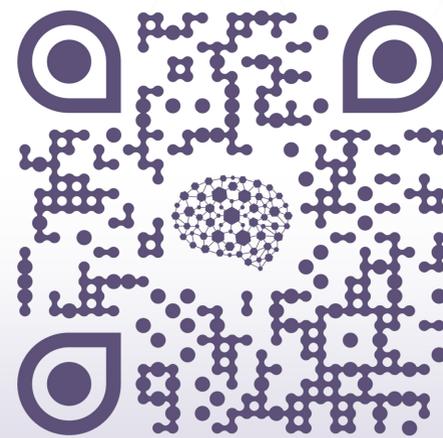
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## SHORT ON TIME? HERE'S THE SUMMARY

This investigation represents the first neurophysiological examination of live-reported aesthetic chills within a substantial cohort (n=120), demonstrating that chill epochs exhibit significantly elevated neural signal complexity across multiple computational metrics (Lempel-Ziv, Permutation Entropy, Higuchi Fractal Dimension). **This complexity increase predicted subsequent enhanced prosociality and altered moral reasoning, establishing neural signal complexity as a critical mediating mechanism underlying social-moral elevating aesthetic experiences.** The findings provide empirical validation for contemporary theoretical frameworks positioning complexity changes as fundamental to consciousness transformation and suggest that aesthetic chills may function as a more democratized alternative to pharmacological promoters of psychedelic states with shared neurophysiological signatures and comparable psychological outcomes.



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## MOTIVATION

→ **Aesthetic chills** represent a promising marker of **self-transcendent experiences**, characterized by ego-dissolution, connectedness, and moral elevation—core phenomenological components **shared with transformative psychedelic states** [1].

→ Neural signal complexity emerges as a critical mediating mechanism underlying psychedelic experiences, facilitating belief updating and cognitive restructuring through enhanced neuroplasticity. We hypothesized that such markers may also be present during aesthetic chills, given their similar capacity for promoting the updating of maladaptive beliefs [2]

→ This investigation represents the first direct examination of neurophysiological correlates of real-time-reported chills as well as their effects on mood and ecologically-valid measures of pro-social belief changes.

## METHODS

→ Participants (n=120) reported on their demographic characteristics, political orientation, religiosity, meditative experience, trait absorption, and big five personality traits.

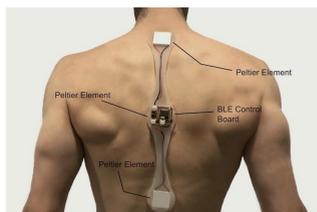
→ Outfitted with a 64-channel EEG headset and physiological sensors, participants closed their eyes and listened to three **empirically validated chills-eliciting stimuli** [3], while reporting on the onset of chills using a clicker device. Half of the participants were also fitted with a "Frisson device" [4].

→ Afterwards, they reported on their mood, emotional break through, psychological insight, and felt self-transcendence (ego-dissolution, connectedness, and moral elevation).

→ They then carried out an ecologically-valid modified Dictator Game, as well as a moral dilemma questionnaire.

→ Following pre-processing, EEG complexity and powerband features were extracted from 4.5s epochs (1.5-6s post-button press to avoid motor confounds) for chills reports and randomly sampled temporally-matched non-chills epochs during music listening. All results are FDR corrected.

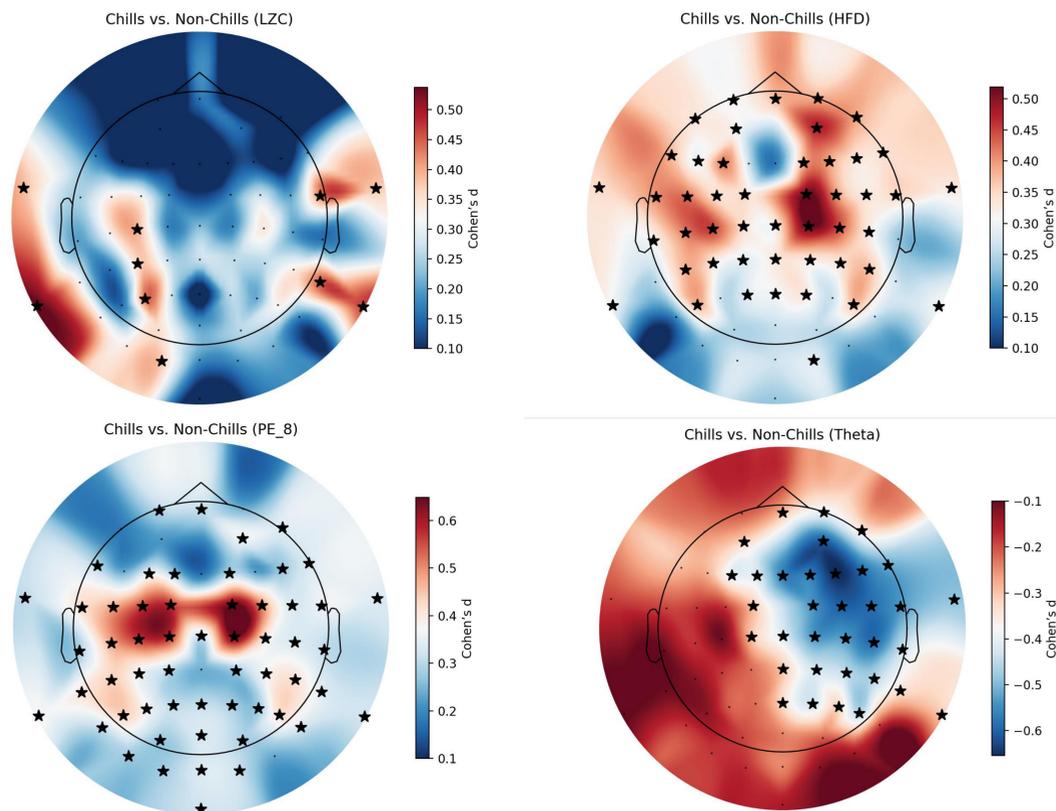
→ Dictator Game generosity, Moral Reasoning tendencies, and Self-Transcendence features (Ego-Dissolution, Moral Elevation) were calculated for each participant, and then used as dependent variables within ANCOVA's to assess the effect of condition, number of chills, traits, and complexity features.



### Frisson Device

triggered a cold sensation down the spine synchronized to empirically defined peak chills moments.

## Aesthetic chills increase neural signal complexity and decrease theta power



## Belief Changes Are Associated with Chills-Related Phenomenology, Frisson Augmentation, and Neural Complexity Increases

**Increase in Monetary Donations:** Permutation Entropy 8 (F = 14.991, p = 0.006), Self Transcendence Scale (F = 18.406, p = 0.004)

**Ego-Dissolution:** Permutation Entropy 64 (F = 7.058, p = 0.033), Religiosity (F = 9.470, p = 0.018)

**Moral Elevation:** Permutation Entropy 8 (F = 4.501, p = 0.042), Chills Number (F = 9.456, p = 0.004)

**Utilitarian Tendencies:** Permutation Entropy 32 (F = 5.834, p = 0.046), Conscientiousness (F = 9.576, p = 0.017)

**Deontological Tendencies:** Condition (F = 7.232, p = 0.031), Conscientiousness (F = 8.743, p = 0.021).

## CONCLUSIONS

- Post-chills EEG epochs show significantly greater complexity and decreased theta compared to non-chills epochs.
- **"Different PE delay lengths predict different outcomes:** PE-8 (Increase in offers, Moral elevation), PE-32 (Utilitarian tendencies), PE-64 (EDI)
- **Higuchi Fractal Dimension** was not significant for any outcome; **Conscientiousness** specifically predicts moral reasoning styles (Utilitarian and Deontological tendencies); and **Religiosity** predicts EDI and marginally predicts Utilitarian tendencies.
- Only **Deontological tendencies** showed sensitivity to the experimental condition (Frisson augmentation)
- Chills appear to be a replicable, controllable micro-transformative state that further demonstrates the intriguing link between increases in neural signal complexity and belief change.

## REFERENCES

- [1] Christov-Moore, L., et al. (2024). *PLOS Mental Health*. <https://doi.org/10.1371/journal.pmen.0000125> [2] Schoeller, F., et al. (2024). *BMC Psychiatry*. <https://doi.org/10.1186/s12888-023-05476-3>  
 [3] Schoeller, F., et al. (2023). *Sci Data*. <https://doi.org/10.1038/s41597-023-02816-6> [4] Haar, A., et al. (2020). *Scientific Reports*. <https://doi.org/10.1038/s41598-020-77951-w>

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