11 Supplementary materials

These supplementary materials show the full pipeline and added diagnostics for the examples in the main article.

As in the main article, all the figures shown in this section are shown as-is, without any aesthetical modifications, with the exception that the arrangement of the sub-figures (for example, aligning true and twin tree horiztonally) is done manually.

11.1 Generative model only

The code used in this part of the article can be found at `https://github.com/richelbilderbeek/pirouette_example_1`.
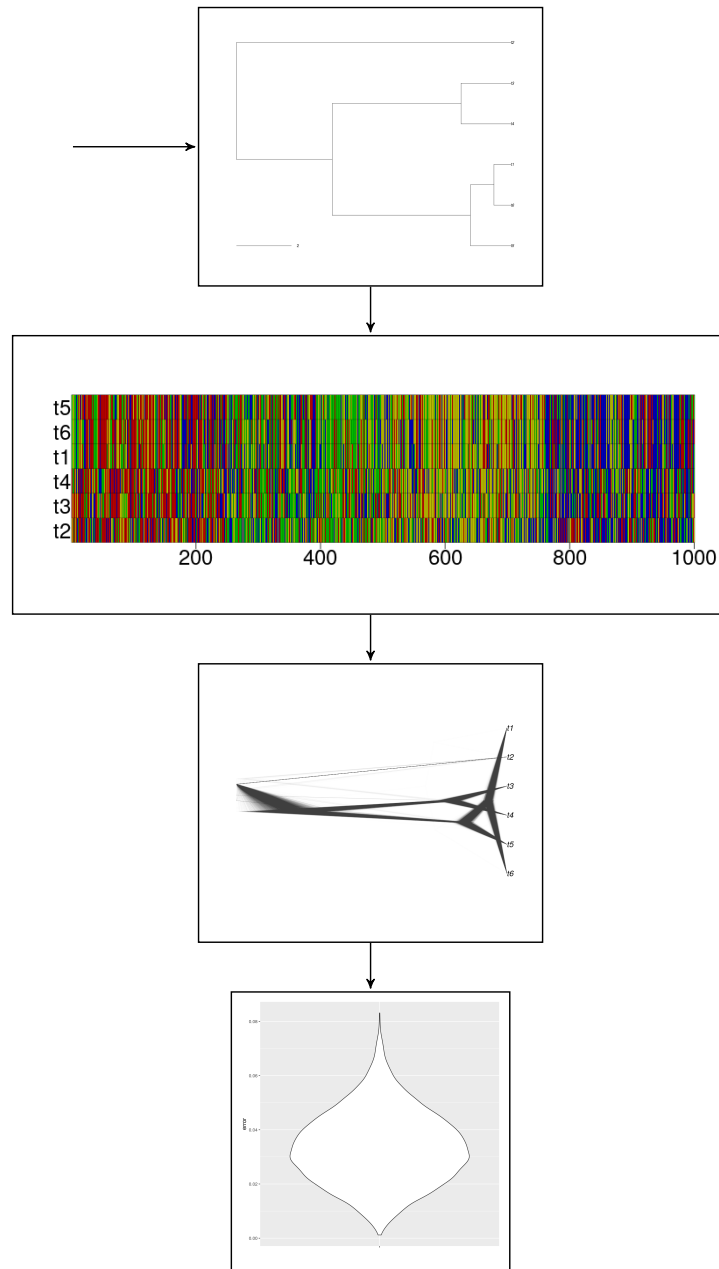
Figure 7: Generative model only: full pipeline

parameter	ESS
posterior	9952
likelihood	9973
prior	9831
treeLikelihood	9973
TreeHeight	9351
YuleModel	9831
birthRate	10001

Table 6: ESSes for generative model

11.2   Comparing to other candidate models

The code used in this part of the article can be found at `https://github.com/`

`richelbilderbeek/pirouette_example_2`.
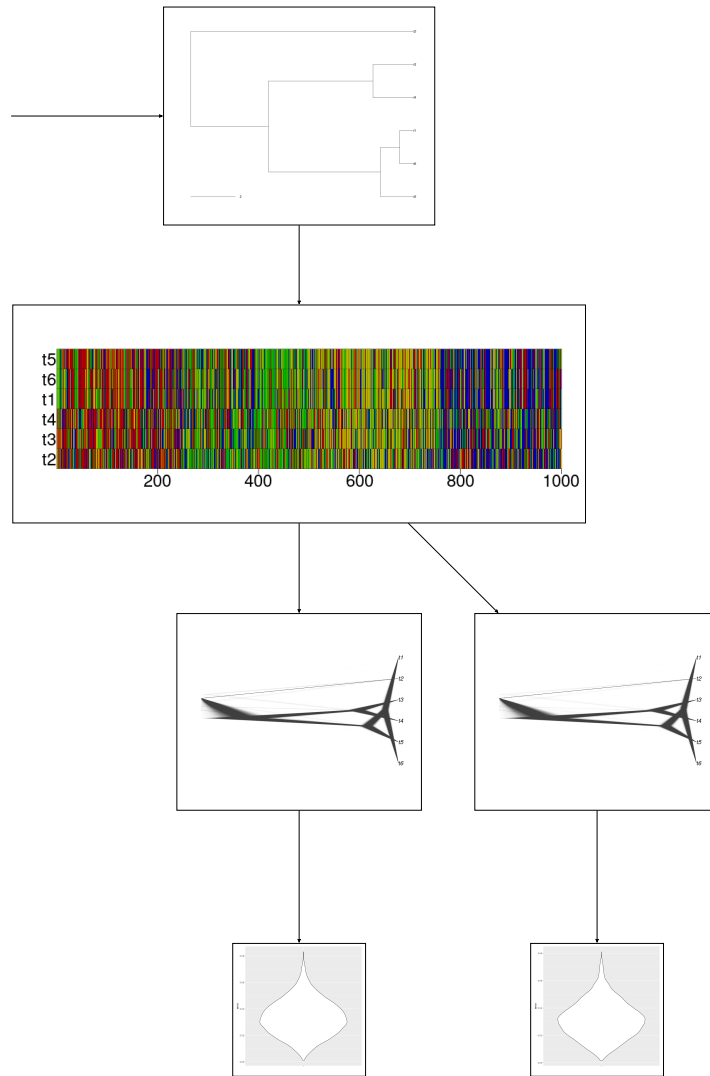
Figure 8: Comparing to other candidate models: full pipeline

11.3 Comparing to background noise

The code used in this part of the article can be found at https://github.com/
richelbilderbeek/pirouette_example_3.

parameter	ESS
posterior	9952
likelihood	9973
prior	9831
treeLikelihood	9973
TreeHeight	9351
YuleModel	9831
birthRate	10001

Table 7: ESSes for generative model

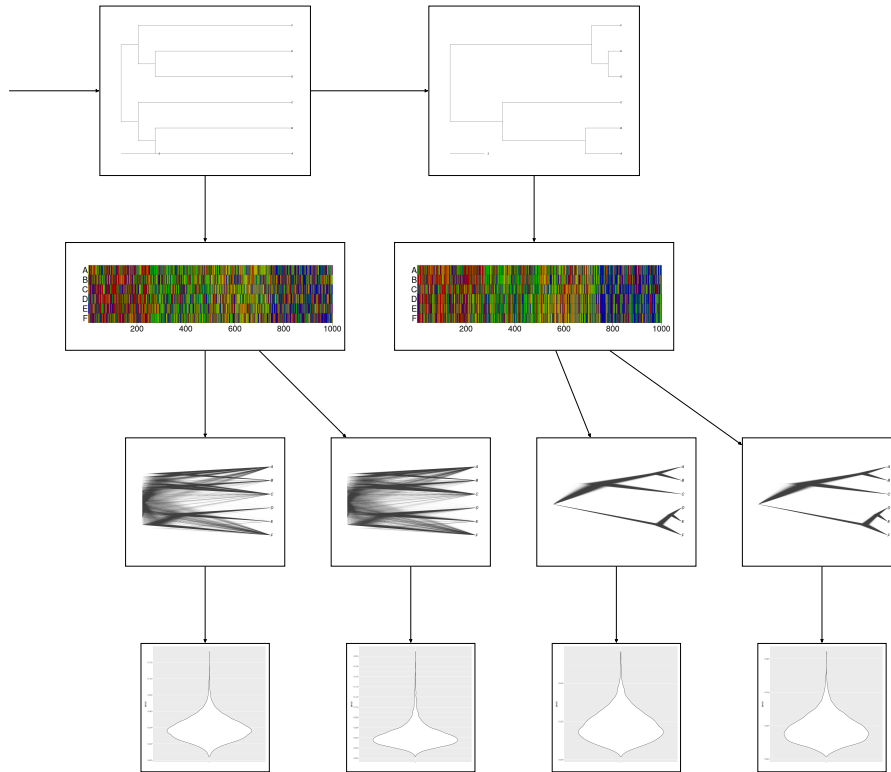| parameter	ESS
posterior	10001
likelihood	10001
prior	10001
treeLikelihood	10001
TreeHeight	10001
popSize	9508
CoalescentConstant	10001

Table 8: ESSes for best candidate model

Figure 9: Comparing to background noise: full pipeline

Site model	Clock model	Tree prior	log(evidence)	log(evidence error)	Weight	ESS
GTR	RLN	BD	-6261.302	5.357	0.000	9.833
GTR	RLN	CBS	-6278.295	7.470	0.000	10.728
GTR	RLN	CCP	-6254.399	5.186	0.000	12.105
GTR	RLN	CEP	-6255.892	6.485	0.000	7.767
GTR	RLN	Yule	-6256.212	5.163	0.000	12.697
GTR	Strict	BD	-6263.454	6.382	0.000	9.058
GTR	Strict	CBS	-6277.141	7.262	0.000	11.460
GTR	Strict	CCP	-6251.537	5.253	0.000	7.868
GTR	Strict	CEP	-6256.706	5.358	0.000	9.399
GTR	Strict	Yule	-6287.204	7.332	0.000	12.029
HKY	RLN	BD	-6249.482	5.684	0.000	5.386
HKY	RLN	CBS	-6260.282	6.046	0.000	9.906
HKY	RLN	CCP	-6255.119	4.639	0.000	10.511
HKY	RLN	CEP	-6248.406	4.879	0.000	7.926
HKY	RLN	Yule	-6253.481	5.760	0.000	8.687
HKY	Strict	BD	-6260.659	6.316	0.000	8.811
HKY	Strict	CBS	-6271.897	6.893	0.000	8.895
HKY	Strict	CCP	-6250.145	5.041	0.000	8.396
HKY	Strict	CEP	-6259.384	5.666	0.000	8.524
HKY	Strict	Yule	-6259.074	6.022	0.000	9.603
JC	RLN	BD	-6245.907	4.149	0.000	5.436
JC	RLN	CBS	-6240.633	4.088	0.011	7.245
JC	RLN	CCP	-6243.069	3.888	0.001	4.743
JC	RLN	CEP	-6245.266	3.838	0.000	6.844
JC	RLN	Yule	-6236.877	3.346	0.452	5.037
JC	Strict	BD	-6245.601	4.708	0.000	5.004
JC	Strict	CBS	-6249.775	4.913	0.000	6.533
JC	Strict	CCP	-6236.711	3.340	0.534	7.152
JC	Strict	CEP	-6242.589	3.679	0.001	6.120
TN	RLN	BD	-6261.176	6.610	0.000	8.304
TN	RLN	CBS	-6265.032	6.017	0.000	8.586
TN	RLN	CCP	-6269.142	6.928	0.000	12.126
TN	RLN	CEP	-6263.625	6.168	0.000	6.841
TN	RLN	Yule	-6253.269	5.558	0.000	8.746
TN	Strict	BD	-6258.623	5.433	0.000	12.387
TN	Strict	CBS	-6261.117	6.114	0.000	6.357
TN	Strict	CCP	-6253.969	4.810	0.000	11.232
TN	Strict	CEP	-6255.960	5.421	0.000	6.297
TN	Strict	Yule	-6261.984	5.550	0.000	8.184

Table 9: Evidences for the true phylogeny

parameter	ESS
posterior	10001
likelihood	10001
prior	10001
treeLikelihood	10001
TreeHeight	10001
YuleModel	10001
birthRate	10001

Table 10: ESSes for generative model

parameter	ESS
posterior	5295
likelihood	9778
prior	1057
treeLikelihood	9778
TreeHeight	1589
ucldStdev	1961
rate.mean	1735
rate.variance	2419
rate.coefficientOfVariation	2078
CoalescentExponential	1592
ePopSize	3230
growthRate	1066

Table 11: ESSes for best candidate model

parameter	ESS
posterior	9937
likelihood	9976
prior	9564
treeLikelihood	9976
TreeHeight	10001
YuleModel	9564
birthRate	9573

Table 12: ESSes for generative model, twin tree

parameter	ESS
posterior	10001
likelihood	10001
prior	8292
treeLikelihood	10001
TreeHeight	10001
CoalescentExponential	9435
ePopSize	7373
growthRate	9001

Table 13: ESSes for best candidate model, twin tree

Site model	Clock model	Tree prior	log(evidence)	log(evidence error)	Weight	ESS
GTR	RLN	BD	-8235.035	5.433	0.000	11.887
GTR	RLN	CBS	-8271.935	7.448	0.000	7.626
GTR	RLN	CCP	-8259.123	3.435	0.000	6.817
GTR	RLN	CEP	-8238.322	5.256	0.000	17.612
GTR	RLN	Yule	-8232.386	4.879	0.000	11.394
GTR	Strict	BD	-8231.421	5.137	0.000	9.668
GTR	Strict	CBS	-8261.153	5.013	0.000	4.658
GTR	Strict	CCP	-8271.502	4.061	0.000	5.271
GTR	Strict	CEP	-8241.062	5.682	0.000	10.707
GTR	Strict	Yule	-8231.957	4.612	0.000	10.747
HKY	RLN	BD	-8221.968	4.167	0.000	11.328
HKY	RLN	CBS	-8230.216	5.367	0.000	9.541
HKY	RLN	CCP	-8235.282	6.246	0.000	11.259
HKY	RLN	CEP	-8212.838	3.467	0.001	8.079
HKY	RLN	Yule	-8236.991	5.929	0.000	16.771
HKY	Strict	BD	-8223.998	4.301	0.000	5.545
HKY	Strict	CBS	-8233.453	5.909	0.000	7.773
HKY	Strict	CCP	-8223.015	3.910	0.000	7.640
HKY	Strict	CEP	-8229.849	5.352	0.000	6.352
HKY	Strict	Yule	-8233.376	5.065	0.000	12.079
JC	RLN	BD	-8215.680	2.857	0.000	4.816
JC	RLN	CBS	-8217.964	4.218	0.000	9.502
JC	RLN	CCP	-8225.709	4.323	0.000	8.683
JC	RLN	CEP	-8206.129	2.407	0.997	6.511
JC	RLN	Yule	-8218.450	3.768	0.000	9.006
JC	Strict	BD	-8215.596	3.058	0.000	8.061
JC	Strict	CBS	-8220.999	3.687	0.000	8.432
JC	Strict	CCP	-8219.782	4.004	0.000	5.627
JC	Strict	CEP	-8212.788	3.049	0.001	3.979
TN	RLN	BD	-8225.680	4.597	0.000	6.907
TN	RLN	CBS	-8239.148	5.453	0.000	13.417
TN	RLN	CCP	-8223.041	5.044	0.000	8.876
TN	RLN	CEP	-8227.377	5.407	0.000	9.157
TN	RLN	Yule	-8228.930	4.756	0.000	5.808
TN	Strict	BD	-8228.812	4.613	0.000	10.916
TN	Strict	CBS	-8224.680	3.871	0.000	14.049
TN	Strict	CCP	-8231.895	5.680	0.000	8.583
TN	Strict	CEP	-8227.486	4.776	0.000	10.844
TN	Strict	Yule	-8232.665	5.184	0.000	5.997

Table 14: Evidences for the true phylogeny

Site model	Clock model	Tree prior	log(evidence)	Weight
GTR	RLN	BD	-6458.436	0.000
GTR	RLN	CBS	-6454.284	0.000
GTR	RLN	CCP	-6473.343	0.000
GTR	RLN	CEP	-6461.819	0.000
GTR	RLN	Yule	-6481.186	0.000
GTR	Strict	BD	-6466.185	0.000
GTR	Strict	CBS	-6486.857	0.000
GTR	Strict	CCP	-6467.652	0.000
GTR	Strict	CEP	-6467.968	0.000
GTR	Strict	Yule	-6462.091	0.000
HKY	RLN	BD	-6460.686	0.000
HKY	RLN	CBS	-6450.405	0.000
HKY	RLN	CCP	-6450.016	0.000
HKY	RLN	CEP	-6444.019	0.000
HKY	RLN	Yule	-6446.606	0.000
HKY	Strict	BD	-6446.149	0.000
HKY	Strict	CBS	-6444.819	0.000
HKY	Strict	CCP	-6440.375	0.000
HKY	Strict	CEP	-6440.521	0.000
HKY	Strict	Yule	-6448.428	0.000
JC	RLN	BD	-6437.823	0.000
JC	RLN	CBS	-6440.057	0.000
JC	RLN	CCP	-6432.812	0.022
JC	RLN	CEP	-6436.226	0.001
JC	RLN	Yule	-6431.832	0.060
JC	Strict	BD	-6440.964	0.000
JC	Strict	CBS	-6443.359	0.000
JC	Strict	CCP	-6438.739	0.000
JC	Strict	CEP	-6429.101	0.917
TN	RLN	BD	-6450.450	0.000
TN	RLN	CBS	-6446.580	0.000
TN	RLN	CCP	-6457.123	0.000
TN	RLN	CEP	-6449.301	0.000
TN	RLN	Yule	-6438.561	0.000
TN	Strict	BD	-6460.984	0.000
TN	Strict	CBS	-6447.802	0.000
TN	Strict	CCP	-6451.071	0.000
TN	Strict	CEP	-6458.571	0.000
TN	Strict	Yule	-6447.318	0.000

Table 15: Evidences for twin phylogeny