

HOW TO DRAW A DESSIN?

MICHAEL MUSTY

ABSTRACT. In this work we present an explicit implementation of an algorithm to draw dessins d'enfants from their combinatorial description as permutation triples. In Section 1 we review some background about dessins d'enfants, Belyi maps, and some of the reasons the reader might be interested in these objects. In Section 2 we review the existing methods for drawing pictures of dessins d'enfants and the available catalogs in the literature. In Section 3 we present our technique for explicitly drawing dessins along with explanations of the choices made during this process. We then include a database of all dessins up to degree 11 and conclude in Section 9 with some observations about the data.

CONTENTS

1. Background	1
1.1. Equivalent categories	1
1.2. Dessins	1
1.3. Clean dessins	1
1.4. Ribbon graphs	1
2. Existing catalogs	2
3. Drawing techniques	2
4. Degree ≤ 4	2
5. Degree 5	2
6. Degree 6	2
7. Degree 7	2
8. Degree 8	2
9. Conclusions	2
References	2

1. BACKGROUND

- 1.1. **Equivalent categories.**
- 1.2. **Dessins.**
- 1.3. **Clean dessins.**
- 1.4. **Ribbon graphs.**

2. EXISTING CATALOGS

3. DRAWING TECHNIQUES

4. DEGREE ≤ 4

5. DEGREE 5

6. DEGREE 6

7. DEGREE 7

8. DEGREE 8

9. CONCLUSIONS

REFERENCES

1. N. M. Adrianov, N. Ya. Amburg, V. A. Drëmov, Yu. Yu. Kochetkov, E. M. Kreĭnes, Yu. A. Levitskaya, V. F. Nasretdinova, and G. B. Shabat, *A catalogue of Belyĭ functions of dessins d'enfants with at most four edges*, Fundam. Prikl. Mat. **13** (2007), no. 6, 35–112. MR 2476028
2. N. M. Adrianov and A. K. Zvonkin, *Weighted trees with primitive edge rotation groups*, Fundam. Prikl. Mat. **18** (2013), no. 6, 5–50. MR 3431854
3. Jean B  tr  ma and Alexander Zvonkin, *Plane trees and Shabat polynomials*, Proceedings of the 5th Conference on Formal Power Series and Algebraic Combinatorics (Florence, 1993), vol. 153, 1996, pp. 47–58. MR 1394945
4. Michael Klug, Michael Musty, Sam Schiavone, and John Voight, *Numerical calculation of three-point branched covers of the projective line*, LMS J. Comput. Math. **17** (2014), no. 1, 379–430. MR 3356040
5. Michael Musty, Sam Schiavone, Jeroen Sijsling, and John Voight, *A database of Belyi maps*, Proceedings of the Thirteenth Algorithmic Number Theory Symposium, Open Book Ser., vol. 2, Math. Sci. Publ., Berkeley, CA, 2019, pp. 375–392. MR 3952023
6. G. Shabat, *Calculating and drawing Belyi pairs*, Zap. Nauchn. Sem. S.-Peterburg. Otdel. Mat. Inst. Steklov. (POMI) **446** (2016), no. Kombinatorika i Teoriya Grafov. V, 182–220, Reprinted in J. Math. Sci. (N.Y.) **226** (2017), no. 5, 667–693. MR 3520428
7. J. Sijsling and J. Voight, *On computing Belyi maps*, Num  ro consacr   au trimestre “M  thodes arithm  tiques et applications”, automne 2013, Publ. Math. Besan  on Alg  bre Th  orie Nr., vol. 2014/1, Presses Univ. Franche-Comt  , Besan  on, 2014, pp. 73–131. MR 3362631

ICERM, 121 S MAIN STREET, PROVIDENCE, RI 02903, FALL 2019

Email address: michaelmusty@gmail.com

