Long w-Knots, what's the group-theoretical fundamental gadget?
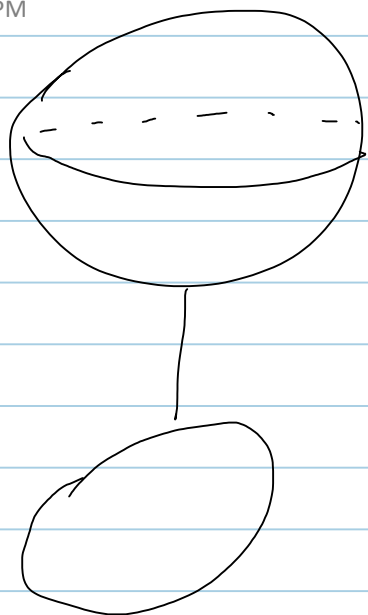
A long w-knot is a baloon carrying a hoop.

$\rightsquigarrow$ "A group and an element in it".

Maybe the fundamental gadget is

$$F_n \longrightarrow G \longrightarrow F_m$$

"A group w/ n marked elements and a homomorphism into F_m" ?

Not quite.