When the Description Outgrows the Described

Symbolic Proliferation, Degrees of Freedom, and the Case for Compression

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Abstract

A recurring failure mode in theory-building: a shared underlying structure is re-described in proliferating, mutually incompatible symbol systems; free parameters multiply until the description is larger than the thing it describes; and a framework flexible enough to fit anything stops explaining anything. This note diagnoses the pattern, locates its cost in both information (redundancy) and energy (the price of carrying description), and argues that the corrective is compression toward minimal description. A single worked example — an exact, losslessly reversible information-encoding — shows that minimal description with perfect reconstruction is achievable. It is offered strictly as an example of the discipline, *not* as a unification of any physical theory. The argument is fenced throughout: notational proliferation is real, but not every dispute it produces is merely terminological; compression generates candidates, not certainties; and a minimal description earns standing by independent reconstruction, never by elegance alone.

1 The proliferation problem

Distinct fields, and distinct workers inside a field, repeatedly arrive at the same structure and then spend their effort disagreeing about how to write it. The notations multiply; the names multiply; and a growing share of the literature becomes an argument about symbols rather than about substance. Real resources — page count, the reader's attention, the cost of teaching the next student — are spent on which character gets which meaning, and on who gets to fix the name.

This is not the claim that the disputes are empty. Some are substantive: wave–particle complementarity, for one, encodes a genuine physical fact, not a quarrel over notation, and no amount of symbol-cleaning dissolves it. The claim is narrower and harder to see: notational proliferation *obscures* the substantive core by burying it under redundant description, so that the real disagreements and the merely terminological ones grow hard to tell apart. The first task is therefore separation — deciding which part of a dispute is about the world and which is about the alphabet.

2 Degrees of freedom

Every free parameter buys flexibility, and flexibility is not free. A model with enough adjustable degrees of freedom can be fitted to any data set, and a model that fits everything predicts nothing. The point is old: with four parameters one can fit an elephant, and with five make its trunk wiggle (a remark attributed to von Neumann). Overfitting is its formal version — variance bought at the price of meaning.

The pathology scales. If any competent worker can take a compact, well-tested relation and decorate it with a handful of extra variables, the result is not one improved theory but an unbounded family of them: each complete enough to look finished, incomplete enough to be unfalsifiable, and none agreeing with the others. The proliferation of degrees of freedom is the engine of the disagreement, and adding more candidates cannot end it — because adding candidates is the disease.

3 When the description outgrows the described

There is a measurable sense in which a description can exceed its object. The minimum description length of a data set is the length of the shortest program that reproduces it (Kolmogorov complexity; Rissanen's MDL), and redundancy is exactly the part of a description that can be removed without loss. When the symbol system grows larger than the underlying degrees of freedom — when the map exceeds the territory — the surplus is, by definition, compressible.

The surplus also carries a thermodynamic price. Description is physical: holding information against noise, and erasing it, both cost energy (Landauer). Redundant description therefore costs energy to carry while contributing no information — a toll paid for nothing. Compression is the one operation that lowers both bills at once: fewer symbols to dispute, and less energy to maintain, for the same recoverable content.

4 Compression as the corrective

Occam's razor, read with teeth, is not an aesthetic preference but the MDL prescription: prefer the shortest description that reproduces the data. Its use here is diagnostic — compression strips the redundant symbols and leaves the actual structure visible, which is precisely what the proliferating literature has hidden.

A homely illustration. There was a long fashion for ever more elaborate ASCII art atop code repositories: bigger banners, finer detail, more characters pressed into the picture. Past a certain elaboration the figure becomes unreadable — the added detail defeats the only thing the figure was for. Description has the same ceiling. Beyond the point where symbols track content, more symbols subtract legibility. The cure is not a better banner. It is fewer characters, chosen to be read.

5 A worked example

That compression to a minimal, exactly reversible code is achievable, and not merely hoped for, can be shown on a single constructed object. Consider a triangular index in which one coordinate is carried by *position* and the other by *value*, so that a message is a set of self-locating points; the inverse map is exact integer arithmetic — a ceiling division and a divisibility test — and every symbol round-trips without loss. Three properties are all that matter here: the symbol set is minimal, the reconstruction is exact, and there are no spare parameters to tune. It is compression done correctly inside its own domain.

Fence. This is an information-encoding, and the example claims nothing beyond information-encoding. It is *not* advanced as a structure underlying physics, nor as a candidate unification of any kind. To advance it that way would be to commit the exact error this note diagnoses: a

compact relation decorated until it claims everything and settles nothing — the nine-thousand-and-first finished-looking theory. Its only role is to show that the discipline — minimal symbols, exact reconstruction, no free parameters — is realizable. No more.

6 Limits

Three honest limits close the argument. First, the separation of terminological from substantive disagreement, on which everything here depends, is itself difficult, and the paper supplies the *motive* for the separation, not a method. Second, compression is a candidate-generator, not a truth-guarantor: the shortest description consistent with today's data may be wrong, and brevity is never evidence of correctness. Third, a minimal description earns standing the only way any description does — by independent reconstruction of the data from it, run by people who did not author it. Elegance recommends; it does not certify.

The whole value of compression is that it shrinks the remaining, genuine disagreements until they are small enough to see. It does not promise they vanish.