OpenMaieutica

Incentivizing openness for verifiable truth

A whitepaper

Non-technical overview — the full specification, source code and smart contracts will be published separately

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Prologue: the Socratic Method – *Maieutica*

In Plato's *Theaetetus*, Socrates explains that his mother, Phaenarete, was a midwife and that he practises the same craft, *maieutiké téchne*, upon minds rather than bodies. He also insists on being barren himself. He has no doctrine to hand over: Knowledge cannot be transferred from outside, it has to be brought out of the person who already holds it, through patient dialogical questioning. The midwife's second and decisive task, however, was to judge the newborn: to establish whether it was viable, or a *wind-egg*, a phantom conceived of nothing. A wind-egg is indistinguishable from a viable birth at the moment of delivery. Both arrive with the same conviction behind them: to the one who bore them, they both feel like something true. Likewise, nothing about an idea itself separates the two natures: not its clarity, its elegance or the confidence of the person holding it. They can be distinguished only through a test, but Socrates does not do it through comparison. He applies *élenchos*: the idea is set against everything else its bearer already accepts. What survives is knowledge.

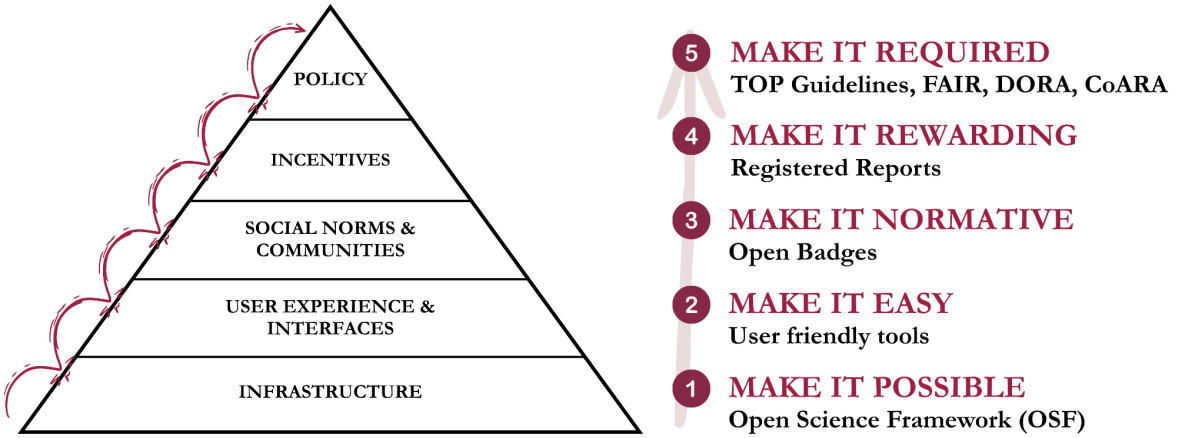
This is why maieutics (*Maieutica* in Italian) is **emergence and scrutiny**, and why neither half has much value without the other. A thought brought forth and never examined is not knowledge and the whole procedure only works if open, because the test requires someone other than the bearer to conduct it.

Science has the same double structure, and it is currently failing at both halves at once. Research materials do not emerge: they stay on the hard drives of the people who made them. What does emerge is largely not scrutinized. And when scrutiny was finally applied at scale, a substantial share of published findings did not survive it.

Around 2010, psychology confronted evidence that a substantial proportion of its published findings could not be reproduced and that the questionable research practices (QRPs) responsible were the ordinary working conditions of the discipline. The QRPs were facilitated by underpowered designs, publication bias towards significant results, and a reward system that counts novelty, exceptional results and volume above all else. Among the QRPs this produces, HARKing (hypothesising after the results are known) is the purest wind-egg of all: A hypothesis reconstructed once the data are in is indistinguishable, on the page, from one formulated in advance, both carry the same conviction.

Open science is the response to the self-scrutiny of this period, named the "replication crisis". Its premise is exactly the maieutic one: make the materials emerge, so that the work can be examined by someone other than the person who produced it. Nosek's *Strategy for Culture Change* (2019) sets out how: make Open Science possible, easy, normative, rewarding and finally required; a gradual change, in which the next step is ineffective unless it builds on a solid foundation laid by the previous one.

Fig. 1. The Strategy for Culture Change pyramid (adapted from Nosek, 2019)



The movement has built infrastructure, tools, norms, and has created rewards and guidelines for open science. Yet, fifteen years on, adoption remains low for pre-registration, open materials, open data and analysis code. The single practice that has genuinely diffused, open access, is the one mandated rather than spontaneously chosen by researchers. The pattern is unambiguous: where openness is required it happens, and where it depends on individual motivation it does not.

The reason is that the levels of the pyramid, especially from the normative one onwards, are not (yet) effective nor consequential. Open Badges, the instrument meant to make openness normative, largely rest on the author's own declaration: a wind-egg with a certificate attached. They are awarded to articles rather than to materials, so nothing in a badge identifies what it certifies, nothing prevents that material from being altered or withdrawn afterwards, and nothing tells a reader whether it can still be retrieved today. Registered Reports are not widespread and in any case reach only publication: reviewing, commenting and sharing knowledge not in paper form earn no

formal recognition at all. Above all, there exists no measure of openness comparable to the h-index. **Behaviour follows what is counted, and openness is not counted.**

Open science therefore needs instruments that really incentivize and recognize it. That is what **OpenMaieutica** sets out to provide, and it is where the two halves of the name meet: *Open* from the open science movement whose objectives it adopts wholesale, *Maieutica* from the method by which those objectives might actually be reached. Indeed, OpenMaieutica takes the structure of the Socratic method: The framework produces no knowledge of its own, but it creates the conditions under which a reproducible, rigorous and transparent truth can emerge from the actors who already possess it, by making openness something that is rewarded rather than merely recommended. Furthermore, OpenMaieutica does not stop at emergence: every claim it records is examined by somebody who had to retrieve the materials before they could say anything about them, and either certified or set aside.

Socrates worked in the agora, the public square, in the open, where anyone could listen and anyone could object. Twenty-five centuries later, the conditions of scrutiny have not changed, which is also why one part of this ecosystem still bears that name: OpenAgora, the beating heart of the framework, a decentralized social network platform where researchers do not merely interact, comment, replicate and share science, but are incentivized to do it and collectively decide on how OpenMaieutica itself operates.

The substrate

Blockchain is the substrate that makes both halves of the OpenMaieutic structure possible at the same time.

It supplies **verifiability**. A public ledger is a chronological list maintained by a network of independent computers, into which entries can be added but never removed or altered. Here it holds nothing but fingerprints and dates: no files, no personal data, no names. Once a fingerprint is written, the moment at which it existed stops being a claim and becomes a fact that anyone can check, forever, without trusting OpenMaieutica or anyone else.

It supplies **incentive**. Credentials issued as non-transferable tokens (Open Badges reimplemented as NFTs) attach to a person rather than to an article, cannot be counterfeited, cannot be sold, and travel with the researcher across institutions and careers. Alongside them, soulbound Merit Tokens accumulate into a Merit Score: an indicator of openness rather than of volume, meant to sit beside the h-index rather than replace it.

The two are inseparable. Verification without reward is a mere audit. Reward without verification does not incentivize openness enough, as we already know. Truth emerges *from* this substrate, because it is the only place where the conditions of scrutiny and the conditions of reward coincide.

The logo states it literally. A spiral rises out of a single block of the blockchain, widens as it turns, and passes through the opening of the **O** of *open science*, releasing the research record into the open, available to everyone.

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1. The incentive problem in Open Science

1.1 The crisis and its precipitating factors

Around 2010 empirical psychology entered a period that Wiggins and Christopherson (2019, p. 205) described as a *"collective challenge to the credibility of psychological science",* widely recognized as the "Replication Crisis" (Pashler & Wagenmakers, 2012; Shrout & Rodgers, 2018; Spellman, 2015; Hughes, 2018; Giner-Sorolla, 2012, 2019).

The main precipitating events are well documented: the fabrication of data by Diederik Stapel (Achenbach, 2011); the publication in a flagship journal of Bem's (2011) claim of precognition, contested and non-replicable, whose replication attempts were initially rejected by the journal that had published the original article (Carey, 2011; Aldhous, 2011; Galak et al., 2012); the finding by John, Loewenstein and Prelec (2012) that 94% of surveyed researchers admitted to at least one questionable research practice (QRPs), 88% in the Italian replication by Agnoli et al. (2017); and the Reproducibility Project, in which only 36% of 100 replicated psychology studies yielded significant results, with effect sizes approximately half as large as those reported in the original studies (Open Science Collaboration, 2012, 2015). Comparable concerns have since been documented beyond psychology (Prinz et al., 2011; Begley & Ellis, 2012; Sarewitz, 2012; Baker, 2016).

The predisposing and perpetuating factors are structural: the flawed use of null-hypothesis significance testing (Cohen, 1994; Gigerenzer, 2004; Wasserstein, Schirm & Lazar, 2019); low statistical power (Maxwell, 2004; Szucs & Ioannidis, 2017); publication bias towards significant results and the resulting file-drawer effect (Sterling, 1959; Rosenthal, 1979; Franco et al., 2014); the culture of *publish or perish* and *winner takes all*, which rewards novelty over rigour (Young et al., 2008; Smaldino & McElreath, 2016; Moosa, 2018); and the family of QRPs that follow: p-hacking, optional stopping, cherry-picking and, above all, **HARKing**: hypothesising after the results are known (Kerr, 1998; Simmons et al., 2011; Andrade, 2021; Nagy et al., 2025).

HARKing is one of the main questionable research practices this ecosystem is architecturally organised around. A hypothesis formulated after the analysis is

indistinguishable from one formulated before it and no amount of methodological transparency in the *reporting* can detect it. Only a record external to the manuscript, fixed in time and impossible to revise afterwards, can separate the two, which is precisely what pre-registration is meant to be. However, this property can be achieved only when the integrity of the pre-registration does not depend on a third-party to trust. OpenMaieutica creates this opportunity.

1.2 The eucatastrophe and the strategy for culture change

Pashler and Wagenmakers (2012) framed the crisis as an opportunity for psychology to lead in overcoming bias and error across the sciences. Indeed, the period has since been variously described as psychology's Renaissance (Nelson, Simmons & Simonsohn, 2018), a credibility revolution (Vazire, 2018), or a *eucatastrophe* (Limonta & Costantini, 2026): a seemingly catastrophic turn that proves to be the pivot towards something better, borrowing a concept from Tolkien (1947). The systematic reform that followed is the Open Science movement, understood as the position that scientific knowledge of all kinds should, where appropriate, be openly accessible, transparent, rigorous, reproducible, replicable, cumulative and inclusive, across all its aspects: open data, open methodology, open source, open access, open peer review and open educational resources (Spellman, Gilbert & Corker, 2018; Crüwell et al., 2019; UNESCO, 2021; FORRT, 2026).

Nosek's (2019) *Strategy for Culture Change* (see Fig.1) organises the reform as a pyramid of five levels, each a precondition for the one above it: infrastructure makes open science **possible**, user experience makes it **easy**, communities and norms make it **normative**, incentives make it **rewarding**, and policy makes it **required**.

Open science, on this reading, is a *behaviour* that all stakeholders must adopt (Corker, 2018), and reforms can credibly rebuild trust only when accompanied by incentive structures that genuinely reward methodological rigour (Hendriks, 2026).

1.3 What fifteen years of reform have actually achieved

Over fifteen years after the Replication Crisis, what is the current state of Open Science? Hardwicke et al. (2024) analysed 400 psychology articles published in 2022 and found rates of pre-registration, open materials, raw or primary data sharing and analysis-script availability consistently low (between 7% and 19%). Open access was the sole widely adopted practice, at approximately 70%. Zogmaister et al. (2024) examined the methodological transparency of 180 articles published between 2011 and 2021 in five psychology journals and found that by 2021 only about half of the potentially shareable methodological information was actually reported. Gorman and Hubbard (2025) identified 227 Registered Reports across 36 experimental psychology journals between 2013 and 2023, roughly 1.2% of 19,576 articles.

The steps of Nosek's pyramid, in other words, are not producing the behaviour change they were designed to produce.

1.4 Why the incentives underperform

Four defects of today's Open Science are specific enough to be addressed by design.

Open Badges do not correspond to reproducibility. The badge scheme introduced by Kidwell et al. (2016) demonstrably increases reported data sharing but Crüwell et al. (2023), examining one issue of *Psychological Science*, found substantial computational-reproducibility failures among badged articles; Hardwicke et al. (2018, 2021) reported analogous gaps at *Cognition* and *Psychological Science*.

Badges do not link to the resources they certify, and cannot guarantee their availability. They are attached to an article, not to a dataset or to code. Nothing in the badge itself identifies the material, so nothing prevents the material from being replaced, edited or withdrawn after the badge is awarded, and nothing tells a reader whether it is still retrievable today.

Badges and incentives exist only for papers, and rewards remain tied to publication. Open peer review, open commentary and open educational resources earn no formal recognition at all. Replication work can be rewarded through Registered Replication Reports (Simons et al., 2014) but it is still tied to publication.

There is no scoring system for openness comparable to the h- or g-index. Scientometrics remain almost entirely quantitative, built on citation and publication counts, which are metrics that contribute to the *publish or perish* pressure in the first place (Giner-Sorolla, 2012; Hicks et al., 2015).

To these should be added the **infrastructural limitations** that sit at the base of the pyramid: reliance on centralised platforms rather than peer-to-peer distribution, a single point of failure rather than redundancy across nodes, the possibility of censorship rather than total transparency, trust in data custodians rather than immutable cryptographic proof, no simple audit trail, and retrieval by location rather than by content.

1.5 The proposed direction

New technologies could help bridge the adoption gap (Spellman et al., 2018), and a substantial literature has proposed distributed-ledger approaches to open science specifically (Bell et al., 2017; Janowicz et al., 2018; Leible et al., 2019; Sivagnanam, Nandigam & Lin, 2019; Stojmenova Duh et al., 2019; Wang, Liew & Zhang, 2020; Ducrée, 2020; Gurung et al., 2023; Sathishkumar, 2024), with timestamping of research materials (Wortner et al., 2019; Hoffmann, 2021; Rouder, 2016), credentials issued as non-fungible tokens (Mohan, 2019; Presutti et al., 2025), and token-based reputation as the three recurring components.

What has been missing is not any one of these ideas but their assembly: a single pipeline in which depositing, timestamping, verifying, certifying, reviewing and

rewarding are not six separate tools but six moments of the same act. That is what OpenMaieutica sets out to be.

2. What OpenMaieutica is for

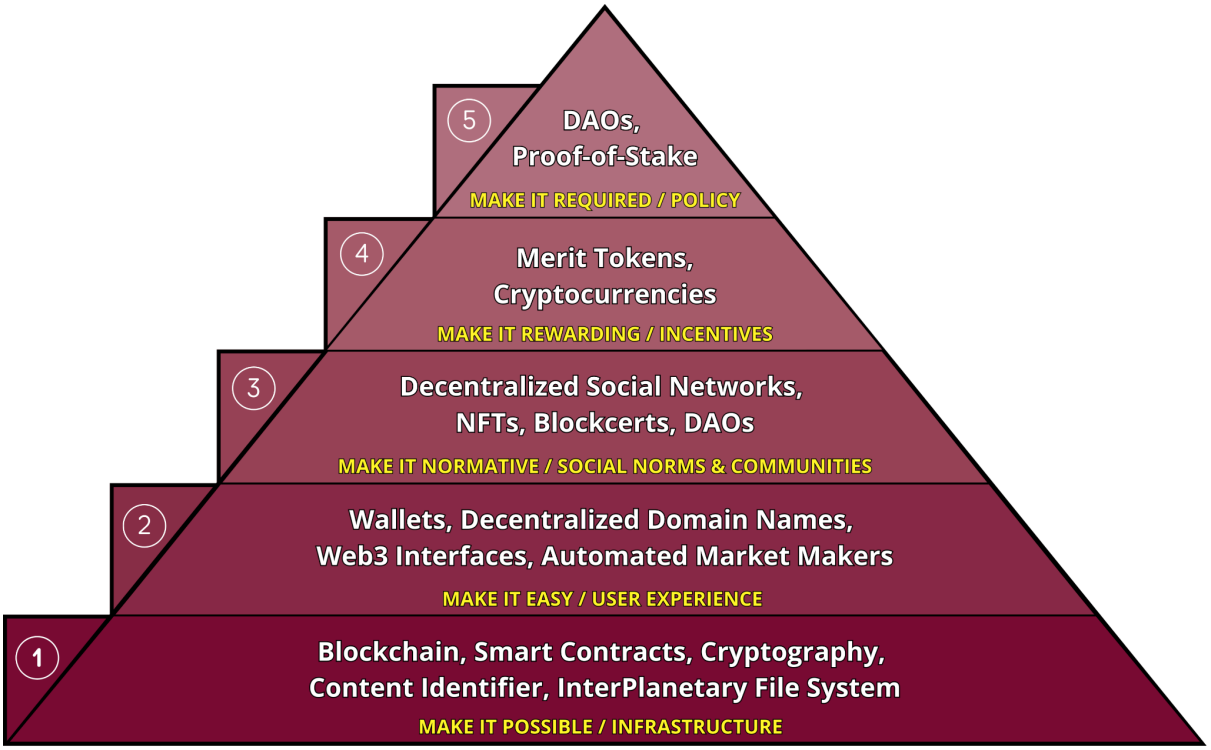
OpenMaieutica records research materials in a way that makes four claims, ordered by increasing difficulty and scientific interest.

1. **These materials existed at this time.** A timestamp attached to a content fingerprint that uniquely identifies them.
2. **These materials are the ones a reviewer inspected.** The fingerprint is derived from the bytes themselves, so any substitution changes the fingerprint; and because the fingerprint is written into a ledger that cannot be revised, the link between identifier and content cannot be broken after the fact.
3. **The pre-registration came before the data.** Not merely that a pre-registration exists, which is what a pre-registration badge normally asserts, but that the public record establishes that it was recorded *earlier*. This is the anti-HARKing procedure implemented by design.
4. **These materials are still retrievable today.** A reader wants to know whether the dataset can still be downloaded and to easily do it.

Alongside these, OpenMaieutica issues soulbound Merit Tokens: non-transferable units of reputation minted whenever a practice is certified, aggregating into a Merit Score intended as an indicator of openness complementary to citation-based metrics. Crucially, the Score is not a single number earned in a single way. Contributions are weighted by the role performed, and the roles correspond to the parts of the ecosystem: as **author**, for opening one's own materials; as **reviewer**, for verifying somebody else's; as **community contributor**, for replicating, commenting and contributing to science in general.

Mapped onto Nosek's pyramid (see Fig.2), OpenMaieutica is an intervention at four levels at once: **infrastructure** (content-addressed, redundantly hostable deposition on IPFS; timestamping on blockchain; smart contracts to automate the pipeline; cryptography in general to achieve transparency, immutability and verifiability) **user experience** (interfaces that make the framework easy to use), **communities and norms** (open badges minted as NFTs; a decentralized social network in which open work is visible), and **incentives** (Merit Tokens and a portable openness score). Finally, **the level of policy** could be operationalized through Decentralized Autonomous Organizations (DAOs) and Consensus Mechanisms (such as the Proof of Stake).

Fig. 2. Contributions of blockchain and Web3 technologies to the Strategy for Culture Change pyramid (see Fig. 1)



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3. The framework

This section is deliberately non-technical: nothing in it requires any prior knowledge of cryptography or blockchain technology. It is an overview on the OpenMaieutica framework and its possible contributions to Open Science.

3.1 The six ideas that matter

Fingerprint. Any file can be reduced to a short string of characters computed from its contents. Change one byte and the string changes completely; two identical files always produce the same string. A fingerprint is therefore both a name and a check: if the file you download produces the fingerprint you were given, it is the file you were promised. In this ecosystem fingerprints are called *Content Identifiers* (CIDs).

A network of shared folders. Instead of uploading materials to a company's server, the researcher keeps them on their own machine, running a small program that makes them available to anyone who asks for them by fingerprint. Other people who fetch the materials can keep a copy and serve it too, so the more interest a package attracts, the more redundantly it is held. This is based on the InterPlanetary File System (IPFS), a peer-to-peer network of archives.

A public notebook nobody can erase. Separately, the fingerprints are written into the blockchain: a public ledger, a chronological list maintained by a network of independent computers, into which entries can be added but never removed or altered. Each entry

carries the time at which it was accepted, thus a “timestamp”. Here it stores nothing but fingerprints and dates: no files, no personal data, no names.

A signature. To write into that ledger the researcher signs the entry with a cryptographic key held in a browser extension called a wallet. The signature is what makes the entry attributable; the wallet address is a pseudonym rather than an identity, since it is nothing but an alphanumeric string.

A badge. When a reviewer has actually downloaded the materials and verified them, they issue a badge: a token recorded in the ledger, permanently attached to the researcher's address, which cannot be transferred, sold or revoked, and which carries with it the address of a written report the reviewer published alongside it.

A token. A second form of recognition is issued: **Merit Tokens**, a meritocratic currency with no economic value, which rewards the adoption of open practices. They cannot be sent to anyone, an algorithm prevents it. They are *soulbound* by design: they belong to the person who earned them, and to nobody else, permanently.

3.2 Five applications

OpenMaieutica is not a platform in the ordinary sense. For now, it is composed of five applications, each covering one moment of the research life cycle, sharing one public record.

OpenStamp, *for the researcher.* Files the pre-registration, the dataset, the analysis code and the readme into a package on the researcher's own machine, computes a fingerprint for every file and every folder, warns when material is being deposited twice, and writes the whole package into the public ledger with a single signature. It hands back an **Integrity Proof**: a small document recording what was deposited, what was registered, when, and by whom.

MeritCert, *for the editor and/or reviewer.* Takes that proof and fetches the package from the network, not merely checking that a listing appears, but pulling down every single component of it, which is the only honest way of establishing that a third party can actually obtain the materials. It keeps a copy, so the work no longer depends on the author’s repository staying online. Then it opens the folders, lets the reviewer read what is inside, and tells them what they could not otherwise know: whether this package has been certified before, whether any of its files were certified before as part of something else, and, most importantly, whether the ledger shows the pre-registration having been recorded *earlier* than the data. The reviewer certifies what they are willing to certify, writes a report, and publishes it. Badges and Merit Tokens are issued only after every claim has been re-verified independently against the ledger.

OpenReview, *for open peer review.* Certifying materials is not the same as judging science, and OpenMaieutica keeps the two rigorously separate. OpenReview carries the second: peer review conducted in the open, with reviews that are themselves deposited, timestamped and permanent, attributable or pseudonymous at the

reviewer's choice, and **rewarded**. A review is a scientific contribution, and it has to be formally recognized and rewarded as one.

OpenAgora, *for the community.* Replication attempts, open commentary, shared knowledge and every contribution to science in general, indispensable yet invisible to every existing metric. Work that lives here earns recognition on the same terms as everything else, because a discipline that rewards only original findings will always maintain the *publish or perish* rule and produce more unreproducible science.

OpenExplorer, *for everyone.* Type in any wallet address and see the certified work: grouped into studies rather than scattered across packages, with the interval between pre-registration and data displayed wherever it exists, with a live check of whether each package can still be downloaded *right now*, and with the reviewer's report one click from every badge. No account, no permission, no gatekeeper.

3.3 Why the order matters

A pre-registration should be deposited **on its own**, and the data added in a later deposit. A package whose pre-registration, dataset and code are all recorded in one act proves that those three files existed at that moment. It proves nothing whatsoever about their order, which is the claim that matters scientifically. When the pre-registration is recorded first and the data months later, the ledger holds two different dates, and the order stops being a promise and becomes a fact.

Everything else in the architecture exists to make that second deposit possible without weakening it. The pre-registration folder is recognized as one already recorded, and keeps its original date rather than being registered afresh. The two deposits are collected in one study. And the pre-registration badge, having been earned once, cannot be earned a second time.

This is the anti-HARKing mechanism in place by design, which makes the *sequence* a matter of public record rather than of authorial testimony.

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4. What a badge will not mean

A system that promises too much is a wind-egg of its own. Four limits are built into the design and stated on the face of every certification.

Not authorship. Priority of registration is not proof of origin. Someone could in principle register material they did not create.

Not quality. A badge states that the materials were retrieved, opened and found to be what they claim. It says nothing about whether the study is any good. That judgement belongs to peer review, which is why OpenReview exists as a separate application rather than as a feature of MeritCert.

Not permanence of access. The badge is permanent; the hosting is not. The two are shown separately and never merged into a single reassuring figure.

Not an identity. A wallet address is a pseudonym. This protects reviewers, authors and contributors in general, and it means accountability in this system is pseudonymous by default rather than nominal.

Epilogue: Science needs an open square

Scientific reform has, for fifteen years, been asking researchers to behave more rigorously. Open Science infrastructures, tools, norms, incentives and policies have been provided yet today's adoption rates remain low.

The premise of OpenMaieutica is that this is not a failure of conviction in Open Science values. Beyond making it possible and easy, behaviour follows what is incentivised: If openness is to become common practice, it has to be truly rewarding in the first place; for it to be rewarding, it has to be *countable* by some recognized score*;* and if it is to be countable, it first has to become *verifiable*, because a metric that can be gamed by declaration will be.

That is the whole architecture, and it is why the two halves cannot be separated. **OpenStamp** makes materials emerge, fixed in time and impossible to revise. **MeritCert** subjects them to scrutiny by somebody who had to obtain them before they could certify and reward them. **OpenReview** does the same for judgement of the science itself. **OpenAgora** extends it to the work that has never been counted at all. And **OpenExplorer** puts the result where anyone can see it, question it, and check for themselves whether the materials are still there.

Emergence and scrutiny, through a record that cannot be edited and a reward that cannot be sold, where everyone can see it.

Socrates practised in the agora because a conversation held in private proves nothing. The whole point was that anyone could walk up, listen, and object. The maieutic test was public, the wind-eggs were recognized as wind-eggs in front of witnesses. Two and a half millennia later, the majority of scientific records are sets of claims about materials that almost nobody can see, not verifiable by everyone, not directly managed by researchers themselves, but hosted on platforms that we have to trust, and rewarded by no metric besides a quantitative one.

OpenMaieutica is an attempt to move science back into the square, incentivizing openness for verifiable truth.

Coming soon

OpenMaieutica is in active development. **OpenStamp**, **MeritCert**, **OpenReview**, **OpenAgora** and **OpenExplorer** will be released together, with their full technical specification, source code and smart contracts published openly. An ecosystem built on the claim that verification should not require trust cannot itself ask to be taken on faith.

For updates:

openmaieutica.org

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OpenMaieutica — incentivizing openness for verifiable truth.

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