The gain in conceptual simplicity achieved by this geometric viewpoint is substantial; of course, the hard calculations remain to be done to compute the Whitehead group. One may compare the achievement of this paper with that of [34; 1953], in which Eckmann and Schopf produce a very significant simplification and clarification of the concept of injective hull of a module and a very easy, natural proof of its existence (first proved by Reinhold Baer); or with a very recent paper [81; 1976], in which Eckmann gave a remarkably simple proof of the Dyer-Vasquez theorem that the complement of a higher-dimensional knot $S^{n-2} \subseteq S^n$, $n \geqslant 4$, is never aspherical unless the knot group is infinite cyclic (thus, if $n \geqslant 5$, unless the knot is unknotted).

The story goes on. I have on my desk the latest manuscript, a joint paper by Eckmann and Bieri, completed in the spring of 1977, entitled "Relative Homology and Poincaré duality for group pairs". As I have said, Beno Eckmann remains active and effective—but more is true. The Eckmann touch remains as sure as ever!

PUBLICATIONS OF B. ECKMANN

[1] Zur Homotopietheorie gefaserter Räume. *Diss. Comm. Math. Helv. 14* (1942), p. 141.
[2] Über die Homotopiegruppen von Gruppenräumen. *Comm. Math. Helv. 14* (1942), p. 234.
[3] Systeme von Richtungsfeldern in Sphären und stetige Lösungen komplexer linearer Gleichungen. *Comm. Math. Helv. 15* (1942), p. 1.
[4] Vektorfelder in Sphären. *Vortrag Schweiz. Math. Ges., Verh. Schweiz. Naturf. Ges.* (1941), p. 85.
[5] Über stetige Lösungen linearer Gleichungssysteme. *Vortrag Schweiz. Math. Ges., Verh. Schweiz. Naturf. Ges.* (1942), p. 78.
[6] Über Zusammenhänge zwischen algebraischen und topologischen Problemen. *Vortrag Math. Ver. Bern, Verh. Naturf. Ges. Bern* (1942), p. 14.
[7] L'idée de dimension, Leçon inaugurale Lausanne 5.2.43. *Revue de Théologie et Philosophie 127* (1943), p. 1.
[8] Stetige Lösungen linearer Gleichungssysteme. *Comm. Math. Helv. 15* (1943), p. 318.
[9] Gruppentheoretischer Beweis des Satzes von Hurwitz-Radon über die Komposition quadratischer Formen. *Comm. Math. Helv. 15* (1943), p. 358.
[10] Über monothetische Gruppen. *Verh. Schweiz. Naturf. Ges.* (1943), p. 63.
[11] Topologie und Algebra, Antrittsvorlesung ETH 22.5.43. *Viertelj'schrift Naturf. Ges. Zürich, 31 März 1944* (89), p. 25.
[12] Über monothetische Gruppen. *Comm. Math. Helv. 16* (1944), p. 249.
[13] Harmonische Funktionen und Randwertaufgaben in einem Komplex. *Comm. Math. Helv. 17* (1945), p. 240.
[14] Lois de Kirchhoff et fonctions discrètes harmoniques. *Bull. Soc. Vaud. Sc. Nat. 63*, 264 (1945), p. 67.
[15] Der Cohomologie-Ring einer beliebigen Gruppe. *Comm. Math. Helv. 18* (1945/46), p. 232.

[16] Der Cohomologiering einer beliebigen Gruppe. *Verh. Schweiz. Naturf. Ges.* (1945), p. 97.

[17] On complexes over a ring and restricted cohomology groups. *Proc. Nat. Acad. Sci. 33* (1947), p. 275.

[18] On infinite complexes with automorphisms. *Proc. Nat. Acad. Sci. 33* (1947), p. 372.

[19] Coverings and Betti numbers. *Bull. A.M.S. 55*, 2 (1949), p. 95.

[20] Sur les applications d'un polydère dans un espace projectif complexe. *C. R. Acad. Sc. Paris 228* (1949), p. 1397.

[21] On fibering spheres by toruses (with H. Samelson and G. W. Whitehead). *Bull. A.M.S.55*, 4 (1949), p. 433.

[22] Formes différentielles et métrique hermitienne sans torsion. I. Structure complexe, formes pures (with H. Guggenheimer). *C. R. Acad. Sci. Paris 229* (1949), p. 464.

[23] Formes différentielles et métrique hermitienne sans torsion. II. Formes de classe k, formes analytiques (with H. Guggenheimer). *C.R. Acad. Sci. Paris 229* (1949), p. 489.

[24] Sur les variétés closes à métrique hermitienne sans torsion (with H. Guggenheimer). *C.R. Acad. Sci. Paris 229* (1949), p. 503.

[25] Quelques propriétés globales des variétés kähleriennes. *C. R. Acad. Sci. Paris 229* (1949), p. 577.

[26] Alexandersches und Cartesisches Produkte in der Cohomologietheorie (with H. Brändli). *Comm. Math. Helv. 24* (1950), p. 68.

[27] Continu et discontinu, Etudes de Philosophie des Sciences, hommage à F. Gonseth (1950), p. 83.

[28] Continu et discontinu. *Actes du Congrès de Philosophie des Sciences*, Paris 1949.

[29] Espaces fibrés et homotopie. *Coll. Topol. Centre Belge de Rech. Math.* 1950.

[30] Sur l'intégrabilité des structures presque complexes (with A. Frölicher), *C. R. Acad. Sci. Paris* (1951), p. 2284.

[31] Complex-analytic manifolds. *Proc. Int. Congr. 1950* (Conf. in topology), vol. II, p. 420.

[32] Räume mit Mittelbildungen. *Proc. Int. Congr. 1950*, vol. I, p. 523.

[33] On complexes with operators. *Proc. Nat. Acad. Sci. USA 39* (1953), p. 35.

[34] Über injektive Moduln (with A. Schopf). *Arch. Math. 4* (1953), p. 75.

[35] Cohomology of groups and transfer. *Ann. of Math. 58* (1953), p. 481.

[36] A class of compact complex manifolds which are not algebraic (with E. Calabi). *Ann. of Math. 58* (1953), p. 494.

[37] Sur les structures complexes et presque complexes. *Géométrie différentielle, Colloques Internat. du Centre Nat. de la Recherche Scientifique*, Strasbourg, (1953), p. 151.

[38] Structures complexes et transformations infinitésimales. *Convegno di Geometria Differenziale*, 1953, p. 1976.

[39] Räume mit Mittelbildungen. *Comm. Math. Helv. 28* (1954), p. 329.

[40] Zur Cohomologietheorie von Gruppen und Räumen. *Proc. Int. Congr. Math.* 1954.

[41] Homotopie et dualité. *Coll. Top. Alg. 1956, Centre Belge de Rech. Math.*, p. 41.

[42] Groupes d'homotopie et dualité. Groupes absolus (with P. J. Hilton). *C. R. Acad. Sci. Paris 246* (1958), p. 2444.

[43] Groupes d'homotopie et dualité. Suites exactes (with P. J. Hilton). *C. R. Acad. Sci. Paris 246* (1958), p. 2555.

[44] Groupes d'homotopie et dualité. Coefficients (with P. J. Hilton). *C. R. Acad. Sci. Paris 246* (1958), p. 2991.

[45] Transgression homotopique et cohomologique (with P. J. Hilton). *C. R. Acad. Sci. Paris 247* (1958), p. 620.

[46] Décomposition homologique d'un polyèdre simplement connexe (with P. J. Hilton). *C. R. Acad. Sci. Paris 248* (1959), p. 2054.

[47] On the homology and homotopy decomposition of continuous maps (with P. J. Hilton). *Proc. Nat. Acad. Sci. USA 45* (1959), p. 372.

[48] Groupes d'homotopie et dualité. *Bull. Soc. math. France 86* (1958), p. 271.

[49] Operators and cooperators in homotopy theory (with P. J. Hilton). *Math. Ann. 141*, (1960), p. 1.

[50] Homotopy groups of maps and exact sequences (with P. J. Hilton). *Comm. Math. Helv. 34* (1960), p. 272.

[51] Structure maps in group theory (with P. J. Hilton). *Fund. Math. 50* (1961), p. 208.

[52] Group-like structures in general categories I. Multiplications and comultiplications (with P. J. Hilton). *Math. Ann. 145* (1962), p. 227.

[53] Homotopie und Homologie. *L'Enseignement Mathém. 8* (1962), p. 209.

[54] Algebraic homotopy groups and Frobenius algebras (with H. Kleisli). *Ill. Journ. Math. 6*, 4 (1962), p. 433.

[55] Generalized means, (with T. Ganea and P. J. Hilton). *Studies in Math. Analysis and Related Topics* (1962), p. 82.

[56] Group-like structures in general categories III. Primitive categories (with P. J. Hilton). *Math. Ann. 150* (1963), p. 165

[57] Group-like structures in general categories II. Equalizers, limits, lengths (with P. J. Hilton). *Math. Ann. 151* (1963), p. 150.

[58] Homotopy and cohomology theory. *Proc. Intern. Congr. Math.*, 1962, Stockholm, p. 59.

[59] A natural transformation in homotopy theory and a theorem of G. W. Whitehead (with P. J. Hilton). *Math. Zeitschr. 82* (1963), p. 115.

[60] Unions and intersections in homotopy theory (with P. J. Hilton). *Comm. Math. Helv. 38* (1964), p. 293.

[61] Exact couples in an abelian category (with P. J. Hilton). *Journ. of Alg. 3*, 1 (1966), p. 38.

[62] Composition functors and spectral sequences (with P. J. Hilton). *Comm. Math. Helv. 41* (1966/67), p. 187.

[63] Filtrations, associated graded objects and completions (with P. J. Hilton). *Math. Zeitschr. 98* (1967), p. 319.

[64] Homologie et différentielles. Suites exactes (with U. Stammbach). *C. R. Acad. Sci. Paris 265* (juillet 1967), p. 11.

[65] Homologie et différentielles. Basses dimensions; cas spéciaux (with U. Stammbach). *C. R. Acad. Sc. Paris 265* (juillet 1967), p. 46.

[66] Commuting limits with colimits (with P. J. Hilton). *Journ. of Alg. 11*, 1 (1969), p. 116.

[67] Continuous solutions of linear equations—some exceptional dimensions in topology. *Battelle Rencontres, 1967 Lectures in Mathematics and Physics.* W. A. Benjamin, Inc., 1968, p. 516.

[68] On exact sequences in the homology of groups and algebras (with U. Stammbach). *Ill. Journal of Math. 14* (1970), p. 205.

[69] Homotopical obstruction theory (with P. J. Hilton). *An. Acad. brasil. Ciênce* (1968), p. 408.

[70] Le groupe des types simples d'homotopie sur un polyèdre (with S. Maumary). *Essays on Topology and Related Topics, Mémoires dédiés à Georges de Rham*, Springer-Verlag, 1970, p. 174.

[71] Simple homotopy type and categories of fractions. *Symp. Math. 5* (1969/70), Academic Press (1971), p. 285.

[72] On central group extensions and homology (with P. J. Hilton). *Comm. Math. Helv. 46* (1971), p. 345.

[73] On the homology theory of central group extensions: I—The commutator map and stem extensions (with P. J. Hilton and U. Stammbach). *Comm. Math. Helv. 47*, 1 (1972), p. 102.

[74] On the homology theory of central group extensions: II—The exact sequence in the general case (with P. J. Hilton and U. Stammbach). *Comm. Math. Helv. 47*, 2 (1972), p. 171.

[75] Groupes à dualité homologique (with R. Bieri). *C. R. Acad. Sci. Paris 275* (nov. 72), A-899.

[76] On the Schur multiplicator of a central quotient of a direct product of groups (with P. J. Hilton and U. Stammbach). *J. of Pure and Applied Algebra 3* (1973), p. 73.

[77] Propriétés de finitude des groupes à dualité (with R. Bieri). *C. R. Acad. Sci. Paris 276* (mars 73), A-831.

[78] Groups with homological duality generalizing Poincaré duality (with R. Bieri). *Inventiones math. 20* (1973), p. 103.

[79] Finiteness properties of duality groups (with R. Bieri). *Comm. Math. Helv. 49*, 1 (1974), p. 74.

[80] Amalgamated free products of groups and homological duality (with R. Bieri). *Comm. Math. Helv. 49* 4 (1974), p. 460.

[81] Aspherical manifolds and higher-dimensional knots. *Comm. Math. Helv. 51* (1976), p. 93.

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