In 1984, Alexander Grothendieck, inspired by a result of Gennadi Bely˘ı from 1979, constructed a finite, connected planar bipartite graph via rational functions $\beta : \mathbb{P}^1(\mathbb{C}) \to \mathbb{P}^1(\mathbb{C})$ with critical values $\{0, 1, \infty\}$ by looking at the inverse image of the triangle formed by these three points. He called such graphs Dessins d’Enfants. Conversely, Riemann’s Existence Theorem implies that every finite, connected planar graph arises in this way.

The difficulty arises in explicitly constructing such a Bely˘ı map $\beta$ from any given planar graph. We may form a valency list by considering the number of edges surrounding each vertex and each face; this forces algebraic conditions on the coefficients of the desired Bely˘ı map. Hence the construction of a Bely˘ı map can be reduced to the computation of roots of a system of nonlinear equations. In this talk, we reformulate the problem of finding these roots into an unconstrained optimization problem. We implement Newton’s method and a Trust-Region Method to approximate these coefficients. Preliminary results are presented and possible directions are discussed. (Received September 05, 2014)