Structures on 2- and 3-manifolds coming from dynamical systems

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In this talk we discuss a construction of 2- and 3-dimensional (sometimes, singular) manifolds starting from 1- and 2-dimensional dynamical systems. Roughly, starting with an endomorphism in dimensions 1 or 2 and taking the inverse limit we obtain a homeomorphism on a complicated continuum; a dynamics-respecting (mild) quotient of this continuum becomes a 2- or 3-manifold, together with a homeomorphism. Dynamical structures, such as stable and unstable sets, invariant measures and their u- and s-decompositions, etc., yield added structures on the underlying manifolds and, under certain hypotheses, turn them into metric-measure spaces with singular foliations or Riemann surfaces with L^1 quadratic differentials, in the 1-to-2D case, or (singular) 3-manifolds with (singular) Riemann surface foliations, in the 2-to-3D case.

These constructions are related, for example, to Williams's discussion of expanding attractors and to Thurston's pseudo-Anosov homeomorphisms and their associated train tracks. Most of the results discussed come from joint work with Phil Boyland, Toby Hall and Daniel Meyer.