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Equivariance of the Source Measure Off the Pure Limit: Contact Sensitivity, Channel Capacity, and the Invariance of Selection Cost

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Abstract

This paper quantifies how partial sidechain cleavage affects the orientation sensitivity and alignment selection cost of stacking contacts in a self-separating substituted-chrysene stock. In the one-reagent limit where every sidechain is a hydroxyethoxy arm, the registration filter of the self-separating source reads the alignment of a stacking contact solely through the initiator, pricing the exogenous supply of alignment at one bit per contact. Extending this analysis to mixed arm words generated by partial cleavage establishes the exact magnitude of orientation sensitivity across operating regimes and demonstrates that the unconditional alignment price of one bit per contact remains invariant.

The orientation sensitivity exhibits a sharp quadratic onset. Writing $\sigma(\pi_h)$ for the probability that a contact drawn from the admitted stream is orientation-sensitive when each arm is cleaved to the phenol h independently with probability π_h, exact arithmetic shows that σ is a degree-8 polynomial with rational coefficients. At the uncleaved limit, $\sigma(0) = f_I^2 = 2.47\times10^{-7}$, arising solely from initiator pairs; the linear correction carries a coefficient of 9.40×10^{-6}, while the quadratic π_h^2 term dominates with a coefficient of 4.00009. Across the three standard operating points of the separation process, partial cleavage increases orientation sensitivity over the pure limit by factors of 1587, 36502, and 131037, such that a one per cent cleavage rate amplifies the source's orientation sensitivity by more than fifteen hundred.

Despite this increase in sensitivity, the induced channel remains unbiased. Because the inversion involution ι fixes the disubstituted (D) and tetrasubstituted (T) families setwise and cleavage acts independently across arms, relabelling a unit's arm word via $a \mapsto a \circ \iota$ forms a measure-preserving involution of the stream that reverses the unit's presented pattern and exchanges the registration numbers at both of its contacts. These involutions generate all bit-flips of the alignment field, ensuring that the field's marginal distribution remains uniform at every cleavage probability π_h — holding exactly in the absence of the initiator, and within 2.83×10^{-7} bits per contact (one part in 3.54×10^6) when the initiator is included. Consequently, the selection cost of $\ell - 1$ bits holds across the entire cleavage regime, as partial cleavage opens an informational channel between the arm words and the alignment field without biasing the alignment state.

Evaluating the capacity of this channel defines its operational utility. For any registration free energy Δ_{rgy}, the channel capacity is bounded above by σ bits per contact and approaches this bound in the high-energy limit, yielding at most 0.1620 bits across a codon-length column at an arm retention of $\pi_e = 0.90$, compared with the 5.0000-bit unconditional specification cost. Utilizing this mutual information requires an agent capable of reading the arm words along the column. Furthermore, while an orientation-sensitive contact distinguishes its two alignment states internally, assigning absolute labels still relies on an asymmetric reference frame: out of 53 nominal contacts in a heritable lattice column at $\pi_e = 0.90$, an average of 1.717 contacts are self-distinguishing while 96.76 per cent continue to reference the terminal cap, accompanied by a corresponding adjustment in overall arm efficiency to 0.9875.

Keywords: Chrysene Formalism; arm cleavage; orientation channel; registration number; alignment field; selection cost; channel capacity; blindness; relabelling involution.

1 Introduction

1.1 A limit the source does not claim

Article 79 arms chrysene in a polyaromatic bulk by bromination, oxalate substitution and reduction, and exports a stock whose

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arms are hydroxyethoxy [Sch26e, Def. "Arm installation"]. Its Theorem "No cleavage, no arm loss" is stated at $\pi_e = 1$, where every oxalate arm is reduced and none is cleaved to the phenol h; its Proposition "Cleavage" treats $\pi_e < 1$, where each arm is cleaved independently with probability $\pi_h = 1 - \pi_e$, and prices the loss in arm efficiency at $\pi_e = 0.99$, 0.95 and 0.90.

That paper records a doubt about the limit, in an appendix whose opening states that nothing there enters a numbered statement:

> if an e-arm is in practice reached through the phenol, then h is an obligatory intermediate, $\pi_e = 1$ is a complete-conversion limit rather than a reagent choice, and Proposition ["Cleavage"] rather than Theorem ["No cleavage, no arm loss"] is the operative statement [Sch26e, App. "The arming route, and its tension"].

The conditional is the author's and is recorded rather than resolved. It is quoted here as a motive for computing off the limit, not as a claim that the source operates off it.

1.2 What Article 84 proved, and what it already said about this

Article 84 [Sch26d] proves that the pattern of locant–arm pairs a unit presents at a stacking contact is unchanged by the flip exactly when its family is ι-invariant and its arm word is constant on the ι-orbits, and that one such *blind* unit at a contact suffices to make the contact blind to its alignment bit. On the one-reagent stock, D at ee and T at $eeee$ are blind, so every contact is blind but I–I; the registration weight cannot read the alignment field, except through the initiator; the endogenous law on that field is uniform; and prescribing it costs one bit per contact.

What that paper says about the present question must be stated exactly, because this paper's contribution is narrower than it may appear. Article 84's two blindness theorems are combinatorial over m arm types and are not confined to the pure limit; what is confined to the limit is their *application* to the delivered stock. And Article 84 states the failure, the mechanism and the source: an arm word "not constant on the ι-orbits of its family—an eh on D, say, from partial cleavage" is flip-visible, "what changes is how many contacts [the theorems] cover, and the frequency 2.5×10^{-7} ... rises accordingly", and "the mixed case is not worked here" [Sch26d, Falsification register]. The same point is made twice more, at its Scholium 7.12 and its Theorem 7.13, and the restriction is carried in the statement of its cost theorem, which prices a field on a column "with blind contacts" [Sch26d, Thm. 9.2].

So the gap this paper fills is not the observation. It is the number, and then the consequence of the number. Article 84's Target 14.4 asks "what fraction of flip-visible *sites* makes the registry filter partially orientation-selective, and whether the resulting bias is in a useful direction". The second clause is answered here, negatively. The first is answered in the form it admits: not a threshold on sites—Article 84 is elsewhere careful that the orientation datum cannot sit at a site [Sch26d, Rem. 4.4], and this paper puts it at the contact—but the fraction of sensitive contacts induced by a per-arm cleavage probability, which is σ.

1.3 What this paper addresses

(i) Which contacts are orientation-sensitive, exactly, and what distinguishes them (Section 5).
(ii) With what probability a contact of the admitted stream is sensitive, as a function of π_h (Section 6).
(iii) How much information such a contact carries, and whether that can be bounded without knowing the registration free energy (Section 7).
(iv) Whether the channel biases the alignment field, and what therefore becomes of Article 84's selection cost (Section 8).
(v) What the channel's capacity is, and who collects it (Section 9).
(vi) How much of Article 84's reference hypothesis cleavage refines (Section 10).
(vii) What the channel costs in Article 79's own currency (Section 11).

1.4 What is established here, by kind

Recovered. Article 79's cleavage model, accepted fractions and arm efficiency (Prop. "Cleavage"), its admitted stream, its registry hypothesis H_{rgy} and the commentary quoted above [Sch26e]; Article 84's presented pattern, unit and contact blindness, the coincidence reading H_ν of the registration number, the alignment field of Article 40 and its selection cost, H_{draw}, H_{frame}, the mean-entropy form of a biased cost [Sch26d, Thm. 7.10(b)], the demand figures ρ^* and p_3/p_4 as that paper's stipulated illustrations [Sch26d, Prop. 9.5], and the coupling of the initiator fraction to sensitivity [Sch26d, Rem. 7.8]; Article 80's heritable minimum [Sch26b].

Proved here. The separation criterion and its symmetry (Prop. 5.1, Cor. 5.2); the D dichotomy (Prop. 5.4); the sensitivity polynomial and its regime (Thm. 6.1, Cor. 6.2); the registration gap and its concentration (Prop. 7.1); the bias a gap induces (Prop. 7.3); the channel ceiling (Thm. 7.4); the relabelling involution and the uniformity of the field law (Thm. 8.1, Thm. 8.2); the exactness of Article 84's cost off the pure limit (Cor. 8.4); the capacity of the channel and its Δ-free bound (Thm. 9.1, Cor. 9.2); the dependence of adjacent contacts (Prop. 10.2); the refinement of H_{frame} (Thm. 10.3, Prop. 10.4); the trade against arm efficiency (Prop. 11.1).

Found. Article 84's Target 14.4 is answered in both clauses. The fraction is σ, which rises by three orders of magnitude at one per cent cleavage (Rem. 6.3). The direction is not useful: the channel is symmetric, so Article 84's figure of $\ell - 1$ bits is

exact at every π_h and its cost theorem is *strengthened* rather than amended (Thm. 8.2, Rul. 9.4).

Computed. Blocks Y1–Y8 of Appendix B.

Supposed. Appendix A. Two premises are added to those Articles 79 and 84 carry: that cleaved units stack in the stock columns (H_{stock}), and that a sensitive contact's two states are distinguishable by their free energy (H_{dist}).

Not claimed. Proposition 3.1.

2 Status, nomenclature, scope

Convention 2.1 (Status labels)**.** [A][A] finite or axiom-free; [D] derived under hypotheses named and registered in Appendix A; [C] imported, source named; [E] molecular reading, entering no proof. Scholia are unlabelled and enter no proof. Every quantitative claim in the body is a macro emitted by `verify_cleave.py`; the emitting block is cited as Y1–Y8 and the blocks are described in Appendix B.

Convention 2.2 (Inheritance)**.** [A]This paper is downstream of Articles 79 and 84. It adds no *object* to either, and the two premises it adds are registered in Appendix A and named in Section 1. Its conventions on seniority and on labels and their premises are those of Article 84 [Sch26d, Convs. 2.3–2.4] and are not restated. No patent is cited here, so Article 84's patent-citation convention is inherited but unexercised.

Convention 2.3 (The arm alphabet)**.** [A]The alphabet of this paper is $\{h, e\}$. Article 79's phosphorylation occurs downstream of admission [Sch26e, Rem. "Phosphate arms"], so a phosphate arm is not in the admitted stream and not in the columns of Definition 4.1. Where a statement is alphabet-dependent—the T counts of Proposition 5.4 are—the $\{h, e\}$ figure is the one quoted and the three-letter figure is given beside it in Y1. Statements that hold over any alphabet are marked as such.

Notation 2.4. $\Lambda = \{3, 6, 9, 12\}$; $D = \{6, 12\}$, $I = \{3, 6, 12\}$, $T = \{3, 6, 9, 12\}$; ι the inversion of the C_{2h} reference acting as $3 \leftrightarrow 9$, $6 \leftrightarrow 12$; $\text{pat}(S, a)$ and $\text{pat}^{\text{flip}}(S, a)$ the two patterns a unit can present [Sch26d, Def. 7.2]; $\pi_h = 1 - \pi_e$ the per-arm cleavage probability; ν_0, ν_1 the registration numbers of a contact aligned and unaligned, the labels being supplied by H_{frame}; $g = |\nu_0 - \nu_1|$ the *gap*; $\sigma(\pi_h)$ the sensitivity; $\Delta = \Delta_{\text{rgy}} > 0$ the free energy of one registration in units of $k_B T$; f_D, f_I, f_T the admitted fractions; $\rho^* = p_2/p_4 = 200$ and $p_3/p_4 = 1/10$, Article 84's stipulated illustrations [Sch26d, Prop. 9.5]; ℓ a column length, with $\ell - 1$ contacts.

3 Non-implications

Proposition 3.1 (Non-implications)**.** *[A]None of the following is asserted.*

(i) No error found in Article 84. *Its blindness theorems are combinatorial and hold over any alphabet; their application to the delivered stock is at $\pi_e = 1$ and is correct there; and its cost theorem is here shown* exact *off the limit as well (Cor. 8.4). Nothing of Article 84 is withdrawn and one of its figures is strengthened.*

(ii) No priority claimed over Article 84's own statement of the failure. *That paper states that a mixed arm word is flip-visible, names partial cleavage as the mechanism, and says the frequency rises; what is new here is the magnitude and its consequence (§1.2).*

(iii) No cleavage rate is claimed. *π_h is a free parameter throughout. The three values at which figures are reported are Article 79's own illustrations and are no more attested here than there.*

(iv) No mechanism for the cleavage. *Article 79 marks the cleavage step* S *and supplies no conditions; this paper inherits that and adds nothing.*

(v) No claim that the source selects. *The channel carries at most σ bits per contact, which at Article 79's operating points is at most 3.24×10^{-2}, and it carries them with no preferred direction (Thm. 8.2). A symmetric channel is not a selector.*

(vi) No claim that the selection cost falls. *The quantity the exogenous agent pays is unchanged (Cor. 8.4). What cleavage creates is a mutual information between arm words and alignment, which is a different quantity and is collected by a different agent (Sch. 8.5).*

(vii) No claim that H_{frame} is discharged. *It is refined: a sensitive contact distinguishes its two states without a frame but does not label them, and the refinement bites on a σ-fraction of contacts (Thm. 10.3). A refinement is not a discharge, and Scholium 10.5 says so.*

(viii) No measurement of Δ_{rgy}. *It is carried as a parameter, and Theorem 7.4 is stated so that the paper's principal bound does not depend on it.*

(ix) No optimum proposed. *Proposition 11.1 exhibits a trade and does not recommend a point on it.*

(x) No independence of arms claimed. *The per-arm independence of the cleavage is Article 79's model, not a finding; correlated cleavage would change σ and is Target 15.2.*

(xi) No independence of contacts claimed. *Adjacent contacts share a unit and are positively correlated (Prop. 10.2); no distributional figure in this paper is binomial.*

(xii) No reading of the gap as a mechanism. *That a sensitive contact carries unequal registration numbers is a statement in the coincidence reading H_ν of Article 84. Under Article 79's own reading, with ν a function of the unordered family pair, there is no gap and $\sigma \equiv 0$; Remark 3.2 states what each reading gives.*

Remark 3.2 (Which reading of ν this paper needs)**.** [D]Article 79 fixes the registration number per family—four for T, two for D—and justifies it by the C_{2h} placement of the arms of one unit over those of the next [Sch26e, Hyp. H_{rgy}]. That statement is given for homogeneous stacks and does not define ν at a mixed-family or initiator contact; read as a function of the unordered family pair, which is the reading taken here when it is contrasted, it cannot depend on the alignment. Article 84 registers the literal refinement H_ν, in which ν at a contact is the number of locant positions at which the two units carry the same arm, and proves its blindness corollary under both.
The two part company here, and this paper needs the refinement. Under Article 79's reading σ vanishes identically and there is no channel. Under H_ν there is one, and its size is what follows. This paper therefore establishes a conditional: *if* the registration number counts coincidences rather than families, *then* cleavage opens a channel of the stated capacity. A reader who prefers the coarser reading should set $\sigma = 0$ throughout, which returns Article 84's figures exactly and makes Sections 9 and 10 empty. Deciding between the readings is Target 15.1 and is the most consequential open question this paper raises.

4 Objects

Definition 4.1 (Cleavage model)**.** [C]Article 79's Proposition "Cleavage": each installed arm is cleaved to the phenol arm h independently with probability $\pi_h = 1 - \pi_e$, the remainder being the hydroxyethoxy arm e. In Article 79's route h and e are the two fates of one oxalate arm rather than e being cleaved to h, so the independence imported here is independence at that step (App. C, Target 15.2). The accepted fractions are $1 - \pi_h^2$ on D and π_e^4 on T, and "unaccepted units remain admitted, as surplus stock available to any use that accepts them" [Sch26e, Prop. "Cleavage"].

Hypothesis 4.2 (H_{stock}, cleaved units stack)**.** [D]A unit that remains admitted but is accepted by no downstream use is present in the stock phase and participates in stacking contacts there.
This is not Article 79's statement. That paper says such units remain admitted; it does not say they stack, and its columnar model is a model of *species* rather than of orientation—its word $w \in \{A, B\}^\ell$ has A the admitted stock and B an impurity, and "its weight . . . carries no orientation variable" [Sch26d, Rem. 4.17]. The step from admitted to stacking is this paper's, it is load-bearing—without it the cleaved units are not in the columns and there is nothing to compute—and it is registered rather than absorbed.

Definition 4.3 (Sighted and blind)**.** [C]A unit (S, a) is *blind* if $\mathrm{pat}(S, a) = \mathrm{pat}^{\mathrm{flip}}(S, a)$, which by [Sch26d, Thm. 7.3] holds iff $\iota S = S$ and a is constant on the ι-orbits of S, and *sighted* otherwise. A contact is *sensitive* if $\nu_0 \neq \nu_1$ and *blind* otherwise.

Remark 4.4 (Which of the two states is which)**.** [A]Definition 4.3 uses the labels ν_0, ν_1 of the Notation, and those labels are what H_{frame} supplies. The *criterion* does not need them: $\nu_0 \neq \nu_1$ is a statement about an unordered pair of numbers. What a sensitive contact furnishes intrinsically is therefore the partition of its two states, not the assignment of the values 0 and 1 to them, and Theorem 10.3 turns on exactly that distinction.

Remark 4.5 (The one-reagent stock, and what cleavage does to it)**.** [A]Over the alphabet $\{h, e\}$ the blind words number $m = 2$ on D—hh and ee—and $m^2 = 4$ on T, and none on I [Sch26d, Thm. 7.3]. At $\pi_h = 0$ the stock carries ee and $eeee$ with probability one, so every D and T unit is blind. At $\pi_h > 0$ the sighted words acquire positive weight: on D the sighted words are he and eh, each of probability $\pi_h\pi_e$, and on T the 12 sighted words carry the rest. The transition is not a change of regime but of measure, which is why σ is a polynomial rather than a case distinction.

5 The structure of a sensitive contact

Proposition 5.1 (Separation criterion)**.** *[A]A contact carrying (S_1, a_1) and (S_2, a_2) is sensitive if and only if*

$$|\mathrm{pat}(S_1, a_1) \cap \mathrm{pat}(S_2, a_2)| \neq |\mathrm{pat}^{\mathrm{flip}}(S_1, a_1) \cap \mathrm{pat}(S_2, a_2)|,$$

that is, if and only if the second pattern separates the first

from its flip by overlap count (Y1).

Proof. $\nu_1 = |\mathrm{pat}_1 \cap \iota\mathrm{pat}_2| = |\iota\mathrm{pat}_1 \cap \mathrm{pat}_2|$, ι being an involution and a bijection of the locants. Substituting gives the displayed form of $\nu_0 \neq \nu_1$. The content of the statement is that the test may be applied to *one* of the two units, the flip having been moved off the partner; the displayed equality of the two mixed intersections is an identity and is not what is checked. Y1 verifies the criterion against Definition 4.3 at all 784 ordered pairs over $\{h, e\}$, and over three arm types as well. □

Corollary 5.2 (Symmetry)**.** *[A]Sensitivity is symmetric in the two units: the second separates the first from its flip exactly when the first separates the second from its flip (Y1).*

Remark 5.3. [A]The criterion restates Article 84's contact theorem and explains it. One blind unit suffices for a blind contact because a blind pattern *is* its own flip, so nothing can separate the two; and the converse fails because a sighted pattern may still fail to be separated by the particular partner it meets. The criterion locates the failure in the partner rather than in the unit, which is what the counts below show.

Proposition 5.4 (D is the exception)**.** *[A]Over any arm alphabet of at most* 3 *letters—in particular over the* $\{h, e\}$ *of Convention 2.3—every pair of sighted D units gives a sensitive contact:* 4 *of* 4 *over* $\{h, e\}$ *and* 36 *of* 36 *over three letters. The bound on the alphabet is sharp,* 24 *of* 144 *both-sighted D pairs being blind over four letters. On T the statement fails already over* $\{h, e\}$*:* 40 *of* 40 + 104 *pairs of sighted units give a* blind *contact, so a cleaved T pair is sensitive with frequency* 0.722 *(*0.806 *over three arm types). On I it fails likewise,* 24 *both-sighted pairs over* $\{h, e\}$ *being blind. The dichotomy is therefore D against the other two families, and its reason is that D carries one ι-orbit, so a sighted D pattern is disjoint from its flip, whereas T carries two and* 8 *of its* 12 *sighted words over* $\{h, e\}$ *meet their own flips (Y1).*

Proof. Let a, b be sighted words on D, so $a(6) \neq a(12)$ and $b(6) \neq b(12)$. Then

$$\nu_0 - \nu_1 = [a_6 = b_6] + [a_{12} = b_{12}] - [a_6 = b_{12}] - [a_{12} = b_6],$$

writing a_k for $a(k)$ and $[\cdot]$ for the indicator. Suppose $a_6 = b_6$. Then $a_{12} \neq b_6$, since $a_{12} \neq a_6$; and $a_6 \neq b_{12}$, since otherwise $b_{12} = a_6 = b_6$, contradicting b sighted. So the last two terms vanish and $\nu_0 - \nu_1 = 1 + [a_{12} = b_{12}] > 0$. The three remaining cases—$a_{12} = b_{12}$, $a_6 = b_{12}$, $a_{12} = b_6$—are the same argument, the last two giving $\nu_0 - \nu_1 < 0$. So the difference is nonzero whenever any of the four equalities holds, and it remains to count. If none holds, both intersections are empty and the contact is blind; that requires a_6 and a_{12} to lie outside $\{b_6, b_{12}\}$, which has exactly two elements since b is sighted, and to be distinct from each other, which is why it needs two letters beyond those two and cannot occur on an alphabet of three or fewer. Over $\{h, e\}$ in particular $\{b_6, b_{12}\}$ exhausts the alphabet, so $b \in \{a, a \circ \iota\}$ and the difference is $+2$ or -2. On T a word may be ι-constant on one orbit and not the other, and the shared orbit then contributes equally to both intersections. Y1 verifies the difference formula, the exclusion of 0 at two and three letters, and its failure at four and five. □

Remark 5.5 (An over-general claim withdrawn)**.** [A]The submitted version asserted this proposition "over any arm alphabet". That is false: at four letters a sighted D word $(6{:}\alpha, 12{:}\beta)$ meets a sighted $(6{:}\gamma, 12{:}\delta)$ in neither pattern, giving $\nu_0 = \nu_1 = 0$ at a contact of two sighted units, and 24 of 144 both-sighted pairs are blind there. The claim is restated at the sharp threshold, and the verification now checks the first alphabet at which it fails rather than only the alphabets at which it holds (Y1).

Remark 5.6 (A correction recorded)**.** [A]The submitted version of this proposition was proved from two lemmas, that a partner pattern meeting one of pat, $\mathrm{pat}^{\mathrm{flip}}$ meets the other in a different number of positions, and that a partner meeting neither is impossible. Both are false: over three arm types they admit 108 and 54 counterexamples respectively, and the first fails over $\{h, e\}$ as well (D at $(6{:}h, 12{:}e)$ against I at $(3{:}h, 6{:}h, 12{:}h)$ meets both patterns once). The conclusion restricted to D survives, but it required the difference formula above rather than either lemma, and the earlier statement's extension to arbitrary partners is withdrawn (Y1).

Scholium 5.7. The asymmetry matters because it is the disubstituted unit—the one Article 79's demand is dominated by—that is the more informative when cleaved. A cleaved D pair is always sensitive; a cleaved T pair is sensitive about seven times in ten. Since the stream is overwhelmingly D, the channel of Section 7 is carried almost entirely by the species the architecture needs most, which is a convenience and not a design. It also means the sighted species is not an exotic one: a D unit armed h at one primary locant and e at the other is the catalogued Dm of Article 77 [Sch26a, Tab. 2], accepted by anchors, residues and the membrane under Article 79's H_{acc} [Sch26e, Hyp. H_{acc}], and Article 79 contemplates supplying part of the membrane as Dm deliberately.

6 The sensitivity

Theorem 6.1 (The sensitivity polynomial)**.** *[D]Under Definition 4.1, H_{stock} and H_{draw}, the probability that a contact of the admitted stream is sensitive is*

$$\sigma(\pi_h) \;=\; \sum_{S_1,S_2} f_{S_1} f_{S_2} \sum_{\substack{a_1,a_2 \\ \text{sensitive}}} \mathbb{P}_{S_1}(a_1)\,\mathbb{P}_{S_2}(a_2),$$

a polynomial in π_h of degree exactly 8 *with rational coefficients, computed exactly at* Y2*. Its value at the pure limit is*

$$\sigma(0) \;=\; f_I^2 \;=\; 2.47\times10^{-7},$$

which is Article 84's frequency of I–I contacts, and the only sensitive contact there.

Proof. The sum is the definition of the probability under independent site and arm draws, the arm-word law $\mathbb{P}_S$ depending on the family through $|S|$. Each $\mathbb{P}_S(a)$ is a monomial $\pi_h^{j}\pi_e^{|S|-j}$, so σ is a polynomial of degree at most $|S_1|+|S_2|\le 8$; the bound is attained, the degree-eight coefficient being nonzero and carried by the T–T terms. Y2 evaluates the coefficients in exact rational arithmetic. At $\pi_h = 0$ only the all-e words carry weight, and among those only I–I is sensitive [Sch26d, Cor. 7.5, Prop. 7.7], giving f_I^2 with $f_I = 4.97\times10^{-4}$ at Article 84's stipulated ρ^* and p_3/p_4. □

Corollary 6.2 (The regime is quadratic)**.** *[D]The first correction to σ is linear, with coefficient 9.40×10^{-6}; but the coefficient of π_h^2 is* 4.00009*—exactly* 16176842/4044121*—so the linear term is smaller by more than five orders and the quadratic term alone carries σ to within $|1-1.02|$ at $\pi_h = 0.01$. Sensitivity requires* two *sighted units; at small π_h the cheapest way to have two is to cleave one arm on each, which costs π_h^2, and the linear term survives only through the initiator, which is sighted already and is rare (Y2).*

Remark 6.3 (The knife edge)**.** [D]At Article 79's three stated operating points,

π_e	0.99	0.95	0.90
σ	3.92×10^{-4}	9.03×10^{-3}	3.24×10^{-2}
$\sigma/\sigma(0)$	1587	36502	131037

One per cent cleavage multiplies the orientation sensitivity of the source by more than fifteen hundred, and ten per cent by more than a hundred thousand (Y2). This answers the first clause of Article 84's Target 14.4: the fraction of flip-visible contacts is not a small perturbation of f_I^2 but a quantity of a different order. It also extends that paper's Remark 7.8, which observes that the initiator fraction p_3 couples to sensitivity through f_I^2; π_h couples far more strongly, and both are parameters of the source.

7 The channel, and its ceiling

Proposition 7.1 (The registration gap)**.** *[A]At a sensitive contact the gap $g = |\nu_0 - \nu_1|$ satisfies $1 \le g \le 4$. At the pure limit every sensitive contact has $g = 1$, the only such contact being I–I at $\nu_0 = 3$, $\nu_1 = 2$. Off the limit the conditional distribution is not spread over that range but concentrated at $g = 2$, whose share is* 0.99997 *at $\pi_e = 0.90$; the shares of $g = 1, 3, 4$ are 3.32×10^{-5}, 5.46×10^{-7} and 4.01×10^{-7}. The conditional mean gap of* 2.000 *is therefore a near-point mass and not a balance of small and large gaps (Y3).*

Remark 7.2. [A]The concentration is the stream's composition seen through the criterion. By Proposition 5.4 the sensitive contacts off the limit are overwhelmingly D–D pairs—at $\pi_e = 0.90$ they carry 98.9 per cent of σ, with D–T under one per cent and T–T a few parts in 10^5—and by the difference formula a sighted D–D contact over $\{h, e\}$ has $g = 2$ exactly. The pure limit's $g = 1$ is the initiator's, and the initiator is rare.

Proposition 7.3 (The bias a gap induces)**.** *[D]Under H_{rgy} a contact carrying ν registrations has relative weight $e^{\nu\Delta}$, so at a sensitive contact of gap g the endogenous law on the alignment bit is Bernoulli with*

$$\theta(g,\Delta) \;=\; \frac{1}{1+e^{g\Delta}},$$

the favoured state being the one of larger ν—which need not be the aligned one. The information the contact carries is $1 - H(\theta)$ bits, H the binary entropy. At $g = 1$ that is 0.160*,* 0.473 *and* 0.725 *bits at $\Delta = 1, 2, 3$; at $g = 2$—the gap that carries essentially all the weight—*0.473*,* 0.870 *and* 0.975*; at $g = 4$,* 0.870*,* 0.996 *and* 1.000 *(Y4).*

Proof. The two alignments are the two states of the contact and their weights are $e^{\nu_0\Delta}$ and $e^{\nu_1\Delta}$; normalise. The entropy statement is the definition. That the favoured state is sometimes the unaligned one is exhibited by two sighted D units with complementary words, for which $\nu_0 = 0$ and $\nu_1 = 2$. Y4 evaluates the information and checks the two limits, $\theta \to \tfrac{1}{2}$ as $\Delta \to 0$ and $\theta \to 0$ as $\Delta \to \infty$; the first endpoint lies outside Article 79's stipulation $\Delta > 0$ and is quoted as a limit only. □

Theorem 7.4 (The channel ceiling)**.** *[D]Suppose, with H_{draw}, that family and arm word are drawn from the admitted stream independently of Δ, and, with H_{rgy}, that the alignment-dependent part of the contact free energy is a function of ν alone. Then the information the endogenous source supplies per contact is at most $\sigma(\pi_h)$ bits, for every $\Delta > 0$ and every gap distribution, with equality approached as $\Delta \to \infty$. At Article 79's operating points the ceiling is 3.92×10^{-4}, 9.03×10^{-3} and 3.24×10^{-2} bits per contact, against realised values of 1.85×10^{-4}, 0.0043 and 0.0153 at $\Delta = 1$ (Y4).*

Proof. By the second premise the alignment weight at a blind contact is the same in both states, so its conditional law is uniform and it contributes $1 - H(\frac{1}{2}) = 0$; this is [Sch26d, Thm. 7.4] with [Sch26d, Cor. 7.5]. A sensitive contact contributes $1 - H(\theta) \le 1$ bit. By the first premise the measure on contacts does not move with Δ, so the expectation is at most $\sigma \cdot 1 + (1-\sigma)\cdot 0 = \sigma$. As $\Delta \to \infty$, $H(\theta) \to 0$ at every $g \ge 1$, so the expectation tends to σ. Y4 computes the expectation over the whole pair ensemble—not by resumming the gap distribution, which would be circular, that sum running over sensitive contacts only—confirms that a blind contact contributes zero and that the blind mass is $1 - \sigma$, and checks the bound at Δ up to 12 and its attainment to nine decimals by $\Delta = 24$. □

Scholium 7.5 (Why the ceiling is the useful statement, and what it rests on). Δ_{rgy} is the parameter the corpus knows least about. Article 79 introduces it as a stipulation and makes it the subject of a target, supplying no value beyond two illustrative magnitudes in its corollary on column impurity. Any result of this paper stated at a particular Δ would inherit that weakness, and Theorem 7.4 does not: it bounds the channel by σ alone, which is combinatorial.

The Δ-freedom is not unconditional, and the premise deserves naming. Article 79's second filter weights a unit's entry to a column by the same registration factor, exponentially in $\nu\Delta_{\mathrm{rgy}}$. If the realised ensemble carried that weight, the sensitive fraction would itself move with Δ and the bound would fail—reweighting the pair law by $e^{\nu_0\Delta} + e^{\nu_1\Delta}$ at $\pi_e = 0.90$ gives 0.0413 bits per contact at $\Delta = 6$ against $\sigma = 3.24 \times 10^{-2}$. What forbids that is H_{draw}, which has family and arm word come from the stream and only the alignment from the contact free energy. The theorem is therefore free of Δ *given* H_{draw}, and the hypothesis register records this among what rests on that premise. Article 84's uniformity theorem likewise premises not the absence of Δ_{rgy} but the absence of anything beyond it [Sch26d, Thm. 7.10(a)], and that paper's most consequential open quantity is the orientation bias of a delivered unit rather than Δ_{rgy} itself [Sch26d, Tgt. 14.1].

8 The channel has no direction

Theorem 8.1 (The relabelling involution)**.** *[A]Let $S \in \{D, T\}$ and let a be an arm word on S. Then $a \mapsto a \circ \iota$ is an involution of the words on S; it is measure-preserving under Definition 4.1; and*

$$\mathrm{pat}(S, a \circ \iota) \;=\; \mathrm{pat}^{\mathrm{flip}}(S, a).$$

Consequently, relabelling one unit of a contact by $a \mapsto a \circ \iota$ exchanges ν_0 and ν_1 at that contact. None of this holds on I, for which $\iota I = \{6, 9, 12\} \neq I$ (Y5).

Proof. $\iota D = D$ and $\iota T = T$, so $a \circ \iota$ is again a word on S, and ι being an involution so is the relabelling. The cleavage law is a product over locants of a common per-arm law, so permuting the locants leaves the probability of a word unchanged; this uses the independence of Definition 4.1 and nothing else. For the pattern, $\mathrm{pat}(S, a\circ\iota) = \{(k, a(\iota k)) : k \in S\} = \{(\iota m, a(m)) : m \in S\}$, substituting $m = \iota k$ and using $\iota S = S$, and that is $\mathrm{pat}^{\mathrm{flip}}(S, a)$. For the exchange, write P_i for the pattern of unit i. Relabelling unit 2 sends $P_2 \mapsto P_2^{\mathrm{flip}}$ and $P_2^{\mathrm{flip}} \mapsto P_2$, so $\nu_0 = |P_1 \cap P_2|$ and $\nu_1 = |P_1 \cap P_2^{\mathrm{flip}}|$ trade places. Relabelling unit 1 instead gives $|P_1^{\mathrm{flip}} \cap P_2|$, and applying ι to both arguments—a bijection of the locants, hence overlap-preserving—turns this into $|P_1 \cap P_2^{\mathrm{flip}}| = \nu_1$; symmetrically for the other. Y5 verifies all three properties on every word of D and T and the failure of ι-closure on I. □

Theorem 8.2 (The law of the alignment field is uniform)**.** *[D]Under H_ν, Definition 4.1, H_{stock} and H_{draw}, consider a column of ℓ sites whose units are drawn independently from the admitted stream and whose alignment bit at each contact is drawn with weights $w(\mathrm{pat}_1, \mathrm{pat}_2)$ and $w(\mathrm{pat}_1, \mathrm{pat}_2^{\mathrm{flip}})$ for* any *weight w that is a function of the two presented patterns—in particular the $e^{\nu\Delta}$ of H_{rgy} and Proposition 7.3, but not only that one. If the initiator is absent from the stream, the marginal law of the alignment field is* exactly *uniform on $\{0,1\}^{\ell-1}$, at every π_h and every Δ. With the initiator present, the cost $-\log_2 \mathbb{P}(c)$ of any field departs from $\ell - 1$ bits by at most 2.83×10^{-7} bits per contact, uniformly in ℓ, π_h and Δ. Equivalently, the expected signed bias $\mathbb{E}[\nu_0 - \nu_1]$ over the stream is exactly zero without the initiator and 2.03×10^{-7} with it (Y5).*

Proof. Let T_i denote the flip of the ith coordinate of $\{0,1\}^{\ell-1}$ and let R_i denote the relabelling of unit i by $a \mapsto a \circ \iota$. By Theorem 8.1, R_i is a measure-preserving involution of the words of D and T; since by H_{draw} the sites are drawn independently, it lifts to a measure-preserving involution of

the column, $\mathbb{P}(R_i u) = \mathbb{P}(u)$. It reverses the presented pattern of unit i and so exchanges ν_0 with ν_1 at every contact unit i belongs to—contacts $i-1$ and i in the interior, and one contact at either end. Writing u for a configuration of units and c for a field,

$$\mathbb{P}(c) = \sum_u \mathbb{P}(u) \prod_j w_j(c_j \mid u),$$

the factorisation being H_{draw}, with $w_j(\cdot \mid u)$ a function of (u_j, u_{j+1}) alone. Because w depends on the two patterns only, exchanging the patterns exchanges the two weights; this is the one property of w the argument uses. So R_i exchanges the two weights at contacts $i-1$ and i and leaves every other factor fixed, giving $\prod_j w_j(c_j \mid R_i u) = \prod_j w_j((T_{i-1}T_i c)_j \mid u)$. Reindexing the sum by $u \mapsto R_i u$ therefore gives $\mathbb{P}(T_{i-1}T_i c) = \mathbb{P}(c)$ for interior i, and $\mathbb{P}(T_1 c) = \mathbb{P}(c)$, $\mathbb{P}(T_{\ell-1} c) = \mathbb{P}(c)$ at the ends. The composites generate all of $T_1, \dots, T_{\ell-1}$, the coordinate flips being commuting involutions: T_1 is given, and $T_i = (T_{i-1}T_i)T_{i-1}$ inductively. So $\mathbb{P}$ is invariant under the full translation group of $\{0,1\}^{\ell-1}$ acting on itself, hence constant, hence $2^{-(\ell-1)}$.

The argument uses $\iota S = S$, which fails for I, and that is the only obstruction: a contact with at least one D or T unit is symmetrised by relabelling that unit, so the residue is carried by I–I contacts and is of order $f_I^2 = 2.47 \times 10^{-7}$. Y5 computes the field law exactly by transfer matrix over the 28 unit types and finds exact uniformity without the initiator; with it, the per-contact cost deviation is maximised over $\pi_h \in \{\frac{1}{10}, \frac{1}{2}\}$, e^{Δ} up to 10^3 and $\ell \in \{3,4,5\}$, at which it saturates. An absolute deviation of the field *mass* is not the right quantity and is not quoted: the uniform mass is $2^{-(\ell-1)}$, so such a figure shrinks with ℓ while the relative deviation grows, and it would bound nothing at $\ell = 54$. □

Remark 8.3 (What the generality in w buys)**.** [A]Theorem 8.2 is deliberately not stated under H_{rgy}. Its proof needs only that the two alignment weights are exchanged when the two presented patterns are, which holds for any weight that is a function of those patterns. This matters because the premise the falsification register concedes could break Theorem 7.4—"a further orientation-dependent term", which Article 84's Theorem 7.10(b) explicitly admits—does not break the uniformity, provided that term is itself a function of what the two units present. The symmetry is therefore the more robust of this paper's two principal findings, and it is the one that leaves Article 84's price untouched. The theorem also holds, trivially, under Article 79's coarser reading of ν, where every contact is blind and $\theta \equiv \frac{1}{2}$; the two readings give it for different reasons.

Corollary 8.4 (Article 84's selection cost is exact off the pure limit)**.** *[D]Article 84 defines the selection cost of a prescribed alignment field as $-\log_2$ of its marginal mass [Sch26d, Def. 9.1] and prices it at exactly $\ell - 1$ bits on a column of blind contacts [Sch26d, Thm. 9.2]. By Theorem 8.2 that mass is $2^{-(\ell-1)}$ at every π_h, so the figures* 5.0000 *bits at $\ell = 6$ and* 53.0000 *at $\ell = 54$ hold off the limit as well: the cost is $(\ell-1)(1 \pm 2.83 \times 10^{-7})$ bits, one part in 3.54×10^6, uniformly in ℓ, π_h and Δ. What is replaced is the hypothesis and not the conclusion—blindness of the contacts is sufficient and not necessary, and what suffices instead is H_ν, H_{stock} and the composition clause of H_{draw}. By Remark 8.3 no ι-invariant arm law lowers the price, so the statement does not rest on the per-arm independence of Definition 4.1 and Target 15.2 lies outside its reach (Y5, Y7).*

Scholium 8.5 (Why a channel can be open and change no price). It is worth saying plainly why these two findings are consistent, since the first invites the opposite conclusion.

A sensitive contact does carry information: its two states have unequal weight, and an observer who knows the two arm words knows which state is the more likely. But which state that is depends on the arm words, and the arm words come symmetrically. Relabelling a D unit from he to eh costs nothing in probability—both words have weight $\pi_h \pi_e$—and reverses the contact's preference. So the preference exists contact by contact and averages to nothing over the stream.

Two different quantities follow, and the submitted version of this paper conflated them. The *selection cost*, which is what an exogenous placement system pays, is the surprisal $-\log_2 \mu(c)$ of the field it prescribes; that system does not choose the arm words that arrive, so it faces the marginal law, which is uniform, and pays $\ell - 1$ bits. The *mutual information* $I(\text{field}; \text{units})$ is what an agent who can read arm words would save; it is positive, and Section 9 computes it. The first is unchanged by cleavage. The second is created by it. A channel with capacity and no direction is exactly the object that has one property and not the other.

9 The capacity of the channel

Theorem 9.1 (The capacity)**.** *[D]Under the hypotheses of Theorem 8.2, the mutual information between the alignment field of a column of ℓ sites and the configuration of its units is*

$$I(\ell, \pi_h, \Delta) \;=\; (\ell - 1)\, \mathbb{E}_g\big[1 - H(\theta(g, \Delta))\big],$$

the expectation being over the gap distribution of the stream with $g = 0$ at a blind contact, and the conditional entropy of

the field given the units is $(\ell-1)-I$*. At* $\ell=6$ *the capacity is* 1.98×10^{-7} *bits at the pure limit and* 0.0213 *and* 0.0766 *at* $\pi_e=0.95$ *and* 0.90 *with* $\Delta=1$*, and* 0.0393 *and* 0.1409 *at* $\Delta=2$*; at* $\ell=54$ *it is* 0.2262 *and* 0.8122 *at* $\Delta=1$*. The corresponding conditional entropies are* 4.9787 *and* 4.9234 *bits against the unconditional* 5.0000 *(Y7).*

Proof. $I=H(\text{field})-H(\text{field}\mid\text{units})$. The first term is $\ell-1$ by Theorem 8.2—exactly so for the initiator-free stream, and otherwise to order f_I^4, the entropy defect being second order in the mass deviation; the display is an identity in the first case and holds to that order in the second, which matters only for the pure-limit column, where the whole capacity is an initiator effect. Given the units, the bits are independent by H_{draw} and the jth has entropy $H(\theta(g_j,\Delta))$, so the second term is $(\ell-1)\mathbb{E}_g[H(\theta)]$, a blind contact contributing $H(\frac12)=1$. Subtracting gives the display. Y7 evaluates both. □

Corollary 9.2 (A bound free of Δ)**.** *[D]*$I(\ell,\pi_h,\Delta)\le(\ell-1)\,\sigma(\pi_h)$ *for every* Δ*. At* $\ell=6$ *that is* 0.0020*,* 0.0451 *and* 0.1620 *bits at Article 79's three operating points, against an unconditional price of* 5.0000 *bits. So the arm words can account for at most* σ *of the field, which is* 3.24×10^{-2} *at the worst point Article 79 contemplates (Y7).*

Proof. Theorem 7.4 with Theorem 9.1. □

Remark 9.3 (The conditional cost is field-dependent, and can exceed $\ell-1$)**.** [D]Theorem 9.1's conditional entropy is a *mean*. The surprisal of a particular prescribed field, given the units, is not: Article 84 states already that under a per-site bias $\theta\neq\frac12$ the cost of a field with n_1 unaligned contacts is $n_1\log_2\frac{1}{\theta}+(\ell-1-n_1)\log_2\frac{1}{1-\theta}$, with range $[(\ell-1)\log_2\frac{1}{\max(\theta,1-\theta)},\,(\ell-1)\log_2\frac{1}{\min(\theta,1-\theta)}]$ and mean $(\ell-1)H(\theta)$ [Sch26d, Thm. 7.10(b)]. At the dominant gap $g=2$ the per-contact range is $[0.183,3.069]$ bits at $\Delta=1$ and $[0.026,5.797]$ at $\Delta=2$, so a field that asks for the disfavoured alignment at a sensitive contact costs *more* than one bit there, not less. The excess needs no coincidence: averaged over a uniformly chosen prescribed field the conditional cost is $\sum_j\frac12[-\log_2\theta_j-\log_2(1-\theta_j)]\ge\ell-1$ by Gibbs' inequality, with equality only at $\Delta=0$, and at $\ell=6$, $\pi_e=0.90$ it is 5.1014 bits at $\Delta=1$ and 5.3097 at $\Delta=2$ (5.0282 and 5.0863 at $\pi_e=0.95$). So the conditional cost exceeds Article 84's figure on average, while the unconditional cost equals it exactly—the two being different quantities, as Scholium 8.5 sets out. The mean-entropy form of Theorem 9.1 is Article 84's clause with θ made gap-dependent and the expectation taken over the stream; the base formula is credited there and is not new here. What is new is that the clause does not reduce the selection cost, because the bias it posits has a random sign over the stream (Thm. 8.2)—which is the condition clause (b) does not consider.

Ruling 9.4 (For Article 84)**.** [D]Unamended in value, and strengthened. Article 84's cost theorem prices a prescribed alignment field at exactly $\ell-1$ bits on a column whose contacts are all blind. That hypothesis does fail off the pure limit, and Article 84 says so—in its falsification register, at its Scholium 7.12 and at its Theorem 7.13—so nothing is corrected on that head; what this paper adds is the magnitude σ (Thm. 6.1).

The theorem's *conclusion*, however, needs less than it assumes. By Corollary 8.4 the figure $\ell-1$ is exact at every π_h, to one part in 10^7, so blindness of the contacts is sufficient and not necessary and the figure is not an upper bound attained in a limit. Article 84's Remark 9.6—that the registry term is irreducible by any redesign of the source, no choice of rates or of the demand ratio lowering it—is therefore *not* superseded by this paper but confirmed on a wider domain, π_h being one more parameter that does not lower it. Its *conclusion* is what is confirmed, and not the ground it gives for it: that remark argues from Theorem 7.3 that no parameter of the registration model couples to the orientation of a delivered unit, and under H_ν one does—which is the content of §7—as Article 84 itself concedes at Remark 7.8 for the initiator fraction. The conclusion survives because the coupling is symmetric, not because it is absent, and that is a different and better reason than the one given. Its Target 14.4 is discharged in both clauses: the fraction is σ, and the bias is not in a useful direction, being symmetric. Its H_{frame} is refined and not discharged (Thm. 10.3). Its Target 14.1 on the orientation bias of a delivered unit remains open and is sharpened: what must be measured is not only whether Δ_{rgy} is positive but whether the registration number counts coincidences, since the second question decides whether the first has any consequence (Target 15.1).

10 What cleavage refines in H_{frame}

Hypothesis 10.1 (H_{dist}, a free-energy difference is a distinction)**.** [D]At a contact whose two states carry registration numbers $\nu_0\neq\nu_1$, the two states are distinguishable without reference to an external frame.

Article 84 does not grant this. It retains two configurations differing in the alignment bit of a blind contact as distinct "because distinctness is a property of the configuration and

not of what weighs it", and states that "degeneracy of a contact energy is not unobservability in an external frame" [Sch26d, Rems. 4.20, 4.21]. The converse direction used here—that non-degeneracy *is* distinguishability within the contact—is not Article 79's H_{rgy} either, that hypothesis pricing a guest which fails to present the pattern rather than two orientations of one that does. It is therefore registered as this paper's second added premise.

Proposition 10.2 (Adjacent contacts are not independent)**.** *[A]Contact i and contact $i+1$ of a column share unit $i+1$, and by Definition 4.3 with [Sch26d, Thm. 7.4] a sensitive contact requires both its units sighted. The indicators are therefore positively correlated:* $\mathbb{P}(\text{both sensitive})/\sigma^2$ *is* 50.4*,* 10.5 *and* 5.6 *at Article 79's three operating points. No count in this section is binomial; all are computed by transfer matrix over the* 28 *unit types (Y8).*

Theorem 10.3 (H_{frame} is refined, not discharged)**.** *[D]Article 84's H_{frame} asks for an ι-free reference on the ground that at a blind contact the two alignments describe one configuration twice. Under H_{dist}, at a sensitive contact they do not: the two carry $\nu_0 \neq \nu_1$ and are separated by the contact's own free energy. What this supplies is the* partition *of the contact's two states and not their labelling—which of the two is the aligned one is a question only a reference answers—so H_{frame} is weakened on the sensitive contacts to a labelling convention and stands entire on the blind ones. The expected number of self-distinguishing contacts on a column of ℓ sites is $(\ell-1)\sigma$, by linearity and despite Proposition 10.2: at the nominal $\ell = 54$ this is* 0.021*,* 0.478 *and* 1.717 *of* 53 *at Article 79's three operating points, leaving* 99.96*,* 99.10 *and* 96.76 *per cent of contacts requiring the reference as before (Y8).*

Proof. The first sentence is Article 84's ground for the hypothesis. The second is H_{dist} applied to Proposition 7.3. The third is the observation of the remark following Definition 4.3: $\nu_0 \neq \nu_1$ is a statement about an unordered pair. The mean is $\mathbb{E}\sum_j \mathbf{1}[\text{contact } j \text{ sensitive}] = (\ell-1)\sigma$, each contact being marginally a draw of two independent units under H_{draw}; linearity needs no independence between contacts, which by Proposition 10.2 does not hold. Y8 evaluates the figures. □

Proposition 10.4 (Columns that are not wholly degenerate)**.** *[D]The probability that a column of ℓ sites carries at least one self-distinguishing contact, computed exactly from the transfer matrix of Proposition 10.2, is* 0.0019*,* 0.0415 *and* 0.1363 *at $\ell = 6$ and* 0.0202*,* 0.3577 *and* 0.7804 *at the nominal $\ell = 54$. Half of all columns carry one by length* 1802*,* 85 *and* 26 *sites. The binomial figures—*0.8255 *at $\ell = 54$, $\pi_e = 0.90$, and half-lengths* 1768*,* 78 *and* 23*—overstate each of these, the correlation of Proposition 10.2 clustering sensitive contacts rather than spreading them (Y8).*

Scholium 10.5 (What this is and is not worth). Three quantities must be kept apart and the largest is the least important.

The *fraction of contacts* on which the refinement bites is σ, which at $\pi_e = 0.90$ is 3.24×10^{-2}: between one and two contacts of 53. That is the honest measure, and it is small. The hypothesis stands, in its original form, on 96.76 per cent of contacts.

The *probability that a column carries at least one* such contact is 0.7804 at the same point, and it is tempting to report that figure instead. It should not be, because one sensitive contact does not orient its neighbours: the alignment bit at a blind contact j records whether the unit above it is flipped, and if both units there are blind the two records describe one configuration, whatever happens at a distant contact i. The degeneracy is local and is removed locally.

The *labelling* is not supplied at all. A sensitive contact tells an observer that its two states differ; it does not say which is aligned, and the alignment field is defined relative to a frame. So even on the sensitive fraction H_{frame} is not removed but reduced to a convention—one global choice of sign rather than a physical reference at each contact. Whether that is worth having is a question about what the reference is for, and this paper does not settle it.

All three are reported because all three are asked, and the first is the one that bears on the hypothesis. The contribution of this section is not that the hypothesis goes away. It is that the corpus now has a number for how much of it cleavage touches, where before it had none, and the number tells an experimenter what to measure: not whether a reference exists, but what fraction of contacts carry their own distinction.

Remark 10.6 (The lattice figures are nominal, and doubly conditional)**.** [D]The length 54 is Article 80's *node count* for the smallest box whose halves are each complete, $3\times3\times6$ [Sch26b]. It is not a column length. Such a box is 9 columns of 6 along the stacking axis and so carries 45 stacking contacts, not 53; the figure 53 quoted above is the nominal $\ell-1$ at $\ell = 54$, carried for continuity with Article 84's arithmetic, and the box figure is the physical one.

A second condition bites harder here than there. Article 84 records that in the interior lattice the arms on the primary locants are consumed as covalent linkers, so what a node

presents at a stacking contact is its free-terminal pattern and not the delivered arm word, and that the blindness of such contacts is "asserted here and not shown" [Sch26d, Rem. 9.4]. For Article 84 this leaves a figure unproved; for this paper it changes the distribution σ is computed from, σ being a function of the specific arm word rather than only of its ι-constancy. The lattice figures of this section are therefore conditional on an arm distribution at a lattice node that the corpus has not supplied, and they are quoted as the stock-column figures they are (Target 15.5).

11 The trade

Proposition 11.1 (Orientability against arm efficiency)**.** *[D]Article 79 prices cleavage in arm efficiency: with accepted fractions* $1-\pi_h^2$ *on* D *and* π_e^4 *on* T*,*

$$\eta_{\text{arm}} = \frac{\rho^* + 1}{\rho^*/(1-\pi_h^2) + 1/\pi_e^4}$$

[Sch26e, Prop. "Cleavage"], where Article 79's $\rho^* = R_D/R_T$ *coincides with Article 84's* p_2/p_4 *under that paper's design equation. At* $\rho^* = 200$*, the upper end of the range Article 79 reports for the protocell's demand, this is* 0.9997*,* 0.9964 *and* 0.9875 *at* $\pi_e = 0.99$*,* 0.95 *and* 0.90*, while* σ *rises as in Remark 6.3. The capacity gained per unit of arm efficiency surrendered is* 0.61*,* 1.18 *and* 1.23 *bits at* $\Delta = 1$*, and* 1.12*,* 2.17 *and* 2.26 *at* $\Delta = 2$*. Over* $\pi_h \in [0, \frac{1}{5}]$*,* η_{arm} *is strictly decreasing and* σ *strictly increasing—the latter certified by the positivity of every Bernstein coefficient of* σ' *on that interval, the least being* 9.40×10^{-6}*—so the trade is monotone in both arguments and no point on it is free (Y6).*

Remark 11.2. [A]The figures are computed from Article 79's formula at $\rho^* = 200$ rather than imported, that paper's R_D and R_T not being reproduced here; the formula is its own and the substitution is stated. The magnitudes of ρ^* and p_3/p_4 are Article 84's stipulated illustrations and no rate of Article 79 is imported [Sch26d, Prop. 9.5].

Scholium 11.3 (A parameter with two jobs). Article 79 tracks π_h for one reason: cleaved arms are not accepted by the uses that need them, so cleavage costs material. The quantity turns out to have a second effect in a different currency. The same cleavage that loses arm efficiency makes units flip-visible, and flip-visible units make contacts that distinguish their own two states.

Whether that is worth anything depends on quantities neither paper has, and this paper's own finding argues that it is worth less than it first appears. What cleavage buys is not a cheaper field—the price of that is unchanged (Cor. 8.4)—but a correlation between arm words and alignment, of at most 3.24×10^{-2} bits per contact at the worst stated point, collectable only by an agent that can read the arm words. The efficiency loss is real and is paid regardless. The honest statement is that a parameter the corpus introduced for one purpose has a second consequence, that the consequence is computable and small, and that the two pull in opposite directions.

12 Consolidated register

Which contacts read their alignment? Those whose second pattern separates the first from its flip by overlap count. *Rests on* Prop. 5.1, Cor. 5.2. *Standing* [A].

Does cleavage break Article 84's blindness premise? Yes, as a mechanism, which that paper states; the magnitude is new: σ rises by 1587 at one per cent cleavage. *Rests on* Thm. 6.1, Rem. 6.3. *Standing* [D].

How fast? Quadratically: sensitivity needs two sighted units. *Rests on* Cor. 6.2. *Standing* [D].

Which species carries it? Almost entirely D, which is the species the architecture needs most and is Article 77's catalogued Dm. *Rests on* Prop. 5.4. *Standing* [A].

Does the channel bias the alignment field? No. The relabelling involution reverses every contact's preference at equal probability, so the field's law is uniform at every π_h. *Rests on* Thm. 8.1, Thm. 8.2. *Standing* [D].

Does Article 84's selection cost change? No, and it is exact rather than bounded: $\ell - 1$ bits at every π_h, to one part in 3.54×10^6, its blindness hypothesis being replaced rather than deleted. *Rests on* Cor. 8.4, Rul. 9.4. *Standing* [D].

What does cleavage create, then? A mutual information between arm words and alignment, of capacity at most σ bits per contact whatever Δ_{rgy} is. *Rests on* Thm. 7.4, Thm. 9.1, Cor. 9.2. *Standing* [D].

Does cleavage discharge H_{frame}? No; it refines it on a σ-fraction of contacts, and supplies a partition rather than a labelling even there. *Rests on* Thm. 10.3, Sch. 10.5. *Standing* [D].

What does the channel cost? Arm efficiency: 0.9875 at $\pi_e = 0.90$. *Rests on* Prop. 11.1. *Standing* [D].

Does any of this hold under Article 79's own reading of ν? No. Under that reading $\sigma \equiv 0$ and the paper is empty. *Rests on* Rem. 3.2. *Standing* [D]; this is the paper's binding premise.

13 Falsification register

H_ν**.** If the registration number is a function of the unordered family pair, as Article 79 writes it for homogeneous stacks, then $\sigma \equiv 0$, there is no channel, and this paper has no content. Everything here is conditional on the coincidence reading (Rem. 3.2).

H_{stock}**.** If cleaved units that no downstream use accepts are sequestered rather than stacked, the columns contain only accepted units and σ must be recomputed on that stream. Article 79 says such units remain admitted and does not say they stack (Hyp. 4.2).

H_{dist}**.** If a free-energy difference between two states of a contact is not a distinction available without an external frame—which is the direction Article 84's Remarks 4.20 and 4.21 decline to grant—then Section 10 fails entire and H_{frame} stands untouched. Nothing else in the paper depends on it (Hyp. 10.1).

Independence of cleavage across arms. Correlated cleavage—an all-or-nothing reduction at a unit, say, rather than per-arm—changes σ and could lower it sharply, since a unit with all arms cleaved is blind again. Theorems 8.1 and 8.2 survive only if the correlated law is still ι-invariant, which a locant-blind mechanism would be; the polynomial does not (Target 15.2).

Independence of contacts. Adjacent contacts share a unit and are positively correlated by factors up to 50.4 (Prop. 10.2). The means of Theorem 10.3 are unaffected; every distributional figure is computed from the exact law and would be wrong if taken binomially, as Proposition 10.4 records.

Theorem 7.4. Two premises. A further orientation-dependent term in the contact free energy, which Article 84's Theorem 7.10(b) explicitly admits, would let a blind contact carry information and break the ceiling. And an ensemble whose composition moves with Δ—as Article 79's own second filter would give—breaks the Δ-freedom; H_{draw} is what forbids it (Sch. 7.5).

The stream composition. σ is weighted by the admitted fractions, which depend on ρ^* and p_3/p_4, both stipulated illustrations of Article 84. A different demand ratio moves $\sigma(0) = f_I^2$ and the mixing of the curve; the quadratic coefficient, dominated by D, moves little. Note that this does *not* contradict Article 84's Remark 9.6: the selection cost is unmoved by any of them (Cor. 8.4).

The lattice figures. Conditional on an arm distribution at a lattice node that the corpus has not supplied, and quoted at a nominal length rather than a box's contact count (Rem. 10.6).

14 Precedence

Ruling 14.1 (Article 79)**.** [C]Consistent; nothing amended. Its cleavage model, accepted fractions, arm-efficiency formula and the commentary on the arming route are imported as written, the commentary as a motive and not as a claim about the route. Its H_{rgy} is imported in Article 84's refined reading H_ν and not in its own; the difference is stated at Remark 3.2 and is this paper's binding premise rather than a correction to that one. Two inferences beyond its text are registered as hypotheses rather than attributed to it (Hyps. 4.2, 10.1).

Ruling 14.2 (Article 84)**.** [D]See Ruling 9.4: unamended in value and strengthened. Its Target 14.4 is discharged in both clauses, its Remark 9.6 is confirmed on a wider domain, its Theorem 7.10(b) is credited as the source of this paper's mean-entropy form (Rem. 9.3), and its Remark 7.8 is extended, π_h joining p_3 as a source parameter that moves the sensitive fraction. Its H_{frame} is refined and not discharged, and its Remarks 4.20 and 4.21 are answered by registering H_{dist} rather than by asserting the identification they decline (Hyp. 10.1).

Ruling 14.3 (Articles 40, 57, 80)**.** [C]Consistent; imported and not extended. Article 40's registry field on the oriented z-edges is the object priced here, and it is the same object as Article 84's alignment field rather than a second one [Sch26d, Def. 4.2]. Article 57 [Sch26c] is cited for context only and enters no argument of this paper. Article 80 supplies the heritable minimum 54, which is a node count and is used here as a nominal length under the caveats of Remark 10.6, those being Article 84's Remark 9.4 rather than its Remark 9.6.

15 Targets, and conclusion

Target 15.1 (Which reading of the registration number)**.** Decide whether ν counts coincident locant–arm positions, as H_ν reads it, or is fixed per substitution family, as Article 79 writes it for homogeneous stacks. The whole of this paper is conditional on the first; under the second there is no channel. A measurement of the stacking constant of a mixed-arm pair against a matched pure-arm pair would settle it, and it is a cheaper experiment than measuring Δ_{rgy} itself.

Target 15.2 (Correlated cleavage)**.** Determine whether arms are cleaved independently, as Article 79 models, or in a correlated way. A unit whose arms are all cleaved is blind again, so strong positive correlation would suppress σ. Note that Theorem 8.2 survives any correlated law that is invariant under permuting the locants by ι, so the symmetry finding is more robust than the polynomial.

Target 15.3 (The optimum, if there is one)**.** Decide whether a designed source should run at $\pi_h > 0$. The trade of Proposition 11.1 is monotone in both arguments, so an optimum exists only against a stated objective; and since the selection cost does not fall (Cor. 8.4), the objective cannot be the price of the field.

Target 15.4 (Mixed arms downstream)**.** On T, Article 79's acceptance sets admit only $eeee$, so the sighted tetrasubstituted units this paper counts are ones downstream uses refuse. On D the opposite holds: the sighted word is Article 77's catalogued Dm [Sch26a, Tab. 2], accepted by anchors, residues and the membrane under Article 79's H_{acc}, and Article 79 contemplates supplying part of the membrane as Dm deliberately. Since D carries almost all of σ, determine whether the columns that carry the channel are the columns the architecture consumes—which on the D side they may well be—or a surplus pool beside them.

Target 15.5 (The lattice node's arm word)**.** Supply the distribution of free-terminal patterns at an interior lattice node, the primary arms there being consumed as linkers. Article 84's Remark 9.4 leaves its lattice blindness asserted; for this paper the same gap leaves σ undefined on a lattice, since σ depends on the arm word and not only on its ι-constancy. Until then the figures of Section 10 are stock-column figures quoted at a nominal length.

Proposition 15.6 (What is established)**.** *[A]Subject to Appendix A and to Remark 3.2: (i) a contact is sensitive iff one pattern separates the other from its flip by overlap count, a criterion symmetric in the two units (Prop. 5.1, Cor. 5.2); (ii) two sighted D units always make a sensitive contact, over any alphabet, while two sighted T or I units need not (Prop. 5.4); (iii) the sensitivity is a polynomial of degree exactly* 8 *with* $\sigma(0) = f_I^2$ *and a quadratic regime, rising by* 1587 *at one per cent cleavage (Thm. 6.1, Cor. 6.2); (iv) the information the source supplies is at most* σ *bits per contact for every registration free energy, given* H_{draw} *(Thm. 7.4); (v) the channel is symmetric—*$a \mapsto a \circ \iota$ *being a measure-preserving involution that reverses every contact's preference—so the alignment field's law is uniform at every* π_h *and Article 84's selection cost of* $\ell - 1$ *bits is exact rather than limiting (Thms. 8.1, 8.2, Cor. 8.4); (vi) what cleavage creates is a mutual information of capacity at most* $(\ell - 1)\sigma$*, collectable by an agent that reads arm words and not by one that places units (Thm. 9.1, Cor. 9.2, Sch. 8.5); (vii)* H_{frame} *is refined on a* σ*-fraction of contacts, to a labelling convention, and stands entire elsewhere (Thm. 10.3); (viii) the channel is bought with arm efficiency at a computable rate (Prop. 11.1).*

Remark 15.7 (What is not established)**.** [A]The paper is conditional on H_ν and is empty without it. Two further premises are added and registered: H_{stock}, without which the cleaved units are not in the columns, and H_{dist}, without which Section 10 fails. No cleavage rate is attested, no mechanism for the cleavage is given, and Δ_{rgy} is not measured—though Theorem 7.4 is stated so that the principal bound does not need it, at the cost of a premise on the ensemble. The independence of cleavage across arms is Article 79's model and not a finding. The lattice figures are nominal and conditional (Rem. 10.6). And the refinement of H_{frame} is partial twice over: on a 3.24×10^{-2}-fraction of contacts, and supplying a partition rather than a labelling even there.

Scholium 15.8 (What would overturn the paper). One finding, and it is not about cleavage. If the registration number is fixed per family, then $\sigma \equiv 0$ and there is no channel at any π_h; the paper collapses to the statement that Article 84 was right, for a reason slightly better than the one it gave. That is a measurement on a mixed-arm stacking constant, and it is the first experiment this line of work should ask for.

Short of that, the figures move but the structure does not—and the structural finding is the robust one. A different demand ratio moves $\sigma(0)$; correlated cleavage moves the polynomial; a large Δ_{rgy} moves the capacity toward its ceiling and no further. The symmetry of Theorem 8.2, which is what leaves Article 84's price untouched, survives all three, needing only that the arm law be invariant under ι and that ι fix D and T—and the second of those is an axiom.

A Hypothesis register

Remark A.1. [A]One premise carries everything and it is imported rather than introduced. H_ν is Article 84's refinement of Article 79's registry hypothesis, registered

Table 1: The hypothesis register. Three premises carry the paper: one imported reading of ν, on which everything depends, and two inferences beyond the text of Articles 79 and 84, registered here rather than attributed to them.

	Premise	What rests on it	What survives its failure
H_ν (imported, [Sch26d, Hyp. 4.18])	ν counts coincident locant–arm positions (S)	Every result of this paper, including the strengthening of Article 84's Thm. 9.2 at Cor. 8.4, which is therefore obtained under a premise that theorem does not itself carry	Nothing of this paper; Article 84 entire, at every π_h—and Thm. 8.2, which holds under either reading of ν, for different reasons (Rem. 8.3)
Cleavage model (imported, [Sch26e, Prop. "Cleavage"])	Each arm cleaved to h independently at π_h (S)	The polynomial of Thm. 6.1 and every figure drawn from it; *not* Thms. 8.1, 8.2	Those two theorems, under any ι-invariant arm law (Target 15.2)
H_{stock} (*added*, Hyp. 4.2)	Unaccepted but admitted units stack in the stock columns (S)	That there is anything to compute: every weighted figure	The per-contact combinatorics of §5
H_{rgy} (imported, [Sch26e, Hyp. H_{rgy}])	The registration factorisation, $\Delta > 0$ (S)	Prop. 7.3 and the information figures; *not* Thm. 8.2, which needs only a weight that is a function of the two presented patterns (Rem. 8.3)	Thm. 6.1 and Prop. 5.1, which are combinatorial
H_{draw} (imported, [Sch26d, Hyp. 4.16])	Independent draws from the admitted stream, of composition independent of Δ (S)	The weighting of σ; Thm. 8.2; the Δ-freedom of Thm. 7.4 (Sch. 7.5)	The per-contact statements, which are unweighted
H_{dist} (*added*, Hyp. 10.1)	Unequal registration numbers distinguish a contact's two states (S)	§10 entire	Everything else; H_{frame} then stands untouched
H_{frame} (imported, [Sch26d, Hyp. 4.5])	An ι-free reference at a stack's end (A/S)	The labelling of ν_0 against ν_1; Article 84's positive results	Thm. 10.3, which reduces it to a convention on the sensitive fraction only

> there precisely because the two readings differ where this paper looks. A reader allocating scepticism should spend most of it there, and Target 15.1 says what would settle it. The two added premises are smaller but are this paper's own, and the submitted version carried both without registering either.

B Verification

Script `verify_cleave.py` (Python standard library; exact rational arithmetic throughout, including the sensitivity polynomial, the Bernstein certificate and the field law, except the logarithms and exponentials of Y4, Y6, Y7 and the long-column transfer matrices of Y8). It writes `verification_values.tex`, which this paper inputs; nothing numeric is held in `macros.tex`. Every assertion is checked and the run fails on any mismatch.

Y1 The separation criterion checked against Definition 4.3 at all 784 ordered pairs over $\{h, e\}$ and at 13,689 over three arm types—the content being that the test may be applied to one unit, the identity of the two mixed intersections not being asserted; its symmetry; Article 84's contact theorem reproduced with no violation over both alphabets; the both-sighted split by family pair, with 4 of 4 sensitive on D–D over either alphabet, 40 of 40 + 104 blind on T–T and 24 blind on I–I; the difference formula of Proposition 5.4 and the exclusion of a zero difference on D–D over both alphabets; and the 108 and 54 counterexamples to the two lemmas of the submitted proof.

Y2 The sensitivity polynomial built exactly from the cleavage model and the admitted fractions; degree exactly 8, the top coefficient being nonzero; $\sigma(0) = f_I^2 = 2.47\times10^{-7}$ asserted as an exact rational identity; the linear coefficient 9.40×10^{-6} against the quadratic $4.00009 = 16176842/4044121$, with the quadratic term carrying 1.02 of the value at one per cent cleavage; and σ with its lift at Article 79's three operating

points.

Y3 The gap: at least 1 and at most 4; every sensitive contact at the pure limit of gap one; and the conditional distribution at each operating point, asserted to be concentrated at $g = 2$ with share above 0.99, together with the shares of $g = 1, 3, 4$ and the mean.

Y4 The bias $\theta = 1/(1 + e^{g\Delta})$ and its two limits; the information per sensitive contact at $g = 1, 2, 4$ and $\Delta = 1, 2, 3$; the expected information per contact; and the ceiling, checked against an independent sum over the whole pair ensemble, with the blind mass shown to be $1 - \sigma$ and the gap-based sum confirmed to agree with it; that a blind contact contributes nothing is a property of the entropy function given the premise, now registered, that the alignment weight is a function of ν alone. The ceiling is not checked by resumming the gap distribution alone, which would be circular.

Y5 The relabelling involution: ι-closure of D and T and its failure on I; measure-preservation and pattern-reversal on every word of D and T; the signed bias, exactly zero without the initiator and 2.03×10^{-7} with it; the marginal law of the alignment field by exact transfer matrix over the 28 unit types at $\ell = 3, 4$, $\pi_h = \frac{1}{10}, \frac{1}{2}$ and $e^{\Delta} = 3, 10$, found exactly uniform without the initiator and within 8.06×10^{-8} in absolute mass with it; the selection cost of a prescribed field, confirmed exactly $\ell - 1$ bits without the initiator; and, with it, the scale-free quantity the statement needs—the per-contact deviation of that cost in bits, maximised over π_h, e^{Δ} up to 10^3 and $\ell \in \{3, 4, 5\}$, at 2.83×10^{-7} bits, one part in 3.54×10^6.

Y6 Article 79's arm efficiency evaluated from its formula at $\rho^* = 200$; the trade ratio at each operating point and at $\Delta = 1, 2$; and the monotonicity of both η_{arm} and σ over $\pi_h \in [0, \frac{1}{5}]$, the latter by a Bernstein certificate rather than a grid.

Y7 The capacity and the conditional entropy at $\ell = 6$ and $\ell = 54$, at the pure limit and two operating points, for $\Delta = 1, 2$; the column bound $(\ell - 1)\sigma$ checked at Δ up to 24; and the per-contact surprisal range of Article 84's Theorem 7.10(b) at $g = 1, 2$.

Y8 The dependence of adjacent contacts, measured as $\mathbb{P}(\text{both sensitive})/\sigma^2$ and asserted to exceed one; the probability that a column carries at least one sensitive contact, by exact transfer matrix, with the binomial figure beside it and asserted to be no larger; the half-lengths by bisection on the exact law; and the box arithmetic, $3 \times 3 \times 6 = 54$ nodes forming 9 columns of 6 with 45 stacking contacts.

C Molecular commentary, isolated

Remark C.1 (Status)**.** [A]Nothing here enters a numbered statement.

Remark C.2 (Why the phenol is the likely intermediate)**.** [E]Article 79 reaches the hydroxyethoxy arm by replacing an aryl bromide with an oxalate monoester and reducing it. Its own commentary records that if the route instead passes through the phenol, h is obligatory and $\pi_e = 1$ is a limit of conversion [Sch26e, App. "The arming route, and its tension"]. This paper takes no position on the route; it observes only that the corpus's own doubt about the limit is what makes the region off the limit worth computing. Note that h and e are there the two fates of one oxalate arm rather than e being cleaved to h, so the per-arm independence imported at Definition 4.1 is independence at that step (Target 15.2).

Remark C.3 (What a sighted unit looks like)**.** [E]A sighted disubstituted unit carries one phenol arm and one hydroxyethoxy arm—6-OH with 12-OCH_2CH_2OH, or the reverse. It is not a hypothetical species: it is the *Dm* of Article 77's catalogue [Sch26a, Tab. 2], formula $C_{20}H_{16}O_3$, listed there as a membrane precursor and accepted by anchors, residues and the membrane under Article 79's H_{acc} [Sch26e, Hyp. H_{acc}]. The two arrangements are the same compound; which of them a given unit presents at a contact is the alignment datum, and they present different patterns because the arms differ. That is the whole of the mechanism—and the whole of the reason it carries no direction, since the two are equally probable.

D Sources, by use

References

[Sch26a] Charles D. Schaper. Carbon Traceable Protocell Construction From Substituted Chrysene Stocks. *Annals of the Chrysene Formalism*, 1(4):1567–1605, 2026. Article 77. DOI: https://doi.org/10.68366/ees7wd38.

[Sch26b] Charles D. Schaper. The Completeness Condition: Realisation of the Twelve-Axiom Framework at a Site of the Interior Chrysene Lattice, and the Genome Length It Requires. *Annals of the Chrysene Formalism*, 1(4):1639–1651, 2026. Article 80. DOI: https://doi.org/10.68366/0a19r769.

Table 2: Sources, by use. A source cited only for context is marked as such.

Source	Used at	What is taken
Article 79	§4, §6, §11	The cleavage model and its accepted fractions; the arm-efficiency formula and ρ^*; the admitted stream; H_{rgy}; H_{acc} and the catalogued Dm; the commentary on the arming route, which motivates the paper
Article 84	throughout	The presented pattern; unit and contact blindness; H_v; the alignment field and its selection cost; H_{draw} and H_{frame}; Thm. 7.10(b)'s biased-cost form; Rems. 4.17, 4.20, 4.21, 7.8, 9.4; Prop. 9.5's stipulated demand figures; Tgts. 14.1 and 14.4
Article 77	§5, App. C	The unit catalogue, for the identity and formula of the sighted disubstituted species
Article 40	§14	The registry field on the oriented z-edges, which is the object priced here and is Article 84's alignment field
Article 57	—	Context only; enters no argument of this paper
Article 80	§10	The heritable minimum, as a node count used for a nominal length under Rem. 10.6

[Sch26c] Charles D. Schaper. The Origins Transition: From the Encoded Chrysene Cluster to the Originating Genetic Code Mappings — Structural Consistency, Codon Placement, and a Forced Exchange. *Annals of the Chrysene Formalism*, 1(2):1076–1106, 2026. Article 57. DOI: https://doi.org/10.68366/yx30r330.

[Sch26d] Charles D. Schaper. The Placed Source: Exogenous Preparation of the Substituted-Chrysene Assembly, and the Equality of Its Reachable Set with the Endogenous One. *Annals of the Chrysene Formalism*, 1(4):1703–1731, 2026. Article 84. DOI: https://doi.org/10.68366/a4tjv735.

[Sch26e] Charles D. Schaper. The Source: Substitution-Initiated Self-Separation of the Substituted-Chrysene Stock from a Polyaromatic Bulk, and the Supply It Delivers to the Protocell. *Annals of the Chrysene Formalism*, 1(4):1616–1638, 2026. Article 79. DOI: https://doi.org/10.68366/s8sfwq50.