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Important publications / impact

General impact statement

Research programme. My research connects categorification, diagrammatics, quantum topology, tensor and monoidal categories, and computational and experimental methods. The central theme is that algebraic structures, pictures, categories and algorithms often encode the same mathematics. The publications below show three sustained strands: diagrammatic foundations for webs, tilting modules and link homologies; higher representation theory for Soergel, KLR and KLRW structures; and new bridges to asymptotics, data-driven experimentation, machine learning, reinforcement learning and cryptography-adjacent algebra.

Career impact beyond papers. The publication record is supported by an ARC Future Fellowship and an ARC Discovery Project, a growing Sydney research group with current and past PhD, Master and Honours students, substantial international event organization, more than 100 invited presentations, and a large public mathematics footprint through VisualMath on YouTube, public lectures, high-school research supervision, open code and open teaching material.

Impact at a glance. Current public metrics include 61 papers | 46 published | 1194 Google Scholar citations | h-index 22 | 5 current primary PhD students | 3 current secondary PhD students | 106 invited presentations | 33k+ YouTube subscribers. The key point is not only volume, but a coherent pipeline: build diagrammatic tools, turn them into structural theorems, use them computationally, train students and collaborators in the ecosystem, and make parts of the mathematics visible beyond the specialist community.

Selection and scoring method

Four-factor score. The publication list is ranked using four factors, each on a 0–25 scale: citations, citations/age, method novelty, and venue reputation. Citations and citation rates use public Google Scholar data from 25 June 2026. Venue reputation uses 2024 MCQ values where available. When no MCQ value is available, for example for preprints, eprints or unlisted venues, I use MCQ 0.50. Method novelty is my qualitative score, calibrated by how unusual the relevant keyword combination was at the time the paper appeared.

Novelty calibration. Novelty is not the same as importance. Common specialist bundles, such as webs/q-Howe duality, link homology/functoriality, Soergel bimodules/2-representations, or KLRW algebras/cellularity, are treated as established research ecosystems. A paper in such an ecosystem can score very highly overall, but its novelty is capped unless it changes the available toolkit. Higher novelty is reserved for comparatively rare keyword interfaces, such as monoidal categories/cryptography, Kazhdan–Lusztig theory/big data, equivariant neural networks/piecewise-linear representation theory, or reinforcement learning/unknotting.

Normalizations. Citation and citation rate scores use square root normalization, so that one very old or very highly cited paper does not dominate the ranking. Citation age is measured from the first public year in the Google Scholar data through 2026. Venue score uses 2024 MCQ values, capped at the best MCQ among the venues appearing in the list. Scores are rounded and are intended as a transparent ordering device, not as a bibliometric truth.

R	Paper	Cites	C/y	MCQ	Nov.	Score
1	Functoriality of colored link homologies	74	7.4	1.89	10	73.8
2	Monoidal categories, representation gap and cryptography	26	5.2	1.64	24	73.7
3	Webs and q-Howe dualities in types BCD	54	6.0	1.39	15	70.7
4	SL2 tilting modules in the mixed case	50	8.3	1.55	10	69.6
5	Simple transitive 2-representations of Soergel bimodules of finite Coxeter types	41	5.1	1.89	15	69.2
6	Growth rates of the number of indecomposable summands in tensor powers	33	8.2	0.62	19	69.1
7	Cellular structures using Uq-tilting modules	92	7.7	0.71	9	68.9
8	Super q-Howe duality and web categories	77	6.4	0.83	9	65.6
9	Symmetric webs, Jones–Wenzl recursions and q-Howe duality	51	4.2	1.22	12	62.8
10	Simple transitive 2-representations via (co)algebra 1-morphisms	45	4.1	1.20	13	62.2
11	The sl3 web algebra	54	3.6	0.96	12	60.3
12	Sandwich cellularity and a version of cell theory	31	6.2	0.44	15	59.7
13	Diagram categories for Uq-tilting modules at roots of unity	45	3.5	0.62	14	57.8
14	Cellularity of KLR and weighted KLRW algebras via crystals	7	1.8	3.70	14	57.4
15	Cellularity and subdivision of KLR and weighted KLRW algebras	21	3.5	1.72	12	57.2

Highest-scoring selected publications

1 **Functoriality of colored link homologies.** M. Ehrig, D. Tubbenhauer and P. Wedrich. *Proc. Lond. Math. Soc. (3) 117 (2018), no. 5, 996–1040.* arXiv:1703.06691. score 73.8

74 cites | 7.4 cites/year | MCQ 1.89 | established programme

This is the highest-scoring paper by the four-factor metric: high citations, strong citation rate, excellent venue, and a clean structural theorem in quantum topology. I score its novelty conservatively because it is a foundational advance inside an established link-homology-ecosystem, not a new cross-field interface.

2 **Monoidal categories, representation gap and cryptography.** M. Khovanov, M. Sitaraman and D. Tubbenhauer. *Trans. Amer. Math. Soc. Ser. B 11 (2024), 329–395.* arXiv:2201.01805. score 73.7

26 cites | 5.2 cites/year | MCQ 1.64 | rare keyword interface

This is the clearest high-novelty item among the established publications. The keyword combination monoidal categories, representation gap and cryptography is genuinely unusual, and the paper creates a new cryptography-facing interface for categorical and representation theoretic ideas.

3 **Webs and q-Howe dualities in types BCD.** A. Sartori and D. Tubbenhauer. *Trans. Amer. Math. Soc. 371 (2019), no. 10, 7387–7431.* arXiv:1701.02932. score 70.7

54 cites | 6.0 cites/year | MCQ 1.39 | non-type-A web toolkit

This paper extends the web/Howe-duality paradigm to orthogonal and symplectic settings. It is a clear anchor for the non-type-A diagrammatic part of the research programme; the novelty is substantial, but still within the recognised web/Howe-duality keyword family.

4 **SL2 tilting modules in the mixed case.** L. Sutton, D. Tubbenhauer, P. Wedrich and J. Zhu. *Selecta Math. (N.S.) 29 (2023), no. 3, Paper No. 39.* arXiv:2105.07724. score 69.6

50 cites | 8.3 cites/year | MCQ 1.55 | reusable toolkit

This has the strongest age-adjusted citation profile in the list (together with another item). It gives a usable diagrammatic calculus for SL2 tilting modules in the mixed case, including characters, quivers, fusion rules and mixed Jones–Wenzl technology.

5 **Simple transitive...finite Coxeter types.** M. Mackaay, V. Mazorchuk, V. Miemietz, D. Tubbenhauer and X. Zhang. *Proc. Lond. Math. Soc. (3) 126 (2023), no. 5, 1585–1655.* arXiv:1906.11468. score 69.2

41 cites | 5.1 cites/year | MCQ 1.89 | classification theorem

This is the flagship higher-representation-theory paper. Its strength is the combination of a major classification statement, a strong venue and a central position in the Soergel 2-representation programme. The method novelty is significant, but the keywords are part of an established research line.

6 **Growth rates...in tensor powers.** K. Coulembier, V. Ostrik and D. Tubbenhauer. *Algebr. Represent. Theory 27 (2024), no. 2, 1033–1062.* arXiv:2301.00885. score 69.1

33 cites | 8.3 cites/year | MCQ 0.62 | asymptotic tensor powers

This is one of the strongest age-normalized papers in the current data (alongside a second paper). It gives a visible entry point into the analytic/asymptotic monoidal categories programme. The novelty reflects an uncommon emphasis on growth and asymptotics inside categorical representation theory.

7 **Cellular structures using Uq-tilting modules.** H. H. Andersen, C. Stroppel and D. Tubbenhauer. *Pacific J. Math. 292 (2018), no. 1, 21–59.* arXiv:1503.00224. score 68.9

92 cites | top cited | MCQ 0.71 | foundational cellularity

This is the most cited paper in the current Google Scholar data. It is an early high-visibility contribution linking tilting modules, diagram algebras and cellular structures. Its novelty score is deliberately modest: these are natural keywords in the same representation theoretic orbit, but the impact is very high.

8 **Super q-Howe duality and web categories.** D. Tubbenhauer, P. Vaz and P. Wedrich. *Algebr. & Geom. Topol. 17 (2017), no. 6, 3703–3749.* arXiv:1504.05069. score 65.6

77 cites | 6.4 cites/year | MCQ 0.83 | web categories

This is one of the core web category papers: it uses super q-Howe duality to give diagrammatic presentations for categories built from symmetric and exterior powers. The keyword bundle is natural inside diagrammatic representation theory, so the novelty score is strong but not maximal.

9 **Symmetric webs, Jones–Wenzl recursions and q-Howe duality.** D. E. V. Rose and D. Tubbenhauer. *Int. Math. Res. Not. IMRN 2016, no. 17, 5249–5290.* arXiv:1501.00915. score 62.8

51 cites | 4.3 cites/year | MCQ 1.22 | symmetric webs

This is an important early web paper in a strong journal. It develops symmetric web technology and Jones–Wenzl recursion methods through q-Howe duality. The novelty is real, but the keyword combination is part of an established web-categorification-cluster.

10 **Simple transitive 2-representations via (co)algebra 1-morphisms.** M. Mackaay, V. Mazorchuk, V. Miemietz and D. Tubbenhauer. *Indiana Univ. Math. J. 68 (2019), no. 1, 1–33.* arXiv:1612.06325. score 62.2

45 cites | 4.1 cites/year | MCQ 1.20 | 2-representation theory

Together with the later PLMS paper and the two-color Soergel paper, this is part of the core 2-representation-theory arc of the CV. It has high raw visibility and solid venue strength.

11 **The sl3 web algebra.** M. Mackaay, W. Pan and D. Tubbenhauer. *Math. Z. 277 (2014), no. 1–2, 401–479.* arXiv:1206.2118. score 60.3

54 cites | foundational | MCQ 0.96 | web algebra

This is a foundational early paper connecting sl3 webs, foams, KLR ideas and diagrammatic categorification. I include it because it is still one of the more cited and recognisable diagrammatic categorification papers.

12 **Sandwich cellularity and a version of cell theory.** D. Tubbenhauer. *Rocky Mountain J. Math. 54 (2024), no. 6, 1733–1773.* arXiv:2206.06678. score 59.7

31 cites | 6.2 cites/year | MCQ 0.44 | cell theory

This is a single author structural paper with a very strong citation rate for its age. It develops a flexible cellularity viewpoint that fits naturally with the diagrammatic and categorical parts of the programme.

13 **Diagram categories for Uq-tilting modules at roots of unity.** H. H. Andersen and D. Tubbenhauer. *Transform. Groups 22 (2017), no. 1, 29–89.* arXiv:1409.2799. score 57.8

45 cites | 3.5 cites/year | MCQ 0.62 | diagrammatic tilting modules

This is one of the early papers that put tilting modules at roots of unity into a diagrammatic framework. It remains important for the long-running tilting module and diagram algebra strand.

14 **Cellularity of KLR and weighted KLRW algebras via crystals.** A. Mathas and D. Tubbenhauer. *Commun. Am. Math. Soc. 6 (2026), 548–633.* arXiv:2309.13867. score 57.4

7 cites | young | MCQ 3.70 | crystal cellularity

This is included despite a lower raw citation count because it has the strongest venue score in the selected list and is a natural companion to the Math. Ann. KLRW paper. The novelty is moderated because KLRW algebras, crystals and cellularity are related keywords, but the venue and structural value are very strong.

15 **Cellularity and subdivision of KLR and weighted KLRW algebras.** A. Mathas and D. Tubbenhauer. *Math. Ann. 389 (2024), no. 3, 3043–3122.* arXiv:2111.12949. score 57.2

21 cites | 3.5 cites/year | MCQ 1.72 | KLRW structure

This is the main high-venue KLR/KLRW structural paper. It scores well by combining a strong journal, solid early citations and substantial technical/foundational value.

Emerging method-driven publications

The next group highlights publications whose present citation counts do not yet fully reflect their role in the research programme. I include them because their keyword combinations are comparatively rare in the surrounding literature: asymptotics and growth in diagrammatic settings, large-scale computation with Kazhdan–Lusztig theory, data analysis of quantum invariants, machine learning with piecewise-linear representation theory, and reinforcement learning with unknotting problems. These papers explain where the programme is moving next.

A **Fractal behavior of tensor powers of the two dimensional space in prime characteristic.** K. Coulembier, P. Etingof, V. Ostrik and D. Tubbenhauer. *Modern algebra. Vol. 1. Representation theory, Contemp. Math. 829, 85–138.* arXiv:2405.16786. score 51.1

9 cites | 3.0 cites/year | MCQ 0.51 | fractal tensor powers

This belongs to the analytic/asymptotic side of the programme. It is young, but the combination of tensor powers, prime characteristic and fractal behaviour gives it a distinct conceptual profile.

B **Growth problems in diagram categories.** J. Gruber and D. Tubbenhauer. *Bull. Lond. Math. Soc. 57 (2025), no. 11, 3454–3469.* arXiv:2503.00685. score 50.4

6 cites | 3.0 cites/year | MCQ 1.00 | growth in diagrams

This is young but already visible. It sits at the intersection of diagram categories, asymptotic questions and computable growth phenomena, so it is a good bridge between the older diagrammatic work and the newer analytic programme.

C **Big data approach to Kazhdan–Lusztig polynomials.** A. Lacabanne, D. Tubbenhauer and P. Vaz. *Journal of Experimental Mathematics 2 (2025), no. 1, 21–62.* arXiv:2412.01283. score 45.4

3 cites | new | MCQ 0.50 | rare data/KL interface

This is the cleanest example of the new experimental-representation-theory direction: large-scale computation and data analysis applied to Kazhdan–Lusztig phenomena. The keyword pair big data/Kazhdan–Lusztig is uncommon, so the method novelty is high even though the paper is too young for citations to have stabilized.

D **Big data comparison of quantum invariants.** D. Tubbenhauer and V. L. Zhang. *to appear in Journal of Experimental Mathematics.* arXiv:2503.15810. score 39.9

1 cite | student/external mentoring | MCQ 0.50 | data/topology bridge

This paper compares quantum invariants using large-scale data and topological data analysis. It connects quantum topology, computation, mentoring, and public-facing mathematical experimentation.

E **Equivariant neural networks and piecewise linear representation theory.** J. Gibson, D. Tubbenhauer and G. Williamson. *Modern algebra. Vol. 1. Representation theory, Contemp. Math. 829, 157–192*. arXiv:2408.00949. score 33.3

machine learning | representation theory | MCQ 0.51 | rare ML/rep-theory bridge

This is the most explicit machine learning bridge: it uses representation-theoretic decompositions to study equivariant neural networks and the piecewise linear maps produced by nonlinear activations. The citation count is still modest, but the keyword interface is genuinely unusual.

F **RL unknotter, hard unknots and unknotting number.** A. Dranowski, Y. Kabkov and D. Tubbenhauer. *Preprint*. arXiv:2603.07955. score 33.2

new | reinforcement learning | knot theory | rare RL/knot bridge

This is too new to have a citation profile, but the keyword combination reinforcement learning/unknotting number is rare and the paper belongs to a distinctive computational-topology cluster. It is also naturally public-facing because knots are visually accessible.

Bottom line. The novelty coding is intentionally conservative. Highly cited web, tilting-module, Soergel and link-homology papers remain the strongest established papers, but they do not receive near-maximal novelty merely for being important. The highest novelty scores are reserved for genuinely uncommon keyword interfaces: cryptography, large-scale data analysis, machine learning, reinforcement learning, and asymptotic/growth methods entering categorical and diagrammatic representation theory.

Data notes

- Publication list and venue/arXiv metadata: https://www.dtubbenhauer.com/Tubbenhauer-publication-list.pdf.
- Citation data: Google Scholar profile, 25 June 2026, showing 1194 total citations, h-index 22 and i10-index 30, with per-paper citation counts used above.
- Venue data: 2024 MCQ values. Examples used above include Commun. Am. Math. Soc. 3.70, Proc. Lond. Math. Soc. 1.89, Math. Ann. 1.72, Trans. Amer. Math. Soc. Ser. B 1.64, Selecta Math. 1.55, Trans. Amer. Math. Soc. 1.39, J. Lond. Math. Soc. 1.29 and IMRN 1.22. Unknown, unpublished or unlisted venue values are set to MCQ 0.50.
- Method novelty scores are qualitative and intentionally conservative. I use keyword rarity as a sanity check: papers inside established keyword ecosystems are not given maximal novelty merely for being influential, while genuinely uncommon interfaces receive a higher score.

Daniel Tubbenhauer (digital signature); 25 June 2026