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Knowledge as a commons

Education and knowledge beyond capital and property

Thomas Schüller

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Author	Thomas Schüller, Syntagma Forschung, Wien · ORCID 0009-0003-9799-6747 · forschung@tschueller.com
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Knowledge as a Commons

Thomas Schüller — Syntagma Forschung, Wien

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Knowledge as a Commons

Education, Knowledge and the Limits of Private Property — a Transdisciplinary Full Work

Thomas Schüller · Syntagma Forschung · Vienna ORCID: 0009-0003-9799-6747 · Contact: forschung@tschueller.com

Work card

FIELD	ENTRY
Identifier	FORSCH-PROV0416 (provisional)
Slug	<code>wissen-als-allgemeingut</code>
Form	Full work, one volume, all strands
Version	v1.2
Date	2026-10-13
Change from v1.0	terminology of enclosure as a table; new sections on training corpora and on licensing and return flow; extended evidence in Parts 3, 5 and 6; v1.2: full reference apparatus, so each language version stands on its own
Languages	German and English (parity)
Licence	CC BY 4.0
isPartOf	FORSCH-0083 — o/δ risk-disposal asvmmetrν (master

	theorem)
Type	Theoretical work with literature and empirical review
Version type	Passive version (repository package). The active version of the RDQ calculator runs on the platform only.
Figures	3 (four-goods matrix, ρ/δ decoupling, three forms of enclosure)
Authorship	Thomas Schüller as a person; Syntagma Forschung as an author brand, not a separate legal entity

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Abstract

The claim that knowledge is a commons does not hold in its usual form, because it collapses four distinct goods into one. This work takes it apart and rebuilds it.

It makes three contributions. First, it separates **data, information, knowledge and education** as four goods with distinct rivalry and excludability profiles. This yields a division of labour among the arguments: for information and codified knowledge, private property is a legally manufactured scarcity, and the non-rivalry argument carries the case. For education, commons status is a normative claim that must rest on human rights, externalities and fairness in social reproduction, because tutoring time is rival. Conflating the two loses the argument to the standard incentive objection.

Second, it formalises enclosure as a **decoupling of risk bearer from disposal holder** (ρ/δ) and proposes the risk-disposal quotient, which relates the public share of research inputs to the public share of disposal rights over outputs.

Third, it describes **enclosure by absorption**, a mechanism not found in the literature reviewed: in the training of large models the commons is not fenced in. It remains legally open and still loses its function, because the circuit of readership, new contributors and funding breaks.

The work carries counterpositions in their strongest form. It does not claim that intellectual property as such is unjustifiable, but that its justification is specific to the type of good and is routinely extended in practice beyond the point where it holds.

1. Question, method and limits

1.1 Question

1. For which of the four goods does “commons” hold analytically, and for which only normatively?
2. How can enclosure be measured rather than deplored?
3. Does the training of large models change the form of enclosure or only its scale?

1.2 Method

Textbook relation: synthesise, evaluate, go beyond. Each school is presented as its own proponents would state it, and only then confronted with the hardest available scholarly critique. Comparative material is tabulated. For every statistic the publisher, funder and stake are named, because in this field almost every

number is produced by a party with a preferred result.

The biological and evolutionary strand is carried explicitly and bounded explicitly (Part 7).

1.3 Limits of this version

The two novelty claims (four-goods decomposition, absorption) rest on targeted but non-exhaustive searching. Negative findings of this kind are always defeasible; a counter-check in Scopus and Web of Science is outstanding. Several 2026 figures come from trade press with primary reference and are marked [secondary]. Page numbers and DOIs of the classics must be verified individually before print. Pending proceedings are marked as pending.

2. Part I — Four goods, not one

2.1 The category error

Since Samuelson (1954), goods theory has distinguished rivalry from excludability. Arrow (1962) derived from this the paradox that still frames the debate: optimal use requires a price of zero, production requires appropriation. Romer (1990) makes non-rivalry the engine of growth and accepts monopoly rent as its price.

Everyday talk of knowledge as a commons skips this distinction. It treats a measurement campaign, a journal article, what a person understands, and a training place as the same thing. They are not.

2.2 The decomposition

Abb. 1 — Vier Güter, vier Profile

Fig. 1 — Four goods, four profiles

	ausschließbar / excludable	nicht ausschließbar / non-excludable
rival	BILDUNG / EDUCATION Betreuungszeit ist rival und knapp; auch die Daten-Erhebung liegt hier. tutoring time is rival and scarce → Anspruch, keine Gutseigenschaft	AUFMERKSAMKEIT · BETRIEB Trägerstruktur der Allmende: Leserschaft, Mitwirkende, Infrastruktur attention and infrastructure → Angriffspunkt der Absorption
nicht rival / non-rival	DATEN · INFORMATION Knappheit erzeugt: technisch (Daten), juristisch (Information) scarcity is manufactured → Nichtrivalitätsargument trägt	WISSEN / KNOWLEDGE im Kopf rekonstruiert, gar nicht ausschließbar reconstructed, not transferred → Eigentum begrifflich leer

Folge: Für Information und Wissen trägt das Nichtrivalitätsargument. Für Bildung ist Allgemeingut ein normativer Anspruch.
Consequence: non-rivalry carries the case for information and knowledge. For education, commons status is a normative claim.

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GOOD	WHAT IT IS	RIVAL?	EXCLUDABLE?	DOES “COMMONS” HOLD ANALYTICALLY?
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Data	raw measurement, survey, sensor value	no (the copy), yes (the collection)	technically high	no — collection is rival and costly, the stock is not
Information	codified, readable, transferable	no	only legally and technically	yes
Knowledge	reconstructed in a mind, partly tacit	no	not at all	yes, categorically
Education	a process with tutoring, time, place	yes	yes	no — defensible as a normative claim, not as a property of the good

The resulting division of labour:

GOOD	LOAD-BEARING ARGUMENT AGAINST PRIVATISATION	COUNTERARGUMENT TO BE TAKEN SERIOUSLY
Data	duplicate collection is waste; hoarding creates welfare losses (Jones and Tonetti 2020)	collection costs money; without prospect of return it does not happen
Information	manufactured scarcity at zero marginal cost	fixed costs of first production and quality assurance
Knowledge	property in the reconstructed is conceptually empty	nobody claims property in understanding, only in its fixation
Education	human right, externalities, fairness in reproduction	rivalry of tutoring time; private return (human capital theory)

2.3 Why knowledge is not a transferable object

The cognitive evidence supports the categorical reading. Bartlett (1932) shows remembering as reconstruction rather than retrieval of a stored copy. Piaget and von Glasersfeld describe knowledge as the subject's own construction. Roediger and Karpicke (2006) show that retrieval itself alters what is remembered. Knowledge is therefore not transferred but formed anew in the recipient. The property metaphor never touches knowledge, only its fixation.

A distinction the work must carry: this finding is epistemological, not pedagogical. Kirschner, Sweller and Clark (2006) show that minimally guided constructivist teaching underperforms direct instruction for novices. Phillips (1995) insists on separating the two levels. The work rests its category argument on the uncontested cognitive finding, not on the contested pedagogy.

2.4 Positioning the contribution

The DIKW hierarchy (Ackoff 1989; Rowley 2007) orders data, information and knowledge as epistemic stages, not as goods. Hess and Ostrom (2007) adopt that threefold division for commons analysis. Jones and Tonetti (2020) treat data as an economic good. Cowan, David and Foray (2000) show that non-rivalry holds fully only for codified knowledge, while tacit knowledge is effectively rival. Education is handled in isolation in education economics, as a merit good (Musgrave 1959) or as an investment (Part 3).

No work in the literature reviewed places all four categories side by side as goods with distinct profiles and derives the division of labour among arguments from that. This is the first contribution of this work.

3. Part II — The positions, each in its strongest form

This part is deliberately non-partisan. A position that appears only as its opponents state it has not been refuted, only unheard.

3.1 Liberal, neoclassical and institutional lines

SCHOOL	STRONGEST FORM	HARDEST CRITIQUE
Classical liberalism	Locke (1689, §27, §33): appropriation by mixing labour, bounded by the “enough and as good” proviso. For non-rival goods the proviso is trivially satisfied, so appropriation is unobjectionable (Hughes 1988). Smith (1776) accepts time-limited inventor monopolies.	Gordon (1993): the proviso is violated once IP blocks future use of the common stock. Shiffrin (2001): Locke’s starting point is common ownership, not ownerlessness.
Neoclassical	Arrow (1962), Nelson (1959): without appropriation, too little is produced. Nordhaus (1969): patent term as a trade-off between incentive and deadweight loss.	Kremer (1998): patent buyouts solve the same problem without monopoly. Budish, Roin and Williams (2015): fixed terms systematically disadvantage long-horizon research.
Human capital	Schultz (1961), Becker (1964), Mincer (1974). Psacharopoulos and Patrinos (2018) compute an average private return of about 9 per cent per year of schooling from 1,120 estimates across 139 countries. Private return justifies private cost sharing.	Signalling: Spence (1973), Arrow (1973), pressed furthest by Caplan (2018). Externalities: Moretti (2004). Origin effects: Bourdieu and Passeron (1970) and the evidence in Part 5.
Austrian School	Hayek (1945): knowledge is dispersed; no centre can collect it. Hayek (1988) treats IP itself as manufactured scarcity. Machlup (1958) before the US Senate: the patent system could not be recommended today, but having it, it cannot responsibly be abolished.	The limit of the price system: at zero marginal cost any positive price is a false scarcity signal, while a zero price covers no fixed costs. The school offers no solution beyond first-mover advantage.
Market-liberal IP abolitionism	Boldrin and Levine (2008, 2013): intellectual property is monopoly, not property, and reduces innovation on net. Kinsella (2008).	Mansfield (1986), surveying 100 US firms for 1981–83: without patent protection 65 per cent of pharmaceutical inventions would not have been introduced and 60 per cent not developed; weighted across industries the figure is about 14 per cent. The pharmaceutical case remains unresolved.
Ordoliberalism	Eucken (1952): patents as a source of monopoly, answered by compulsory licensing. Böhm (1937): competitive order as a state task.	Applied to journals: individual titles are not substitutable and bundling reinforces this. No competition-law review of the big deals is known. Counterposition: fixed costs of quality assurance justify scale.
Property rights	Cassidy (1990), Demerouti (1997)	Heller (1998), Heller and Eisenberg

Property rights	Coase (1960), Demsetz (1967): clearly assigned rights internalise externalities; who holds them is secondary for efficiency.	Heiler (1998), Heiler and Eisenberg (1998): too many rights produce anticommons and underuse. Evidence mixed — Williams (2013) finds 20 to 30 per cent less follow-on research for the Celera data, Sampat and Williams (2019) no effect for gene patents, Murray and Stern (2007) moderate effects.
Commons institutionalism	Ostrom (1990): commons work under eight design principles, broadly evidenced. Hess and Ostrom (2007) extend this to knowledge, and Frischmann, Madison and Strandburg (2014) build the Governing Knowledge Commons framework on it. Cox, Arnold and Villamayor Tomás (2010) largely confirm the principles.	Stern (2011): the principles presuppose bounded groups and mutual observability; they do not scale to global, anonymous stocks.

On the tragedy of the commons: Hardin (1968) is routinely cited as refuted. More precisely, he is bounded. Feeny, Berkes, McCay and Acheson (1990) show he conflated a regulated commons with open access. Hardin himself corrected to “unmanaged commons” in 1998. Declaring him simply finished repeats his error with the sign reversed.

3.2 Critical political economy

SCHOOL	STRONGEST FORM	CRITIQUE
Marx	<i>Grundrisse</i> , Fragment on Machines: the general intellect becomes the principal productive force, straining the value form.	Heinrich (2013): Marx did not pursue but revised this line in <i>Capital</i> . Pitts (2017): the immeasurability thesis is not operationalised.
Dispossession and rent	Harvey (2003): accumulation by dispossession continues primitive accumulation. Christophers (2020), Mazzucato et al. (2023), Rikap (2021): disposal over knowledge as a rentier position.	Quasi-rents cover fixed costs. The line between productive and extractive rent is conceded as blurred by the authors themselves.
Cognitive capitalism	Vercellone (2007), Moulrier Boutang (2011), Hardt and Negri (2000, 2009): value creation migrates out of the wage form into cooperative knowledge networks.	The share of immaterial labour is overstated and the central claim is hard to test empirically (Pitts 2017).
Critical theory	Adorno (1959), theory of half-education: education becomes adaptation; access alone does not change that.	Reception research (Hall 1980) shows active appropriation. An elitism charge applies. The finding remains compatible with section 2.3.

3.3 Commons, free software, anarchism

Kropotkin (1902) sets mutual aid against the competition reading of evolution. Stallman (1985) turns this into a legal technique: copyleft uses copyright against enclosure. Benkler (2002, 2006) describes commons-based peer production as a third mode alongside market and hierarchy. Lessig (2004) and Creative Commons supply

the licensing instruments; Bollier and Bauwens the movement perspective.

The hardest critique comes from within and is called the **paradox of open**: open resources are disproportionately exploited by capital-rich actors who return nothing. Halfaker et al. (2013) further show that Wikipedia's own thickening of rules deters newcomers — commons also fail from the inside, not only through enclosure.

3.4 Theory of education and of science

SCHOOL	STRONGEST FORM	CRITIQUE
Humboldt	education as an end in itself; solitude and freedom as institutional conditions	Paletschek (2002), Ash (2006): the Humboldt model is a retrospective construction around 1900.
Dewey (1916)	knowledge as shared practice; democracy as a condition of education, not its consequence	neglect of canonical content (Hirsch 1996)
Freire (1970)	critique of banking education: the learner treated as an account to be filled. This is the property metaphor inside pedagogy.	limited operationalisation
Illich (1971)	deschooling; the credential monopoly as the real barrier	removing institutions tends to worsen origin effects
Luhmann (1990, 2002)	education and science operate on their own media; property is alien to them. The technology deficit (Luhmann and Schorr 1979) is the systems-theoretic counterpart to section 2.3.	normative abstinence
NPM and audit culture	Strathern (1997): when a measure becomes a target it ceases to be a good measure. Fire and Guestrin (2019) show this for bibliometrics.	Without indicators, reputation networks govern, which tends to reinforce origin effects. DORA and CoARA aim at reform, not abolition.
Sociology of science	Merton (1942): CUDOS, including communism of findings — results belong to the community. Ziman (2000): post-academic science replaces this with PLACE.	Mitroff (1974), Mulkay (1976): the norms were always partly rhetoric.

3.5 Postcolonial and feminist critique

Spivak (1988), Mignolo (2011) and Santos (2014) show that the question is not only who has access to knowledge, but whose knowledge counts as knowledge. Shiva (1997) documents biopiracy, 't Hoen (2009) the effect of TRIPS on access to medicines.

Counter-critique the work carries: Agrawal (1995) warns against essentialising “traditional knowledge”; protective rights over it reproduce the property logic they are meant to resist. Attaran (2004) shows that only a small share of essential medicines is patented in poor countries at all — the barrier there is often procurement and infrastructure, not the patent.

Feminist economics (Folbre 1994, 2001; Federici 2012) makes visible that knowledge transmission rests on unpaid care work. The link to IP theory remains thin (Halbert 2006) and is an open flank this work names but does not close.

4. Part III — How the scarcity is made in law

INSTRUMENT	DATE	STATUS AND ASSESSMENT
Statute of Anne	1710	14 plus 14 years; conceived as a limit on a publishers' monopoly, not its extension
Berne Convention	1886, Paris 1971	formality-free protection, life plus 50; globalised via TRIPS Art. 9
Term extensions	Dir. 2006/116/EC (70 years p.m.a.), Dir. 2011/77/EU, US CTEA 1998	Akerlof, Arrow et al. (2002), amicus brief in <i>Eldred v. Ashcroft</i> : the incentive gain is about one per cent. Pollock (2009) estimates an optimal term near 15 years. Heald (2014): protected works are less available than public-domain ones.
TRIPS	1994, in force 1995	Kyle and McGahan (2012): more research only for diseases of solvent markets
Doha Declaration	2001	Art. 31bis in force since 2017, effectively one application
COVID decision	2022	vaccine patents only, no extension to therapeutics
Bayh-Dole Act	1980	Mowery et al. (2001): only partly causal for the rise in university patenting. March-in rights never exercised.
Abolition of the professor's privilege	AT: §106 UG 2002; DE: §42 ArbNErfG 2002; NO: 2003	Hvide and Jones (2018): in Norway start-ups and patents fell by roughly half afterwards. No evaluation exists for Austria.
DSM Directive, Arts. 3 and 4	2019	AT: §42h UrhG, 2021 amendment. The remuneration duty foreseen in the draft was dropped; the deletion duty goes beyond the Directive, as research bodies criticised. DE: §§44b, 60d UrhG.
Nagoya Protocol	in force 2014; Reg. (EU) 511/2014	gap for digital sequence information; the Cali Fund created in 2024 is voluntary and its effect unproven
Database Directive	1996	evaluations in 2005 and 2018 find no demonstrable production effect; the Data Act narrows the right
AI Act, Art. 53	Reg. 2024/1689	copyright policy and a sufficiently detailed summary of training content; enforcement from 2026, legacy models to 2027

Appendix S · Syntax card

The card renders the work in Syntagma Syntax 1.0 (specification: syntagma-science.com/syntax/). Levels G0-G5 describe the evidence, T1-T6 the kind of source; every hypothesis names its test, every card its limits.

Element	Level	Statement
F1 Question		For which of the four goods data, information, knowledge and education does “commons” hold analytically, and for which only normatively?
F2 Question		How can enclosure be measured rather than lamented?
F3 Question		Does the training of large models change the form of enclosure or only its scale?
G1 Object		Knowledge and education goods with their property, legal and funding regimes ebene: Güter, Institutionen, Recht · ort: Österreich, EU, global · zeit: vom Statute of Anne 1710 bis 2026
G2 Object		Knowledge commons (Wikipedia, Stack Overflow, open corpora) as raw material for training large models ebene: Plattformen und Korpora · ort: global · zeit: ab etwa 2022
B1 Term		Data := raw measurement, survey, sensor value; the copy is non-rival, the collection is rival and costly fach: ökonomie
B2 Term		Information := codified, readable, transferable good; non-rival, excludable only legally and technically fach: ökonomie
B3 Term		Knowledge := good reconstructed in the mind, partly tacit; it is formed anew in the recipient, not transferred fach: ökonomie · bruecke: kognitionswissenschaft=Erinnerung als Rekonstruktion
B4 Term		Education := process with supervision, time and place; rival and excludable, justifiable as a commons only normatively fach: bildungsökonomie · bruecke: recht=Menschenrecht auf Bildung
B5 Term		Risk-disposal decoupling ($p/6$) := whoever bears the cost and risk of knowledge production (p) is not whoever disposes of the result (6) fach: politische ökonomie
B6 Term		Enclosure by absorption := intake of open holdings into proprietary models; the holding remains legally open, the inflow of readers, contributors and funding dries up fach: politische ökonomie · bruecke: recht=Schränkennutzung, die Lizenzbedingungen verdrängt
B7 Term		Commons := jointly used holding that can function under design principles (Ostrom) fach: institutionenökonomie · bruecke: evolutionsbiologie=mikrobielle öffentliche Güter mit Trittbrettfahren
B8 Term		Teaching := an individual promotes another's learning at its own cost (Caro and Hauser) fach: verhaltensbiologie · bruecke: feministische-oekonomie=unbezahlte Sorgearbeit der Weitergabe
S1 Statement	G3	Non-rivalry holds fully only for codified knowledge; tacit knowledge is de facto rival belege: Q1
S2 Statement	G4	Memory is reconstruction, not retrieval of a stored image; retrieval changes the memory content belege: Q2 Q3
S3 Statement	G3	In Austria around 31 per cent of students have parents without Matura; the recruitment rate differs by father's education by a factor of around 2.5 belege: Q4
S4 Statement	G2	Freedom from price is a necessary, not a sufficient condition for equal access to education belege: S3 Q4
S5 Statement	G4	The effect of patents on innovation is sector-specific; the evidence is split, pharmaceuticals are the special case belege: Q5 Q6
S6 Statement	G3	Activity on Stack Overflow fell by around 25 per cent within six months after ChatGPT relative to Russian and Chinese counterparts

		belege: Q7
S7 Statement	G2	In model training the courts assess the manner of acquisition and memorisation; the functional devaluation of the commons has not yet been at issue in any proceeding belege: Q8
S8 Statement	G1	Copyright and share-alike do not apply if training is classified as use under a copyright exception, because the exception displaces the licence
H1 Hypothesis	G2	Training large models removes readership from knowledge commons and with it the inflow of contributors and funding, without legally closing the holding belege: Q7 Q9 · pruefung: P1
P1 Test		Fails if commons overlapping thematically with language models show no stronger decline in contribution and views than comparison holdings
H2 Hypothesis	G1	No work in the literature sets data, information, knowledge and education side by side as goods with distinct profiles and derives a division of labour of arguments from this pruefung: P2
P2 Test		Fails if the pending cross-check in Scopus and Web of Science finds such a work
Q1 Source	T2	Cowan, David and Foray: The Explicit Economics of Knowledge Codification nachweis: Cowan, David und Foray 2000
Q2 Source	T2	Bartlett: remembering as reconstruction nachweis: Bartlett 1932
Q3 Source	T2	Roediger and Karpicke: retrieval changes memory content nachweis: Roediger und Karpicke 2006
Q4 Source	T1	Student Social Survey, IHS Vienna commissioned by the BMBWF nachweis: Studierenden-Sozialerhebung 2023
Q5 Source	T2	Mansfield: survey of 100 US firms on the effect of patents nachweis: Mansfield 1986
Q6 Source	T2	Williams: follow-on research after the Celera data nachweis: Williams 2013
Q7 Source	T2	del Rio-Chanona, Laurentsyeve and Wachs: Large Language Models Reduce Public Knowledge Sharing nachweis: del Rio-Chanona, Laurentsyeve und Wachs 2024
Q8 Source	T1	Munich Regional Court I, GEMA v OpenAI, not final nachweis: LG München I, 11.11.2025
Q9 Source	T2	Burtch, Lee and Chen: consequences of generative AI for online knowledge communities nachweis: Burtch, Lee und Chen 2024
M1 Method		Textbook approach: each school in the version of its own proponents, then confronted with the strongest available critique
M2 Method		For every statistic the publisher, funding and interests are named; comparative data are given in tables
X1 Measure		Risk-disposal quotient (RDQ): public share of R&D inputs divided by the public share of disposal rights over the output; 1 means congruence einheit: dimensionslos (Verhältnis) · misst: G1
L1 Limit		The novelty claims (four-goods decomposition, absorption) rest on targeted, not exhaustive research; figures on 2026 from trade press are marked secondary
L2 Limit		The biological-evolutionary strand is used heuristically, not as justification; no legal ought follows from biological being
L3 Limit		The RDQ is a metric, not a value judgement; it claims no causality and does not measure who bears the risk of failure in late phases
L4 Limit		On absorption the work claims a mechanism with evidenced partial findings, not a closed causal chain; it does not deny that intellectual property can be justified
O1 Open		Cross-check of the novelty claims in Scopus and Web of Science
O2 Open		For Austria a causal evaluation of tuition fees differentiated by origin is missing