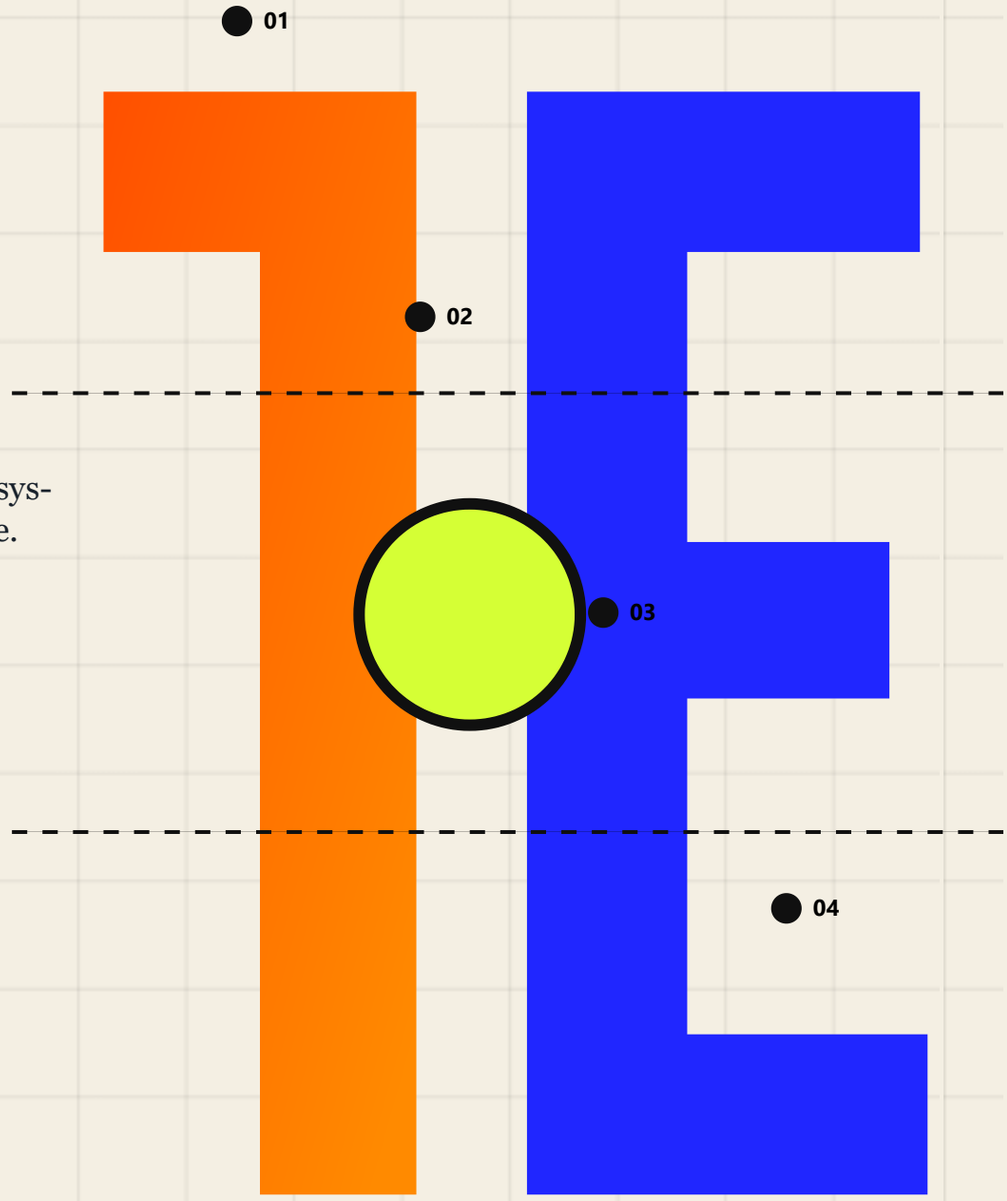
SPECIMEN BOOK / 1

TEN

Ten disciplines. Ten visual systems. One document engine.



01 MATHEMATICS	02 LAW	03 JOURNALISM
04 PHYSICS	05 MARKETING	06 FINANCE
07 ARCHITECTURE	08 NONFICTION	09 SYSTEM

The shape of shortest paths

Dr. Noor al-Khatib Institute for Geometric Analysis · Received 14 March 2026

Abstract. We show that a constrained geodesic remains unique inside a convex normal neighbourhood and give a constructive bound for its deviation under smooth perturbation of the metric.

Keywords. geodesics, convexity, metric perturbation **MSC 2020.** 53C22, 58E10

1. Introduction

Shortest paths on a smooth manifold are governed by a simple variational principle, yet their behaviour under perturbation is subtle. A small change of metric can move the cut locus and destroy global uniqueness. Inside a convex normal neighbourhood the situation is rigid enough to admit a quantitative answer.

We fix a compact set $K \subset M$ and compare the minimizing curves of two nearby metrics. The main result controls both the curve and its velocity by the C^2 distance between those metrics.

1.1. Variational setup

Let (M, g) be a complete Riemannian manifold and let $p, q \in M$. The energy of a smooth curve $\gamma : [0,1] \to M$ is

$$E(\gamma) = \frac{1}{2}\int_0^1 g_{\gamma(t)}(\dot\gamma(t), \dot\gamma(t))\, dt.$$

Critical points of E with fixed endpoints satisfy the geodesic equation. On a convex neighbourhood the minimizer is the only critical point with sufficiently small energy.

Theorem 1.2. *For every compact convex set $K \subset M$, there exists $\varepsilon_K > 0$ such that every metric h satisfying $\|h - g\|_{C^2} < \varepsilon_K$ admits one minimizing geodesic between any two points of K.*

The constant depends only on a lower bound for the convexity radius and upper bounds for the curvature and its first derivative on a neighbourhood of K.

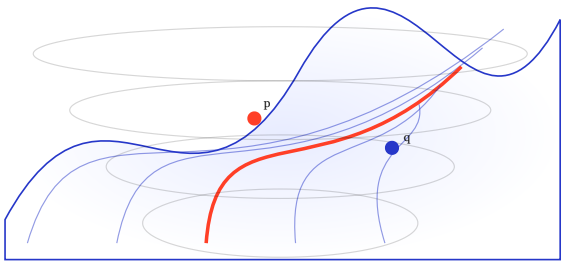


FIG 1 Perturbed geodesics joining p and q inside a convex chart.

2. Stability of the minimizer

The proof follows from coercivity of the index form and a quantitative inverse function argument. If V vanishes at both endpoints, convexity gives

$$I_g(V,V) \geq \lambda_K \|V\|_{H^1}^2.$$

Proof. Work in exponential coordinates centered at p. The Jacobi operator is invertible on the orthogonal complement of the tangent field, with inverse norm at most λ_K^{-1}. The coefficients of the operator vary continuously with the metric.

Applying the contraction estimate to the endpoint map produces a unique fixed point and the bound

$$\|\gamma_h - \gamma_g\|_{C^1} \leq A_K \|h - g\|_{C^2}.$$

The energy inequality then excludes a second minimizer in the chart. Compactness supplies one constant for all endpoint pairs in $K \times K$.[1] □

3. Uniform endpoint control

Choose finitely many convex charts $U_1, \dots, U_N$ covering K. The local estimates agree on overlaps because the minimizing curve is unique, hence

$$A_K = \max_{1 \leq j \leq N} A(U_j) < \infty.$$

The same argument controls the distance functions uniformly on $K \times K$. In particular, the perturbed exponential map remains injective on the relevant tangent vectors.

Corollary 3.1. *The map $h \mapsto d_h|_{K\times K}$ is locally Lipschitz from the C^2 topology to the uniform topology.*

Article 2. The bounded-path argument reappears in the evidentiary standard on page 3.

4. Sharpness and limitations

The loss of two derivatives is natural. The geodesic equation contains the first derivatives of the metric, while stability of its linearization requires one further derivative. For a conformal family $g_s = e^{2sf} g$, differentiation at $s = 0$ gives

$$\left.\frac{d}{ds}\right|_{s=0} \gamma_{g_s} = -J_g^{-1}(\nabla f - 2\, df(\dot\gamma)\dot\gamma)\,.$$

Thus the constant must depend on curvature control near the entire image of the curve. No estimate uniform over all of M can hold when the convexity radius tends to zero.

References

M. do Carmo, *Riemannian Geometry*, Birkhäuser, 1992.

J. Jost, *Riemannian Geometry and Geometric Analysis*, 2017.

W. Klingenberg, *Riemannian Geometry*, de Gruyter, 1982.

1. The bound is uniform only on compact convex subsets; the cut locus prevents a global statement.

SUPREME COURT OF AURELIA

Marin v. Office of Civic Algorithms

No. 24-118 - Argued February 11, 2026 - Decided June 4, 2026

HELD An automated public decision is reviewable when its output materially determines access to a statutory benefit.

REYES, C.J.
delivered the opinion of the Court.

I. Background

II. Reviewability

III. Reasons

IV. Remedy

24 AUR. 118
2026 AHC
3

The question is whether a citizen may challenge a score that no official formally adopts, yet every official follows. We hold that she may.

I

The Civic Allocation Act requires the Office to give reasons when it denies priority housing. Marin received only a number - 0.41 - generated by a model trained on prior applications. Her caseworker lacked authority to depart from it.

Agency action is final when it marks the consummation of a decision process and determines rights or obligations. *Bennett v. Spear*, 520 U.S. 154, 177-178 (1997). The score did both.[2]

II

A reason need not disclose source code. It must identify the decisive facts, the governing rule, and the route connecting them. A conclusion that cannot be traced cannot be reviewed.

III

When an automated output supplies the operative reason, the agency must preserve the factors, weights, and review path used in the individual case. A generic description of the model cannot substitute for that record.

IV

The remedy is a new determination by an officer empowered to examine the score, correct the record, and give reasons that respond to Marin's actual evidence. Review requires a decision that can still be changed.

THE COURT

Administrative convenience does not convert an operative decision into a mere recommendation.

The judgment is reversed, and the case is remanded for proceedings consistent with this opinion.

It is so ordered.

REVERSED AND REMANDED

2. The Office may use automated tools. It must still expose the path from material facts to the legal conclusion.

THE SIGNAL
WEEKEND DATA EDITION

The unequal *shade* of summer

A block-by-block analysis finds that trees protect the coolest neighbourhoods twice over, while the hottest streets wait longest for relief.

By Mara Venn Data reporting by Elias Roth Illustration by Studio North

At 4:10 p.m., the pavement on Delancey Street reached 54 degrees Celsius. Two kilometres west, beneath mature plane trees, it was 17 degrees cooler.

The Signal combined 1.8 million satellite temperature readings with the city tree register. The pattern was sharper than income alone could explain. Streets built before 1940 held nearly twice the canopy of post-war districts.

17°C

the largest temperature gap measured between two streets on the same afternoon

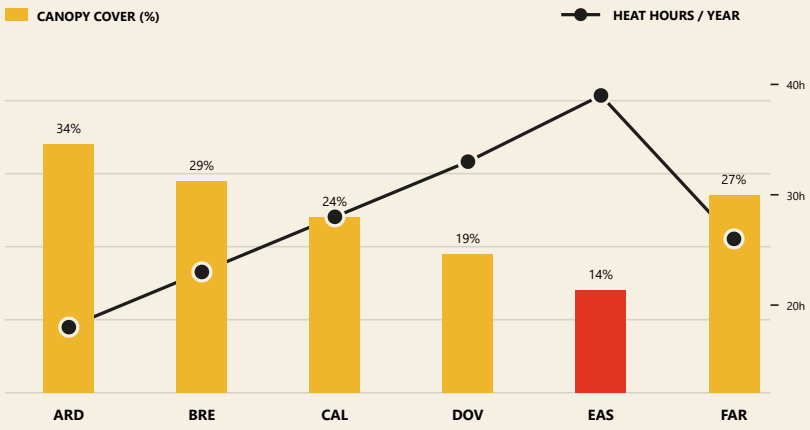


FIG 2 Canopy cover and annual hours above the local heat threshold.

canopy cover heat hours

Source: Urban Climate Observatory, 2025

01

Shade follows age

Older street grids hold the widest crowns and the smallest gaps between them.

02

Night is the risk

Emergency calls rise when streets stay above 29°C after midnight.

03

Maintenance wins

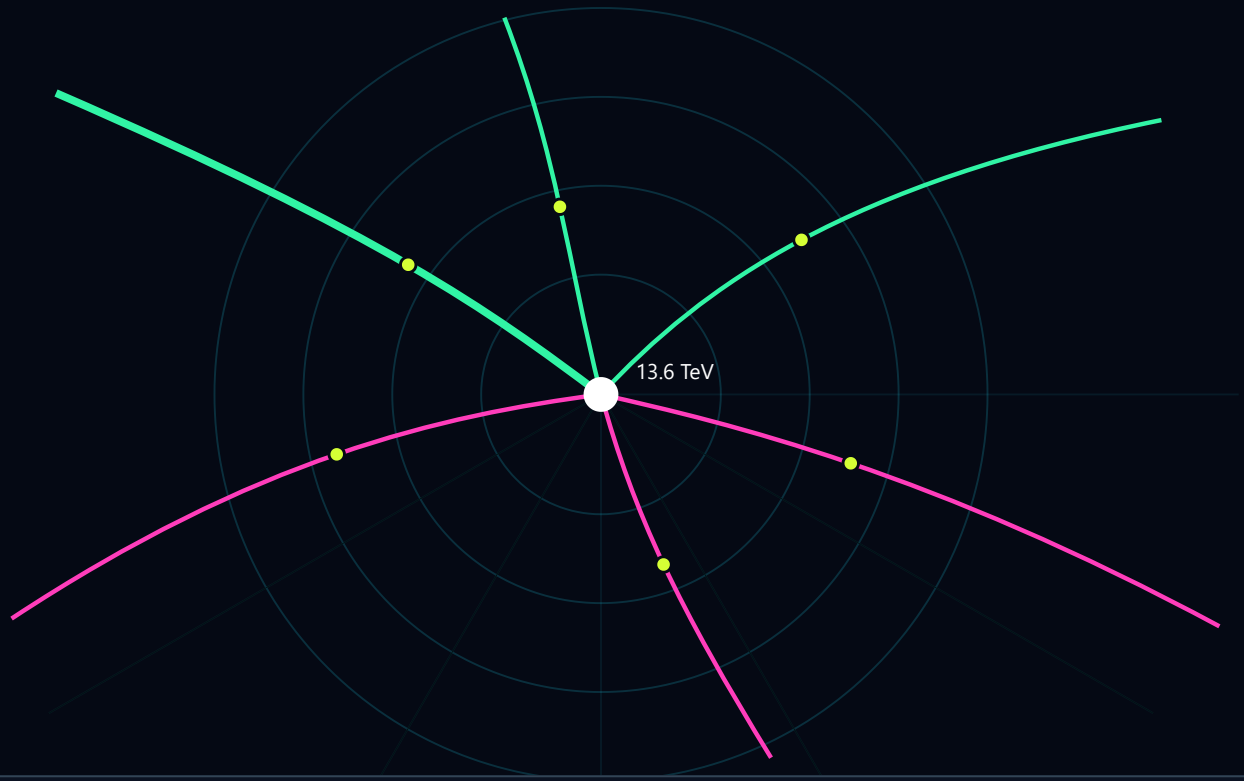
Survival after five years matters more than the number planted in year one.

CONTINUED ONLINE WITH METHODS AND DATA

Anatomy of an event

Six charged tracks, two jets and one imbalance that may point beyond the standard model.

LEADING JET 482.7 GeV / c	**MISSING ET** 214.3 GeV
VERTICES 37 reconstructed	**SIGNIFICANCE** 4.1σ local



INVARIANT MASS

$$m^2c^4 = E^2 - p^2c^2 \qquad m_{jj} = 3.82\ \mathrm{TeV}/c^2$$

FIG 3 Transverse view of candidate event 881204.

TRIGGER

Passed HLT_j420 and missing-energy cross-check.

INTERPRETATION

Compatible with a heavy resonance; global significance remains below discovery threshold.

NEXT TEST

Compare the opposite-charge channel in the full Run 4 sample.

DOI 10.4801/OCL.881204

Make space for *sound.*

Auralis One turns any room into a listening field. Twelve hours untethered. One continuous form.

LISTEN WITHOUT EDGES

auralis.audio/one

12 h BATTERY	**360°** FIELD
1.8 kg WEIGHT	**IP67** SEALED

Growth with operating leverage.

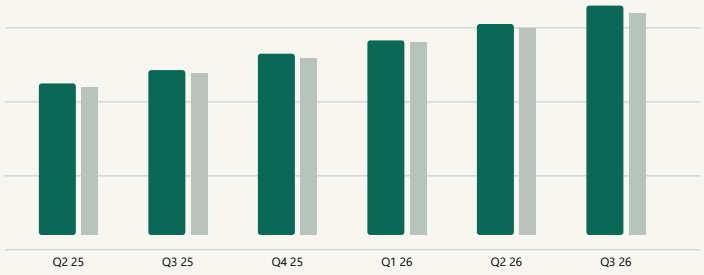
DECISION 03

Release the sovereign cloud capacity envelope.

€4.2m

ARR	NRR	GROSS MARGIN	EBITDA
€84.2m	119%	78.4%	€8.7m
+31%	+4 pp	+2.3 pp	+€6.1m

REVENUE / €M — ACTUAL ■ PLAN ▪



Signal Expansion and usage pricing offset slower new-logo volume.

PORTFOLIO — Q3 CLOSE

Segment	Revenue	Growth	GM
Enterprise	€14.8m	+38%	81%
Mid-market	€5.9m	+24%	76%
Public sector	€1.7m	+17%	70%
Total	**€22.4m**	**+31%**	**78%**

WATCH

Delivery capacity

Sovereign cloud is the critical path for 14 signed customers.

OPENING ARR		NEW		EXPANSION		CHURN		CLOSING ARR
78.1	+	3.8	+	3.1	-	0.8	=	84.2

FY26 OUTLOOK

€91-94m

ARR range / 84% confidence

BASE

CAPITAL ALLOCATION

PRODUCT	38%
SOVEREIGN CLOUD	27%
GO-TO-MARKET	21%
CONTROL FABRIC	14%

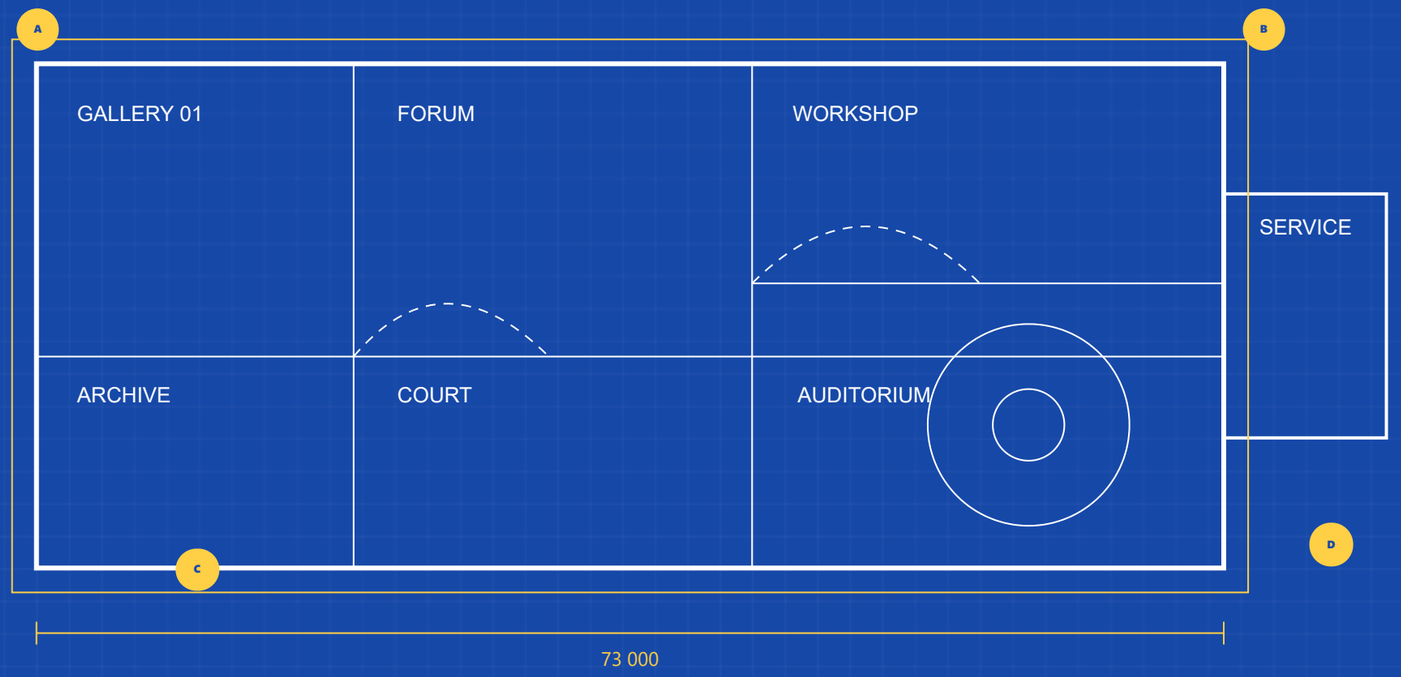
NEXT THREE GATES

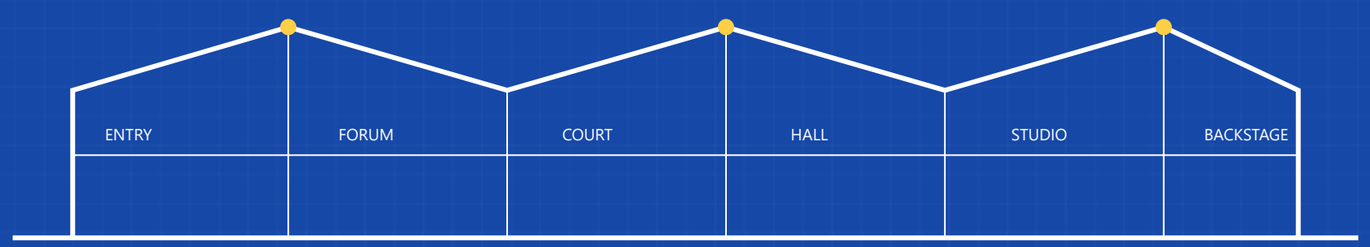
08 AUG	Sovereign readiness
15 SEP	Atlas beta exit
22 OCT	Q4 board

House for many voices

A civic room formed by one continuous wall, a shaded court and seven ways in.

GROSS AREA 7 860 m²	**PUBLIC FLOOR** 71%
EMBODIED C 312 kg/m²	**GRID** 7.2 m





SECTION AA / 1 : 200

STATUS
SHORTLIST
07.2026

01 / WALL

Rammed earth carries structure, thermal mass and the public route.

02 / COURT

Rain, shade and sound collect in the centre rather than at the edge.

03 / ROOF

A timber cassette field spans every room with one repeatable detail.

The quiet machine

How a mechanical bird taught its makers to listen

The bird did not sing on the first morning. It clicked, waited, and turned its brass head toward the rain.

For eleven years, engineer Hana Vale had reduced flight to ratios: lift over drag, mass over span, stored energy over time. The equations were exact. The animal remained impossible.

Her breakthrough came from the reeds. A living wing never meets still air; it reads a field of small disturbances and yields before it corrects. Vale replaced the rigid joint with a thin spring that could remember its last position.[3]

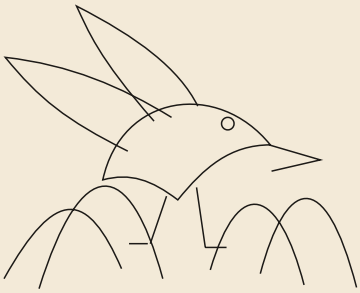


Plate 9. The third prototype at rest.

A machine becomes graceful when correction stops looking like resistance.

The new mechanism used less energy because it ceased fighting every error. Its control law was almost modest:

$$u_{t+1} = u_t + \alpha e_t - \beta \left(u_t - u_{t-1} \right)$$

Vale tuned the final mechanism by ear. A clean return made one soft click; a correction that arrived too late made two. By winter, the machine could yield to a gust, recover its line, and settle without the rigid shudder of the earlier frames.

The same principle appears elsewhere in this book. The shortest path on page 2 and the reviewable path on page 3 both depend on bounded correction.

IV

3. The final spring was 0.18 millimetres thick and cut from tempered phosphor bronze.

One engine. *Many forms.*

1 **Ten document forms** 01

2 **Mathematics - The shape of shortest paths** 02

3 **Law - Opinion of the Court** 03

4 **Data journalism - The unequal shade of summer** 04

5 **Physics - Anatomy of an event** 05

6 **Marketing - Auralis One launch campaign** 06

7 **Finance - Northstar quarterly pulse** 07

8 **Architecture - House for many voices** 08

9 **Nonfiction - The quiet machine** 09

10 **System - Index of forms** 10

10
PHYSICAL PAGES

08
PAPER FORMATS

01
REACT TREE