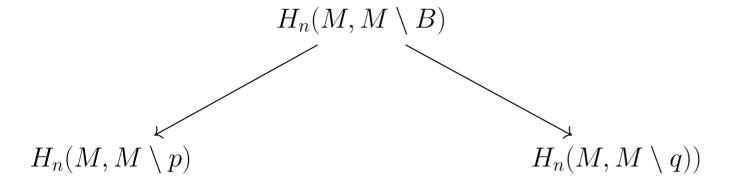
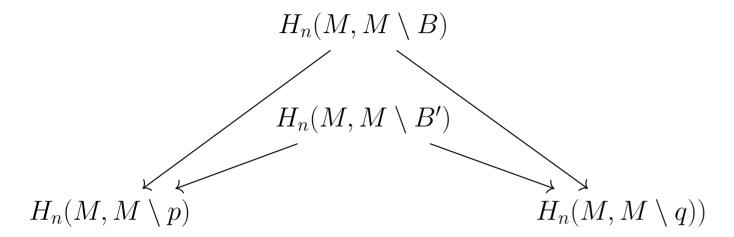
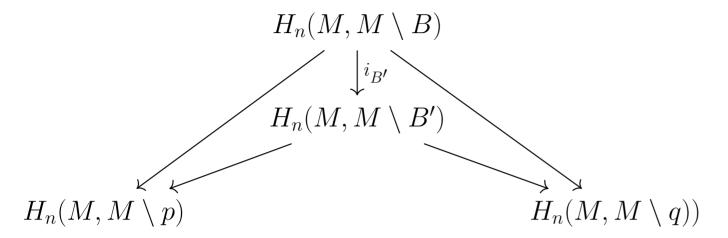
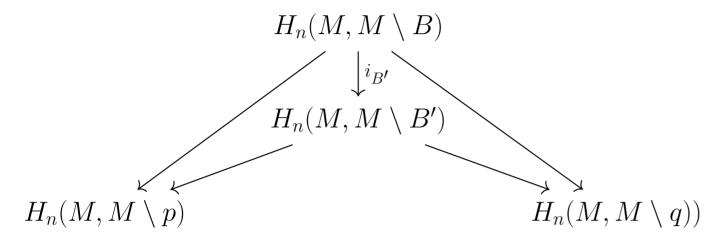
Observation on local consistency:

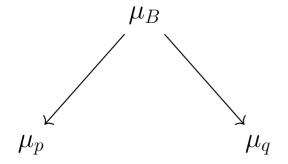


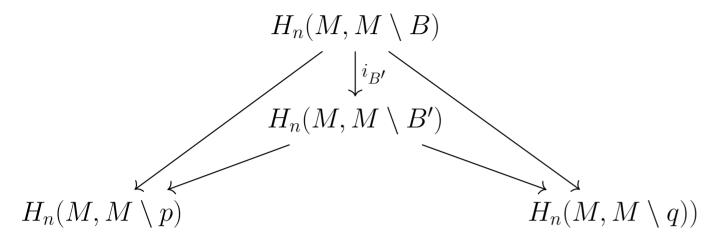




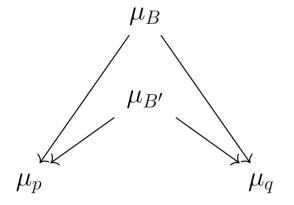


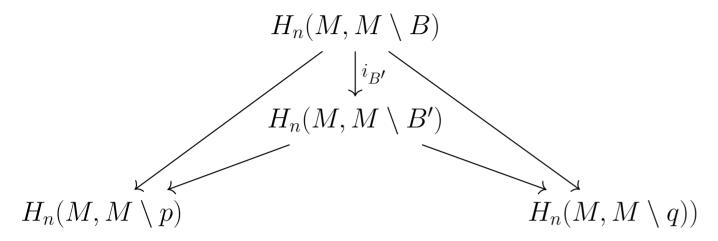
An orientation on M needs the assignment $p \to \mu_p$ to satisfy compatibily criterion.



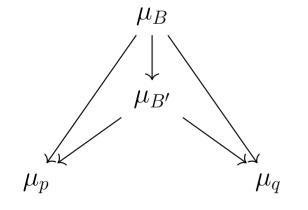


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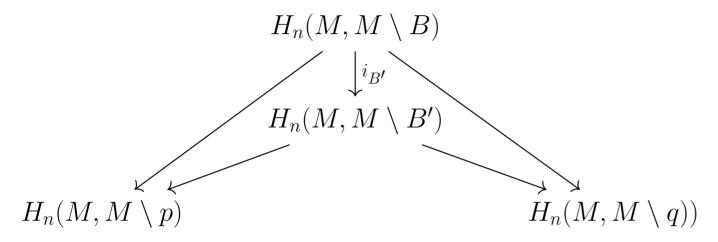




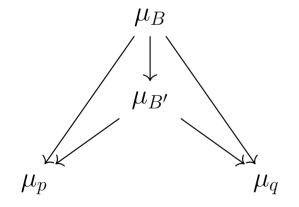
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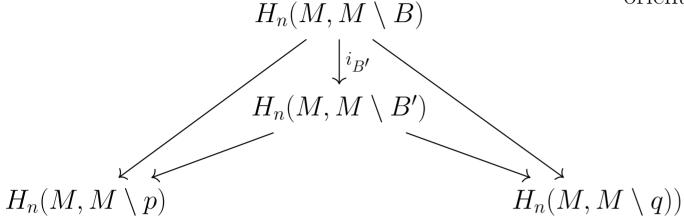


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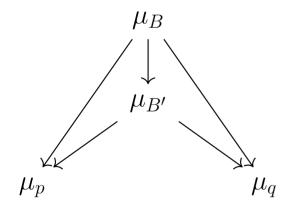


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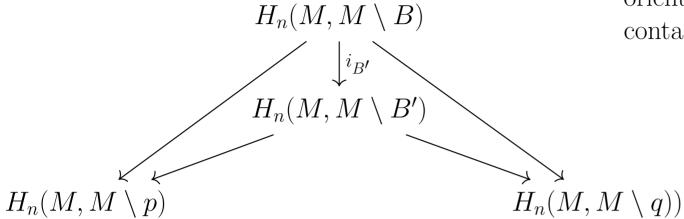
Informally, if a ball is responsible for compatible local orientations at two points,



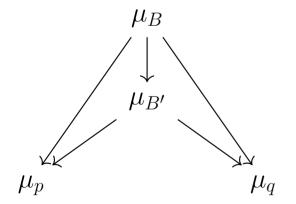
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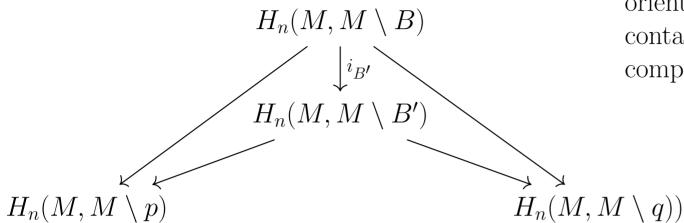


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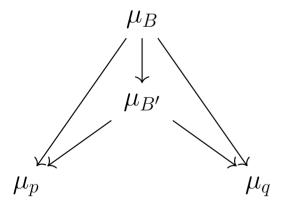


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Informally, if a ball is responsible for compatible local orientations at two points, then any smaller ball that contains those two points may also be used to ensure compatibility of the orientations at these points.

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Question: A compact.

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commutativity of the appropriate diagram, A compact. How is $\alpha \in H_n(M, M \setminus A)$ characterized $(j_{A*}(\alpha_A))_x = \alpha_{A \cap B_x} \forall x \in A$, so by the uniqueness assumption $j_{A_*}(\alpha_A) = \alpha_{A \cap B}$. Similarly, $j_{B_*}(\alpha_B) = \alpha_{A \cap B}$. Therefore, the map,

 $H_n(M, M \setminus A) \oplus H_n(M, M \setminus B) \xrightarrow{\Psi} H_n(M, M \setminus (A \cap B))$

 $\Psi(\alpha,\beta) = j_{A*}(\alpha) - j_{B*}(\beta)$ sends (α_A,α_B) to 0. By Mayer Vietoris, there is $\alpha_{A \cup B}$ such that $(i_{A*}(\alpha_{A\cup B}), i_{A*}(\alpha_{A\cup B})) = (\alpha_A, \alpha_B)$

Sketch of proof. Can we patch it up from simpler By commutativity of the appropriate diagram, if $x \in A$, then $(\alpha_{A\cup B})_x = (i_{A*}(\alpha_{A\cup B}))_x = (\alpha_A)_x = s(x)$. Similarly for B. This proves the claim.



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Rest of the steps as before:

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- 3. Can replace A by any "sane" bigger compact set , eg. closed ball B, such that $A \subset B$ (exercise!). The theorem is true if A is a closed ball (exercise! Use the observation on local consistency described at the beginning)

Theorem. There is a covering $\pi: M_{\mathbb{Z}} \to M$ such that (Here, $n := \dim M$)

- 1. $H_n(M, M \setminus p) \cong \mathbb{Z}$ is the fibre at p.
- 2. $M_{\mathbb{Z}}$ is a disjoint union of a copy of M and copies of \widetilde{M}
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Theorem. Given any $s \in \Gamma_{\mathbb{Z}}(M)$, there is a **unique** $\alpha \in H_n(M, M \setminus A)$ such that $\alpha_x = s(x)$ for all $x \in A$.

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