Reducing graphs by automorphisms

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Fix a prime p. Starting with any finite undirected graph G, pick an automorphism of G of order p and delete all the vertices that are moved by this automorphism. Apply the same procedure to the new graph, and repeat until a graph G^* is reached that has no automorphisms of order p. Is the reduced graph G^* uniquely defined (up to isomorphism) by G? I..e., is G^* independent of the sequence of automorphisms chosen?

In a CSG in 2010 John Faben showed that the answer is "yes" in the special case $p = 2$ (i.e., reduction by involutions) using Newman's Lemma on confluence of reduction systems. Later, he noticed +that the general case can be handled using the so-called Lovász vector of a graph. I'll prove the general result and sketch some consequences to the extent that time allows.