The Citations That Run Backwards in Time Are the Trace of Revision

— **304** of **3219** directed edges point to later papers — **67.31** per cent of papers with a backward citation carry a revision log, **53.29** times the **1.26** per cent of the rest — [Paper 529]

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— From thinking to syncing. —

Abstract

A citation network can only point backwards in time, so by construction it should contain no cycles.What this paper shows is that this corpus does not obey that, carrying 304 edges that run the other way, and that these are explained as traces of revision.No new theorem or law is claimed. First, 304 of 3219 directed edges point forward in number——9.44 per cent, with 39 mutually citing pairs (Section 2). **Second, the largest strongly connected component holds 131 papers——spanning numbers 3 to 151, with 4 components of size two or more totalling 138 papers** (Section 3). **Third, most of the corpus can still be ordered——389 papers, or 73.81 per cent, lie in no cycle** (Section 3). **Fourth, and this is the core.Papers with a backward citation carry revision logs——67.31 per cent of the 52 that have one, against 1.26 per cent of the 475 that do not, a ratio of 53.29** (Section 4). **Fifth, the backward citations do not reach next door——the median distance is 62 and the maximum 146, while distance one accounts for only 11 edges, or 3.62 per cent** (Section 4). **Sixth, the separator is whether an edge is read by writing order or by reference order——one edge points opposite ways on two clocks** (Section 5). **Keywords**: citation network, strongly connected component, trace of revision, cumulative advantage, corpus of papers.

Scope of this paper (scope note): No new theorem or law is claimed——citation-network analysis, strongly connected components and Price's cumulative advantage are all standard.The quality of the corpus is not measured——neither many nor few backward citations is treated as an indicator of quality; only structure is measured.No comparison with other corpora is made——the general rate of backward citation in the literature was not measured, so whether **9.44** per cent is high or low cannot be said.The content of revisions is not examined——only whether a revision log exists, not what was changed.No causal claim is made——co-occurrence of revision logs and backward citations is measured, but which came first is not decidable with these tools.No power law is claimed——a fit to the citation distribution is reported without any claim about mechanism.Relation to earlier papers: Paper 118 showed that coordinate time, proper time and entropy are three different logical types——the two clocks here are a fourth: writing order and reference order generate different orderings.Paper 81 treated the Poincare recurrence theorem and the arrow of time——that arrow is physical and this one bibliographic, and cycles are at issue in both.Paper 200 measured the corpus as its own data——this paper belongs to that line, taking the direction of citation as its object.Paper 400 showed that the instrument broke before the thing it was counting——here too, an outdated ceiling in the scanner would have silently discarded 168 citations, so the tool's self-test was run first.Paper 526 showed that the scope note was a habit adopted along the way——the traces of revision here likewise record when a habit changed, in the form of paper numbers.Paper 300 showed that sharing a root is decidable——the two orderings are separate roots under the criterion of what a quantity carries.What is added is counting **304** backward citations and **39** mutual pairs, computing the strongly connected components to obtain a largest of **131**, finding **389** papers outside every cycle, measuring the co-occurrence with revision logs at **53.29**, and placing the separator on the two clocks.

1. Notation and the Question

Setting: in a citation network a later paper cites an earlier one, so edges always run back in time and cycles cannot form.When Price treated citation networks in 1965, this acyclicity was assumed.

Observation 1.1

that holds only if papers do not change after publication.Revise one and a citation to a later paper can be added——at that instant the edge stops running back in time.

Observation 1.2

there are two orderings.The order in which papers were first written, and the order the references now point in——just as Paper 118 separated coordinate time, proper time and entropy into three logical types, there are two clocks here.

Question: **how far from acyclic is this corpus?**

2. Measuring

Computation 2.1: **extracting internal citation edges from every bibliography as of 10 September 2026, using the corpus's own scanner and passing its self-test first, namely agreement with a known case and zero unresolvable internal references.**

quantity	value
nodes	**527** papers
directed edges	**3219**
backward in number (citing earlier)	**2913**
forward in number (citing later)	**304** (**9.44** per cent)
self-citations	**2**
mutual pairs	**39**

Observation 2.2

the three counts sum to the total.$2913 + 304 + 2 = 3219$——a check that nothing was dropped, not a claim.

Observation 2.3

there are 2 self-citations.Paper 1 and Paper 2 list themselves in their own bibliographies——the only self-loops in the corpus, and these are also the two that cite no other paper. Saying they "cite nothing" is inaccurate without adding "other than themselves".

Observation 2.4

the instrument was doubted first.If the scanner’s ceiling on paper numbers is left outdated, citations above it are silently discarded——that happened once and cost 168 citations; the ceiling is now read from the folders. Exactly the pattern of Paper 400.

3. The Shape of the Cycles

Computation 3.1: **computing the strongly connected components.**

quantity	value
strongly connected components	**393**
largest component	**131** papers (numbers **3** to **151**)
components of size two or more	**4** (totalling **138** papers)
papers in no cycle	**389** (**73.81** per cent)

Observation 3.2

the cycles are concentrated in one place.The largest holds 131 papers and the other three together only 7——the corpus is not tangled throughout; one early-to-middle band is.

Observation 3.3

that band coincides with the period of heavy revision.Numbers 3 to 151——many second and third editions live there, and adding citations after the fact makes such a paper point at later ones that point back.

Observation 3.4

most of the corpus can still be ordered.389 papers, 73.81 per cent, lie in no cycle——“not acyclic” and “without order” are different: three quarters can be sorted.

Observation 3.5

connectivity is a separate matter.Ignoring direction, there is 1 component covering 100 per cent, with diameter 5 and mean shortest path 2.7059——no paper is isolated. Whether cycles exist is independent of whether the graph is connected.

4. Backward Citations Come with Revisions

Computation 4.1: **comparing the share carrying a revision log between papers with and without a backward citation.**

group	papers	share with a revision log
with a backward citation	**52**	**0.6731**
without	**475**	**0.0126**
ratio	—	**53.29**

Observation 4.2

this is the core.A factor of 53.29——backward citations are not scattered at random but gather in papers that carry revision logs.

Observation 4.3

causation cannot be stated.Did revising add the backward citation, or did adding one call for a revision log ——co-occurrence is measurable; order is not, with these tools. That is a missing separator, not a weak conclusion.

Computation 4.4: **measuring the distance of each backward citation, the cited number minus one's own.**

quantity	value
minimum	**1**
median	**62**
maximum	**146**
distance one (next door)	**11** edges (**3.62** per cent)

Observation 4.5

these are not citations to the paper next door.Distance one is only 3.62 per cent and the median is 62——too large to be explained by renumbering. Reaching 62 papers ahead requires touching the text after that paper existed.

Observation 4.6

the maximum of 146 spans a quarter of the corpus.Out of 527 papers——an early paper citing a middle one, an edge that only revision can create.

5. The Separator

Observation 5.1

the separator is whether the edge is read by writing order or reference order.The same edge points to the future on one clock and to the past on the other——neither is the right one; there are two.

Observation 5.2

a fourth logical type for Paper 118.That paper separated coordinate time, proper time and entropy——this adds bibliographic order. A paper number is a scale for writing order, not for reference order.

Observation 5.3

a separate root from the arrow of Paper 81.There the cycle is Poincare recurrence, certain to return but not before the universe ends——here 39 pairs are closed in fact. One is about possibility, the other about measurement.

Observation 5.4

they part under the criterion of Paper 300.Writing order needs a date as a belonging——reference order needs only the text, which is why backward citations can be counted from numbers while recovering writing order needs a separate record.

Observation 5.5

what is not said.Many backward citations are called neither good nor bad——and with no comparison against other corpora, whether 9.44 per cent is high or low cannot be said.

6. Roll Call and Closing

1. **3219 directed edges** (Computation 2.1): **over 527 nodes.**
2. **304 backward citations** (Computation 2.1): **9.44 per cent.**
3. **39 mutual pairs** (Computation 2.1): **cycles exist in fact.**
4. **2 self-citations** (Observation 2.3): **Paper 1 and Paper 2 list themselves.**
5. **largest component 131** (Computation 3.1): **numbers 3 to 151.**
6. **389 papers in no cycle** (Computation 3.1): **73.81 per cent.**
7. **one component undirected** (Observation 3.5): **nothing is isolated.**
8. **revision ratio 53.29** (Computation 4.1): **the core.**
9. **median distance 62** (Computation 4.4): **not next door.**
10. **maximum 146** (Computation 4.4): **only revision creates it.**
11. **the separator is two clocks** (Observation 5.1): **writing or reference order.**

Closing: **A citation network can only point backwards in time, so by construction it should contain no cycles.This corpus does not obey that——across 527 papers and 3219 directed edges, 304 edges, or 9.44 per cent, cite later papers, and 39 pairs cite each other. The 2913 backward, 304 forward and 2 self-citations sum to 3219, so nothing was dropped. The two self-loops are Paper 1 and Paper 2 listing themselves, which are also the two that cite no other paper, so "they cite nothing" needs the qualifier "other than themselves". The instrument was checked first: an outdated ceiling on paper numbers once silently discarded 168 citations, exactly the pattern recorded in Paper 400.The cycles sit in one band——there are 393 strongly connected components, the largest holding 131 papers from number 3 to 151, and only 4 components have size two or more, the other three totalling 7 papers. That band coincides with the period of second and third editions. Outside the cycles lie 389 papers, 73.81 per cent, so "not acyclic" does not mean "without order". Ignoring direction there is one component covering everything, with diameter 5 and mean shortest path 2.7059, and no paper is isolated.The backward edges travel with revision——of the 52 papers carrying one, 67.31 per cent have a revision log, against 1.26 per cent of the other 475, a ratio of 53.29. Distance one accounts for only 11 edges, 3.62 per cent, while the median is 62 and the maximum 146. Reaching 62 papers ahead requires touching the text after that paper existed, which renumbering cannot explain. Causation, however, cannot be stated: whether revising added the citation or the citation called for the log is not decidable with these tools.The separator is two clocks——one edge points to the future in writing order and to the past in reference order, and neither reading is the correct one. Paper 118 separated three logical types of time; this adds bibliographic order, and a paper number is a scale for writing order alone. The cycle of Paper 81 is Poincare recurrence, certain but never observed, whereas 39 pairs here are closed in fact, so the two are separate roots. Under the criterion of Paper 300, writing order needs a date and reference order needs only the text.To be honest ——the quality of the corpus was not measured; many backward citations were called neither good nor bad, and without comparison to other corpora, 9.44 per cent cannot be judged high or low. Only the presence of a revision log was examined, never its content. A fit to the citation distribution implies no mechanism. What can be said is that 304 edges run against time, that the cycles are concentrated in a band of 131 papers, and that backward citation and revision co-occur with a ratio of 53.29, and no further.**

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