Effect of Light Wavelength on Pseudo-Hallucination Production in the Multi-Modal Ganzfeld

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Background

- **Altered States of Consciousness (ASCs)** are transient multidimensional changes in subjective experience, which can be induced through a variety of methods (Ludwig, 1966; Vaitl et al., 2005; Fort et al., 2025).
- The **Multimodal Ganzfeld (MMGF)** is a controlled non-pharmacological induction method of ASCs that combines homogeneous visual and auditory stimulation to reduce external sensory input, that sometimes leads to the emergence of **pseudo-hallucinations (PHs)** (Wackermann et al., 2008; Schmidt et al., 2020).
- Recent studies suggest that **light wavelength** might modulate ASC content (Kübel et al., 2021):
  - **Red light** is associated with **increased arousal** and **duration**
  - **Green light** is linked to **relaxation**

➢ *Does red light, via increases in biological arousal, lead to increased psuedo-hallucinations?*

Method

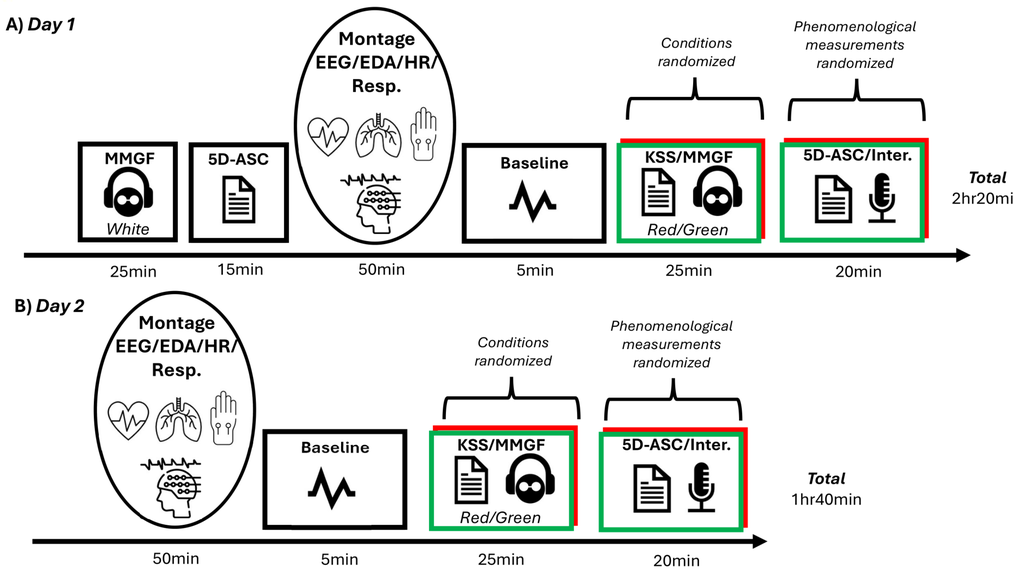


Figure 1. *Design & Procedure*. Within-subjects design (n = 33) over two days. Healthy volunteers (Age: 19 - 75). Deception-based blinding. White light MMGF as a pseudo-control (training).

Psychometric Measures

- Five Dimensional Altered States of Consciousness (**5D-ASC**) Rating Scale
- Dissociative Experiences Scale II (**DES-II**)
- Tellegen Absorption Scale (**TAS**)
- Vividness of Visual Imagery (**VVIQ**) Questionnaire
- **OCEAN** Questionnaire

Results

	Variable	Statistic (*W*)	*p*FDR	Effect Size (r)
5D-ASC	General Altered State Score (G-ASC)	215	.42	.202
	Oceanic Boundlessness	161	.11	.37
	Dread of Ego Dissolution	197	.29	.258
	Visionary Restructuralization	323	.55	.131
	Auditory Alterations	253	.84	.034
	Vigilance Reduction	360	.30	.246
11-ASC	Experience of Unity	173	.75	0
	Spiritual Experience	156.5	.43	0
	Blissful State	147.5	.23	.303
	Insightfulness	249	.43	0
	Disembodiment	108	**.03***	.476
	Impaired Control and Cognition	229	.47	.159
	Anxiety	96	**.02***	.517
	Complex Imagery	375	**.02***	.508
	Elementary Imagery	328	.29	.271
	Audio-Visual Synesthesia	238	.75	0
	Changed Meaning of Percepts	84	**.02***	.501

Table 1. *Wilcoxon Signed-Rank Test Results (paired).* Statistical results are reported using Wilcoxon signed-rank tests (*W*), with FDR-corrected p-values (*p*FDR) and effect sizes (*r*). **Red light** induced significantly more **intense Complex Imagery** experiences**. No significant differences** were found between Red and Green light for **Elementary Imagery**. Green light induced significantly more Disembodiment, Anxiety, and Changed Meaning of Percepts.

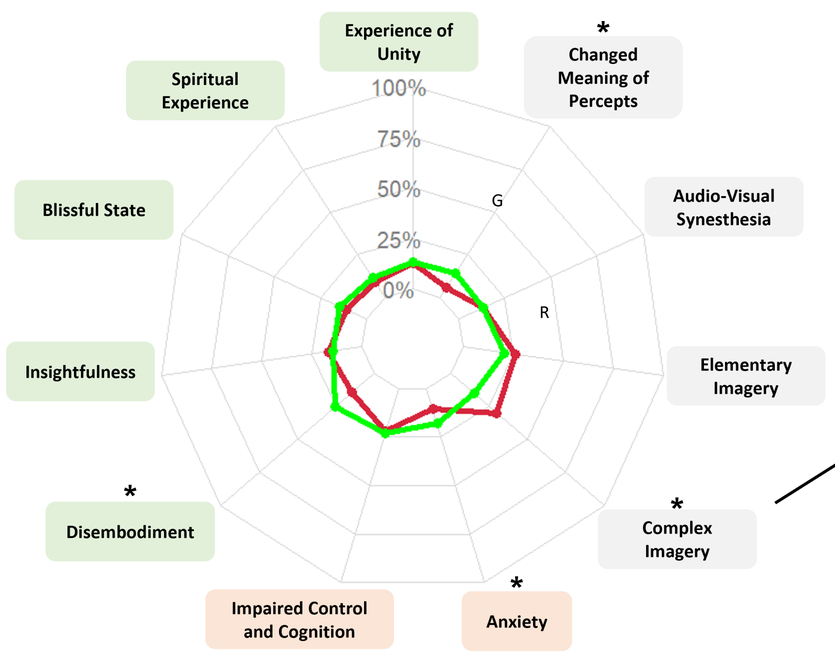


Figure 2. *Radar plot of 5D-ASC (11 factors) Comparison of Red vs. Green MMGF***.** Red light (red) compared to green light (green) for n=33. *=p<0.05

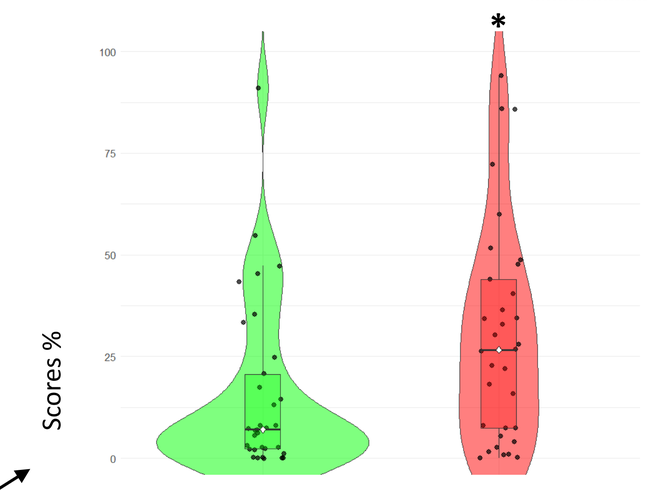


Figure 3. *Violin plot of Complex Imagery scores (Red vs. Green).* Scores significantly higher in Red condition (Wilcoxon signed-rank test with FDR correction). Each dot = 1 participant. The distribution in the Red condition was more spread out and skewed toward higher values.

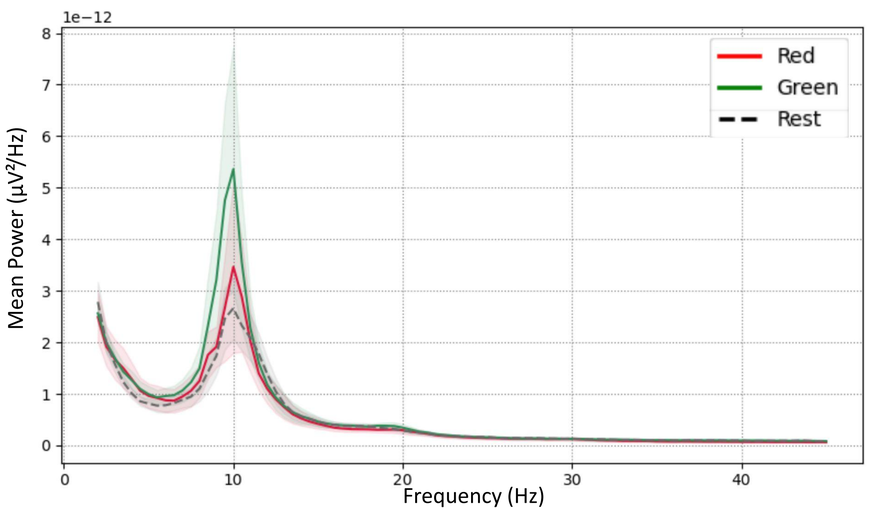


Figure 5. *EEG spectral power in PHs participants (n=7)***.** Mean occipito-parietal power spectral density (8–12 Hz) in Red and Green conditions for participants who reported pseudo-hallucinations. Alpha peaks were present in both conditions, indicating altered but wakeful states.

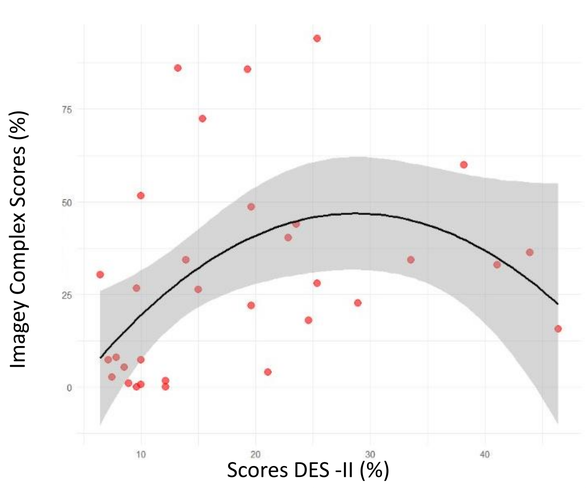
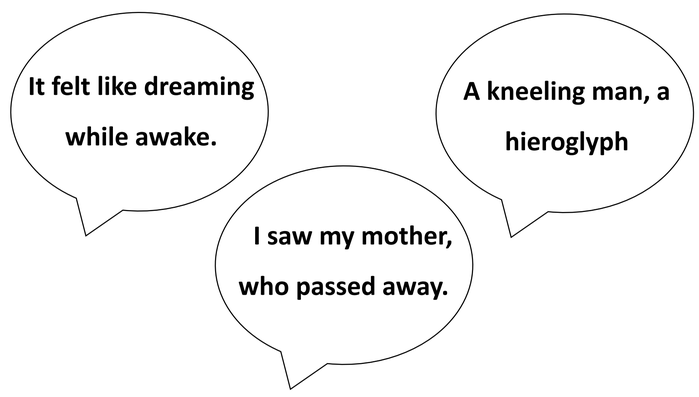


Figure 4. *DES-II vs. Complex Imagery scores.* After Spearman correlation showed a strong positive association (ρ = .461, p < .001), a significant quadratic relationship was observed (p = .028, R^2 = 21.8%), indicating that moderate levels of dissociation were associated with the highest Complex Imagery scores.

Figure 6. *PH Examples from Free Association Interviews.*



Conclusion

❖ In the **red-light condition**, participants **reported significantly more Complex Imagery** than in the green condition, with **no difference in Elementary Imagery**. This supports a **specific phenomenological effect of red light** in **enhancing the richness and complexity** of **internally generated experiences.**

❖ Preliminary EEG data suggest that participants retained occipito-parietal alpha peaks in both red and green conditions, consistent with **an altered but wakeful state**, **distinct from sleep or dreaming**. Interestingly, mean alpha power was higher in the green condition, which may reflect increased cortical inhibition or reduced visual engagement, although no significant differences were found.

❖ **Complex pseudo-hallucinations** were often reported in **both** color conditions by the same individuals, suggesting an underlying **susceptibility**. This was further supported by trait-level data: **dissociation (DES-II)** correlated with Complex Imagery intensity, especially at **moderate levels.**

❖ MMGF offers a **non-pharmacological, low-risk, and reversible method** for inducing hallucination-like states in healthy individuals, particularly in its red-light version, making it a valuable tool for **investigating** their **neural and experiential correlates.**

❖ Finally, the narrative and symbolic quality of some reports, including references to autobiographical memories, suggests that MMGF could also serve as a potential therapeutic induction method, by facilitating the emergence of internally generated imagery.

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