FN-Wahrnehmung-Gestalt-EN-v0.1-2026-05-17

Research Note — Gestalt Laws

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1. Thesis

The perception strand has so far shown **that** interpretation takes place. L1 showed the unambiguous misinterpretation (everyone sees the Müller-Lyer line equally wrongly), L2 and L3 supplied mechanisms (lateral inhibition, opponent colours), L5 showed the flipping interpretation (bistable figures). What remained open: **by what rules** is interpretation made?

The tested baseline model M1 reads: *"We see what is there. Grouping is a property of the image — what belongs together is in the stimulus; perception reads it off."*

This module's claim: grouping is not a property of the stimulus but an **attribution**. And the rules by which attribution happens are not laws in the strict sense but **competing weights** — which is why, under balanced competition, they yield no unambiguous result and perception flips.

With this the strand closes: the gestalt laws explain **when** the bistability from L5 occurs.

2. Assumptions

1. Grouping tendencies can be quantified as strengths.
2. The proximity tendency falls monotonically with distance.
3. With several possible groupings, the ratio of strengths decides.
4. Luminance profiles are measurable and fully represent the physical stimulus.
5. Different gestalt factors can be weighted additively (a simplification).

3. Mathematical model

M1 — "grouping is in the image": The perceived grouping is uniquely determined by the stimulus.

M2 — proximity quantified. After Kubovy & Wagemans (1995) the attraction between two dots at distance d falls exponentially: $$s(d) = \exp\!\left(-\alpha\left(\frac{d}{d_{\text{ref}}}-1\right)\right),$$

\qquad \alpha \approx 2.5.\] For a lattice with spacings \(d_x\) and \(d_y\) the fraction of column perception is \[p_{\text{columns}} = \frac{s(d_x)}{s(d_x)+s(d_y)}.\]

M3 — illusory contours. The luminance contrast along a line: \[C = \max(L) - \min(L), \qquad G = \max\left|\frac{dL}{dx}\right|.\] For a real edge \(C > 0\); for the illusory edge of the Kanizsa triangle \(C = 0\).

M4 — competition. If similarity additionally acts with weight \(w\) in favour of rows: \[p_{\text{columns}} = \frac{s(d_x)}{s(d_x)+s(d_y)\,(1+\beta w)}, \qquad \beta = 1.8.\]

Symbol	Meaning	Unit
\(s\)	grouping strength	—
\(\alpha\)	proximity decay parameter	—
\(w\)	weight of similarity	—
\(C\)	luminance contrast	—

4. Parameters

Scenario	Setup
A proximity	aspect ratios \(d_x/d_y\) from 0.5 to 2.0; \(\alpha = 2.5\)
B contours	luminance profile across the illusory edge (400 points), comparison with a real edge
C competition	six aspect ratios × four similarity weights

Tolerance: \(\varepsilon = 0\) — one case suffices where perception is not determined by the stimulus.

5. Prediction

Scenario	Expectation
A	no unambiguous result for the square lattice
B	contrast along the illusory edge exactly zero
C	similarity can override proximity; ambiguous cases occur

6. Falsification criterion

M1 is refuted as soon as (a) a physically symmetric stimulus leads to ambiguous perception, (b) something is perceived that is measurably absent from the stimulus, or (c) the same arrangement is grouped differently depending on an additional factor.

7. Competing models

- **K1 — imaging theory (M1):** tested baseline.
- **K2 — Wertheimer's gestalt laws (1923):** proximity, similarity, good continuation, closure, common fate — as qualitative principles.
- **K3 — quantitative formulation (Kubovy & Wagemans 1995):** grouping as a comparison of strengths.
- **K4 — Prägnanz tendency:** the visual system selects the simplest

interpretation — formulated as a single principle but hard to operationalise.
- **K5 — Bayesian interpretation:** gestalt factors as priors about the structure of natural scenes.
- **K6 — neural correlates:** illusory contours elicit responses in V2 (von der Heydt et al. 1984) — the construction is physiologically demonstrable.

8. Domain of failure

- **The parameter \(\alpha = 2.5\) is a plausible order of magnitude**, not fitted to own data. The structure of the claims (tipping point at \(d_x = d_y\), continuous transition) is independent of it; the concrete fractions are not.
- **Additive weighting is a simplification.** Real gestalt factors interact nonlinearly; \(\beta = 1.8\) is a model value.
- **Only two factors.** Good continuation, common fate, symmetry and connectedness are absent.
- **Static stimuli.** Motion-based grouping (common fate) would be the connection to the open module L4.
- **Individual differences and learning effects** are not modelled.
- **The Prägnanz tendency remains vague.** "Simplest interpretation" is circular without a measure of simplicity — a well-known problem of gestalt psychology that this module does not solve.

9. Simulation

Numerical evaluation in `gestalt_simulation.py`:

1. Scenario A: grouping strengths for nine aspect ratios; fraction of column perception; determination of the ambiguous range.
2. Scenario B: luminance profile across the illusory edge; contrast and gradient; comparison with a real edge.
3. Scenario C: 24 combinations of aspect ratio and similarity weight; count of ambiguous cases; tipping-point determination.

Results in `gestalt_results.json`, plot as `gestalt_szenen.svg`.

10. Result

10.1 A — proximity quantified

\(d_x/d_y\)	fraction columns	interpretation
0.5	0.777	columns
0.7	0.679	columns
0.85	0.593	columns
0.95	0.531	ambiguous
1.0	**0.500**	**ambiguous**
1.05	0.469	ambiguous
1.2	0.378	rows
1.5	0.223	rows
2.0	0.076	rows

Assessment M1: refuted.

10.2 B — illusory contours

Quantity	Illusory edge	Real edge
luminance contrast	**0.0**	0.25
maximum gradient	**0.0**	0.125
physically present	**no**	yes
perceived	**yes**	yes

Assessment M1: refuted.

10.3 C — competition of the laws

Quantity	Value
combinations tested	24
of these ambiguous	4
lattice \(d_x/d_y = 0.8\) (proximity favours columns)	—
similarity weight to flip	**0.361**

Assessment M1: refuted.

11. Assessment

M1 (“we see what is there”) is refuted in all three scenarios — and the three refutations form an escalation.

Scenario A shows grouping as attribution. A dot lattice contains neither rows nor columns. It contains dots. That we see rows or columns is an achievement of the visual system, not a property of the stimulus.

Normally this goes unnoticed because the attribution is unambiguous: at \(d_x/d_y = 0.5\), 78 % see columns, at 2.0 only 8 %. The transition is continuous and follows the spacing ratio. **The decisive case is \(d_x = d_y\).** A square lattice is physically perfectly symmetric — there is no preferred direction, no reason to favour rows or columns. The fraction is exactly 0.500, and perception becomes **ambiguous**: sometimes rows, sometimes columns, and it flips.

The square dot lattice is thus a bistable stimulus — the same situation as the Necker cube from L5. This is not an analogy but the same mechanism: two interpretations are equally well supported, neither wins, so the system alternates.

Scenario B shows generation instead of distortion. For the Kanizsa triangle one measures a luminance contrast of **exactly zero** and a gradient of **exactly zero** along the perceived edge. For comparison: a real edge has contrast 0.25. There is simply no edge there — the background is uniformly white.

Nevertheless one is seen, and more: the illusory triangle appears **brighter** than the background although both are identical. The visual system interprets the three cut-out circular sectors as **occlusion** — and what occludes must lie in front, must have edges, must be a surface.

This is an escalation over everything previous in the strand. L1 showed distortion: the Müller-Lyer lines *are* present, they are merely misjudged. L5 showed alternation: the Necker cube *is* present, it is merely interpreted differently. **L6 shows generation: the edge is not present and is seen nonetheless.** And it is not merely a

subjective claim — von der Heydt et al. demonstrated in 1984 that neurons in V2 respond to illusory contours as if they were real. The construction is physiologically anchored.

Scenario C clarifies the logical status of the gestalt laws. Since Wertheimer (1923) they have been carried as a list: proximity, similarity, good continuation, closure, common fate. Two problems have accompanied this list for a century: it was never completed, and there is no ranking among its entries.

The calculation shows why. A lattice with \(d_x/d_y = 0.8\) clearly favours columns through proximity. Introducing colour similarity along the rows flips perception at a weight of **0.361** — the same dot arrangement is then seen as rows. Of 24 combinations tested, 4 are ambiguous.

The gestalt laws are not laws in the strict sense but competing weights in a trade-off. This dissolves both old problems: a ranking cannot exist because the outcome depends on the balance of forces in each case; and the list could never be completed because every new factor is simply another weight, not another rule.

The completion of the strand. Five modules now form a complete arc:

- **L1** — interpretation happens, and unambiguously wrongly (illusions)
- **L2/L3** — how it works mechanistically (lateral inhibition, opponent colours)
- **L5** — it can be ambiguous and flip (bistability)
- **L6** — by what rules interpretation happens, and that the rules compete

The connection between L5 and L6 is not merely thematic. **L6 explains when L5 occurs:** bistability is not an exotic special case but the normal case under balanced competition. Where the gestalt factors yield an unambiguous result, we see unambiguously and notice nothing. Where they balance, perception flips — and precisely then the constructive character becomes visible.

With this the cave-allegory core (Module 02) is fully worked out, and not as a metaphor but as a computed claim: **we do not see the stimulus but the best interpretation of the stimulus according to weighted principles — and where several interpretations are equally good, we alternate between them.**

12. Next test

Module L4 Motion Illusions (MOTUS) remains the only gap in the strand: phi phenomenon, waterfall illusion, common fate as a motion-based gestalt factor.

Possible extension v0.2: further gestalt factors (good continuation, symmetry, connectedness); nonlinear interaction instead of additive weighting; Prägnanz with an operationalised simplicity measure; figure-ground factors; neural correlates in V1/V2 quantitatively.

Appendix A — Cross-references

- Practice explanation: `PRAXIS-Gestalt-EN.md` · Companion paper: `BEGLEITPAPIER-Gestalt-EN.md`
- Tool: `GESTALT.html`
- Code: `gestalt_simulation.py` · Plot: `gestalt_szenen.svg` · Data:

`gestalt_results.json`

- **Strand modules:** 02 cave allegory (core), L1 illusions, L2 brightness contrast, L3 opponent colours, L5 bistability
- **Related merge modules:** M1 signal chain (interpretation as a station), N1/N2 (task-specific perception)

Appendix B — External stocktaking

- **Wertheimer (1923)** — the gestalt laws.
- **Kanizsa (1955)** — illusory contours.
- **von der Heydt, Peterhans & Baumgartner (1984)** — neural responses to illusory contours in V2.
- **Kubovy & Wagemans (1995)** — quantitative formulation of proximity.
- **Wagemans et al. (2012)** — review of a century of gestalt psychology.

What the workshop note adds: the bringing together into a falsification of imaging theory; the calculation identifying the tipping point at the symmetric lattice as a bistable stimulus, thereby connecting L5 and L6; the framing of the gestalt laws as weights rather than laws, dissolving the two old problems (ranking, completeness).

Appendix C — Sources

- Wertheimer, M. (1923). Untersuchungen zur Lehre von der Gestalt II. *Psychologische Forschung* 4:301–350.
- Kanizsa, G. (1955). Margini quasi-percettivi in campi con stimolazione omogenea. *Rivista di Psicologia* 49:7–30.
- von der Heydt, R.; Peterhans, E.; Baumgartner, G. (1984). Illusory contours and cortical neuron responses. *Science* 224:1260–1262.
- Kubovy, M.; Wagemans, J. (1995). Grouping by proximity and multistability in dot lattices. *Psychological Science* 6:225–234.
- Wagemans, J. et al. (2012). A century of Gestalt psychology in visual perception. *Psychological Bulletin* 138:1172–1217.

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