

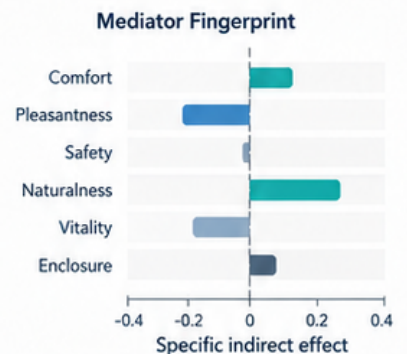
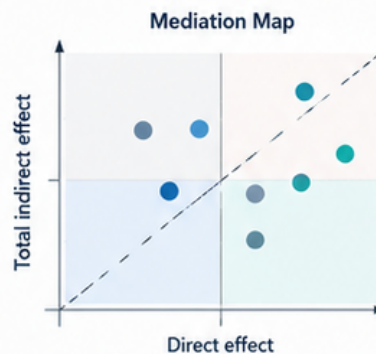


Visualscapy

VWP MEDIATION SIGNATURE

A visual grammar for interpreting perceptual mediation mechanisms in visual walkability research

FROM **PIXELS**
TO **PERCEPTION**
TO **INSIGHT**



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1. What is Visualscapy?

A visual grammar for interpreting perceptual mediation mechanisms

Visualscapy is a new visual grammar designed to translate complex mediation outputs into intuitive and interpretable visual mechanisms in Visual Walkability Perception (VWP) research. It summarises, in a single and coherent representation, how each visual component affects VWP directly and indirectly through multiple perceptual mediators.

One visual component = one mediation signature.

Each component is represented by two complementary visualisations:

(1) a Mediation Map showing the direction and structure of the mechanism, and (2) a Mediator Fingerprint revealing the perceptual composition of the indirect effect.

1.1 The problem: complex results, difficult to read

Mediation analysis with multiple perceptual mediators produces a large number of coefficients for each visual component: direct effects, specific indirect effects, total indirect effects and confidence intervals. When several components and mediators are considered, the results are often presented in long tables, which makes it difficult to quickly understand the mechanisms and to compare components.

Example of traditional mediation output (one component)

Path	Coefficient	Boot SE	95% CI	p-value
Direct effect (c')	0.18	0.06	[0.07, 0.29]	0.001
Indirect via Comfort (a_1b_1)	0.12	0.05	[0.04, 0.21]	0.003
Indirect via Pleasantness (a_2b_2)	0.08	0.04	[0.01, 0.16]	0.021
Indirect via Safety (a_3b_3)	-0.05	0.03	[-0.11, -0.01]	0.018
Indirect via Naturalness (a_4b_4)	0.14	0.06	[0.03, 0.27]	0.010
Indirect via Vitality (a_5b_5)	0.03	0.02	[-0.01, 0.08]	0.112
Indirect via Enclosure (a_6b_6)	-0.02	0.02	[-0.06, 0.02]	0.298
Total indirect effect (I)	0.30	0.08	[0.15, 0.46]	<0.001

1.2 The Visualscapy solution: from coefficients to visual mechanisms

Visualscapy converts the key mediation outputs into a clear and intuitive visual representation, allowing researchers to understand at a glance how each visual component acts on VWP and through which perceptual dimensions.

Statistical mediation outputs

Direct effect (c')

Specific indirect effects ($a_1b_1, a_2b_2, \dots, a_nb_n$)

Total indirect effect (I)

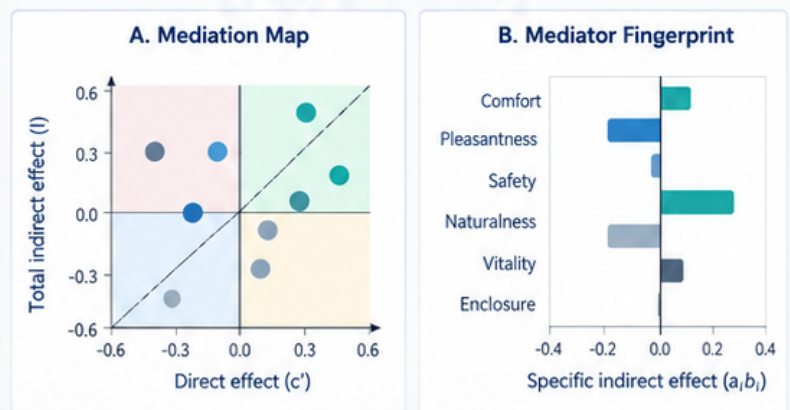
Total effect (c)

Confidence intervals

Visualscapy

New visual grammar

Visualscapy visualisations



1.3 Key equations

For each visual component X , Visualscapy is based on the standard parallel mediation framework:

Direct effect

$$c'$$

Direct effect of X on VWP
(Controlling for mediators)

Total indirect effect

$$I = \sum_{i=1}^n a_i b_i$$

Sum of the specific indirect effects
through the n perceptual mediators

Total effect

$$c = c' + I$$

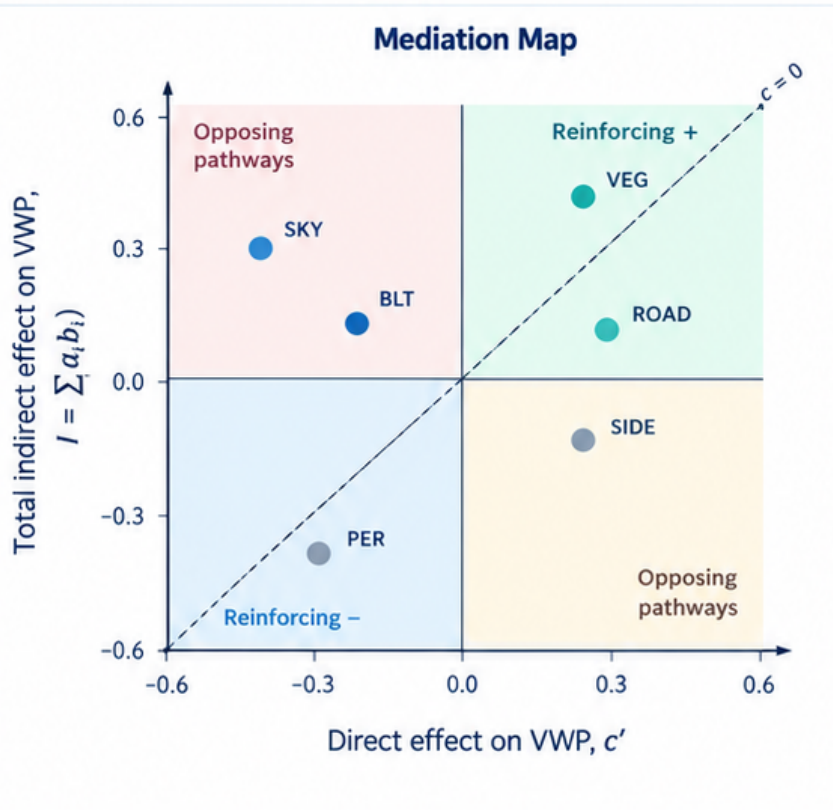
Overall effect of X on VWP

2. The Visualscapy visual grammar

Two complementary views for reading mediation mechanisms

Visualscapy represents each visual component through two complementary views. The Mediation Map summarises the direction and structure of the mechanism, while the Mediator Fingerprint reveals the perceptual composition of the indirect effect. Together, they form one mediation signature.

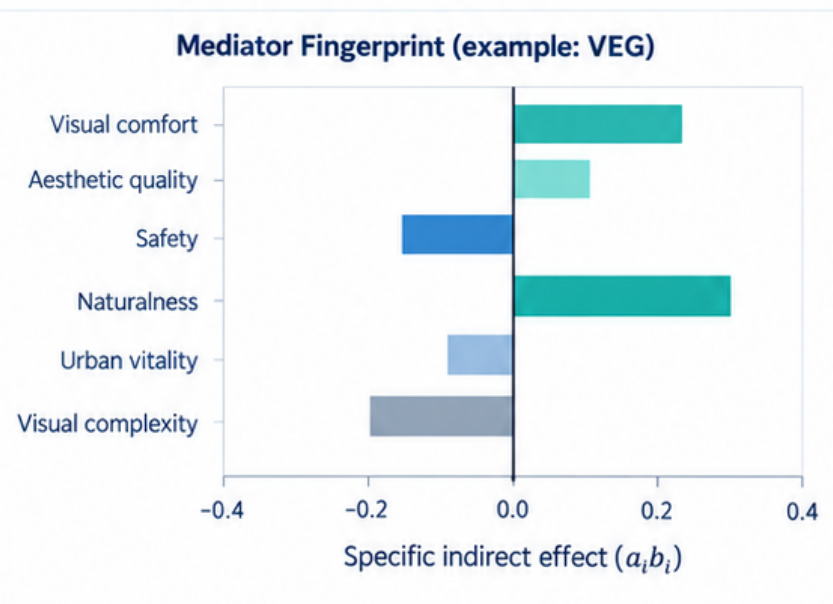
2.1 A. Mediation Map



How to read the Mediation Map

- x-position = direct effect c'**
Horizontal position shows the direct effect of the component on VWP (controlling for mediators).
- y-position = total indirect effect I**
Vertical position shows the total indirect effect through all perceptual mediators ($I = \sum(a_i b_i)$).
- $c = c' + I$**
The overall effect equals the sum of the direct and total indirect effects.
- Dashed diagonal ($c = 0$)**
The dashed diagonal separates components with positive (above the line) and negative (below the line) total effects.
- Quadrant interpretation**
The position reveals whether the direct and indirect pathways reinforce one another (same sign) or oppose one another (opposite sign).

2.2 B. Mediator Fingerprint



How to read the Mediator Fingerprint

- Each bar is one specific indirect effect**
Each bar represents $a_i b_i$ for a single perceptual mediator.
- Positive and negative pathways**
Positive pathways extend to the right, negative pathways extend to the left.
- Sum equals total indirect effect**
The signed sum of all bars equals the y-coordinate of the same component in the Mediation Map ($I = \sum a_i b_i$).

Key equations

$$IE_i = a_i b_i$$

Specific indirect effect for mediator i

$$\sum_{i=1}^n IE_i = I$$

Sum of specific indirect effects equals total indirect effect

The map shows how a component acts; the fingerprint shows through which perceptions it acts.

3. Using Visualscapy in research

Code, platform, and companion survey

Visualscapy can be used through its computational implementation or through a no-code web platform. A separate companion module, Visualscapy Survey, supports the standardized collection of perceptual ratings but should not be confused with the Visualscapy visualization platform.

3.1 Three complementary routes

A. Visualscapy Code



For computational users. Researchers input mediation results directly and generate the two Visualscapy outputs programmatically.

- **Input:** direct effect c' and specific indirect effects $a_i b_i$
- **Output:** Mediation Map + Mediator Fingerprint
- **Use case:** integration into a reproducible analytical workflow

B. Visualscapy Platform



No-code web interface for researchers who do not wish to work with raw code.

- **Upload** mediation results (CSV or manual entry)
- **Generate** the two Visualscapy visualisations automatically
- **Export** SVG / PDF / PNG

Planned web address: visualscapy.pages.dev

C. Visualscapy Survey

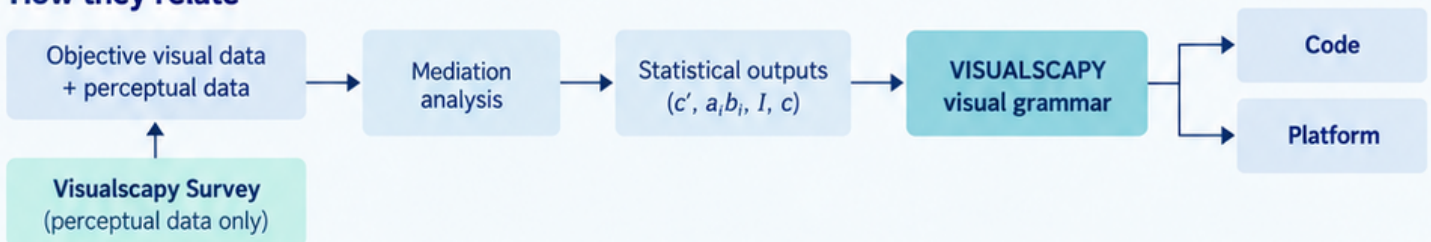


Companion data-collection branch for standardized image-based perceptual assessment.

- Standardized image presentation
- Likert-scale perceptual ratings
- Can support studies that later use Visualscapy

Not the same as the Visualscapy visualization platform.

How they relate



3.2 Who is it for?

- | | | | |
|--|--|---|--|
|  | Visual walkability research |  | Environmental psychology |
|  | Streetscape and urban perception studies |  | Mediation analysis and research methods |
|  | Urban analytics and GIS |  | Researchers seeking publication-ready visual summaries |

3.3 Authors, affiliation, and citation

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If you use Visualscapy in a scientific publication, report, thesis, or presentation, please cite the software and, when available, the associated methodological paper.

Suggested citation

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The platform provides a no-code route to the same Visualscapy visual grammar; Visualscapy Survey is a separate companion module.