

Supplementary Information

Spontaneous Mirror Symmetry Breaking in reaction-diffusion systems: Ambivalent role of the achiral precursor

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Standard deviation and significance of the mean values over several simulations

All graphs in the main text show values averaged over many simulations, but do not feature error bars. We discuss this choice in detail here.

Fig. S1 shows the evolution of the time required to reach global homochirality as a function of the average concentration of achiral reactant. Each point is obtained from a sample of five hundred simulations with error bars representing the standard deviation. We observe that the errors are significantly higher when low slope intensities are combined to high values of the average achiral reactant concentration ($a_{avg} > 85$). The standard deviation is significantly smaller when the slope increases.

To better visualize this, Fig. S2 reports the time distributions required to achieve homochirality for the same average achiral reactant concentration, but with two distinct values of the slope intensity p . It can be seen that the results are much more spread out in the case that the slope is very small ($p = 1\%$).

A parallel can be drawn with the observations made when constant profiles of the achiral reactant concentration were used. In some cases, the co-existence of homochiral domains could be observed, which we call local homochirality. This situation corresponds to an infinite time required to observe homochirality. When we introduce linear profiles of a with small slopes, the initial conditions that previously gave rise to stable coexisting domains will eventually lead to global homochirality, but on quite long time scales.

This observation explains why the time needed to reach global homochirality increases with a_{avg} . We showed in Fig. 3 that in the absence of gradient ($p = 0\%$), the probability of observing local homochirality increases with the concentration a . When gradients of a are introduced, this high probability results into a larger proportion of simulations requiring long times to reach homochirality. The results shown in Fig. 7(a) and Fig 9(a) in the manuscript are, thus, to be understood as trends for the average times. Individual realisations of the simulations can either lead to a monotonously decreasing time for homochirality (Fig S3(a)), or to a discontinuity arising from the appearance of local homochirality, as illustrated in Fig. S3 for two distinct initial conditions.

S1

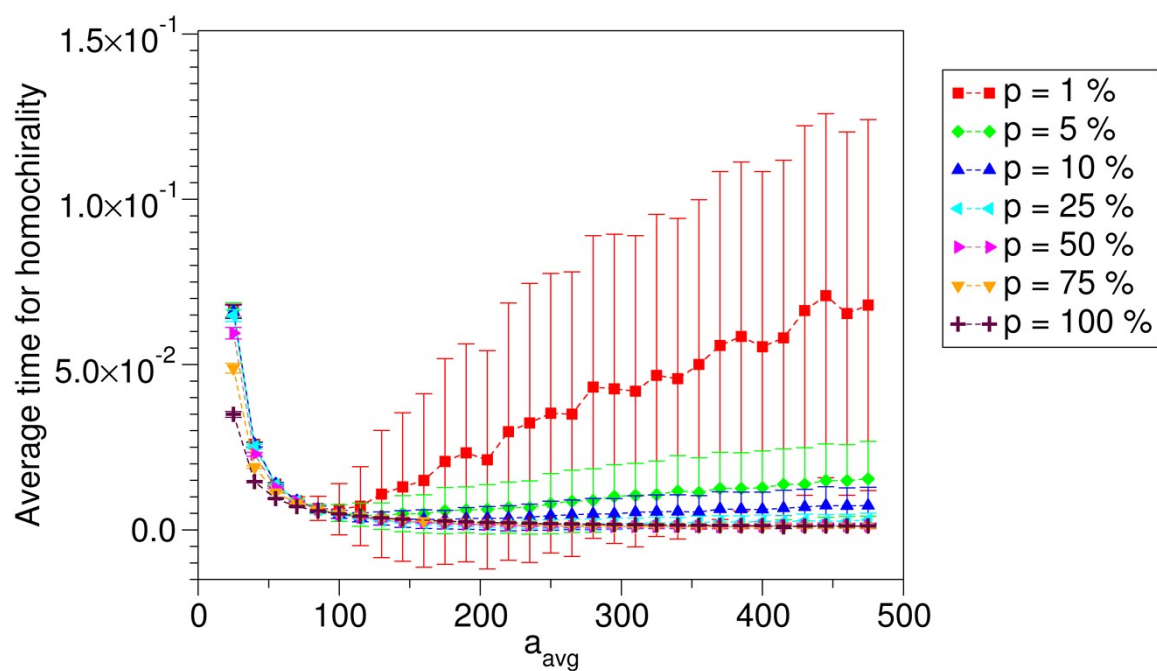


Figure S1 - Evolution of the time required to reach global homochirality as a function of the average concentration of achiral reactant. Each point is obtained from a sample of five hundred simulations. The error bars represent the standard deviation. The various colours are associated to the various slopes intensities according to the parameter p . Dashed lines are guides to the eye. Simulation parameters: $r_0^d = 1.0$, $s_0^d = 1.0$, $L = 0.1$.

S2

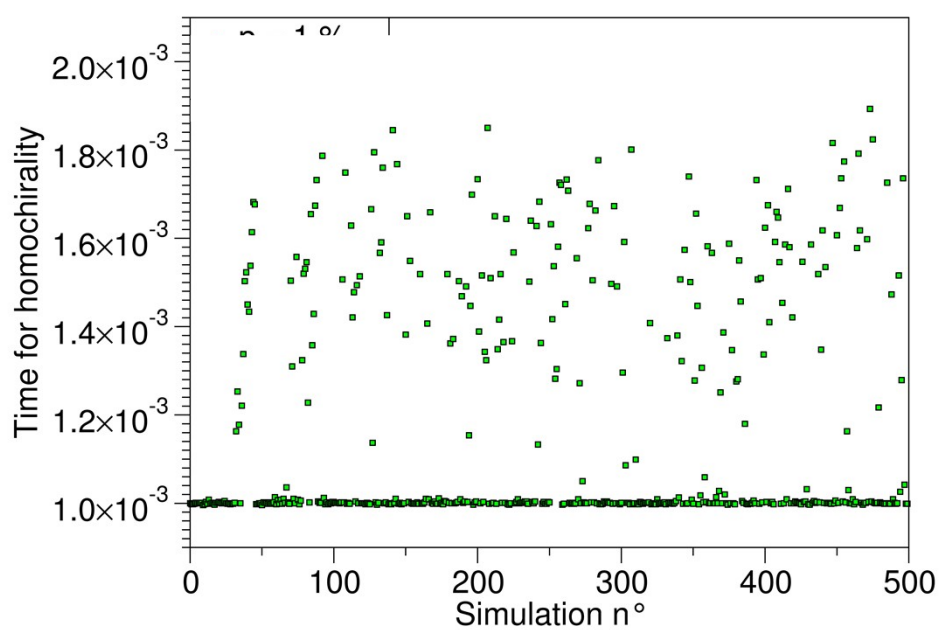
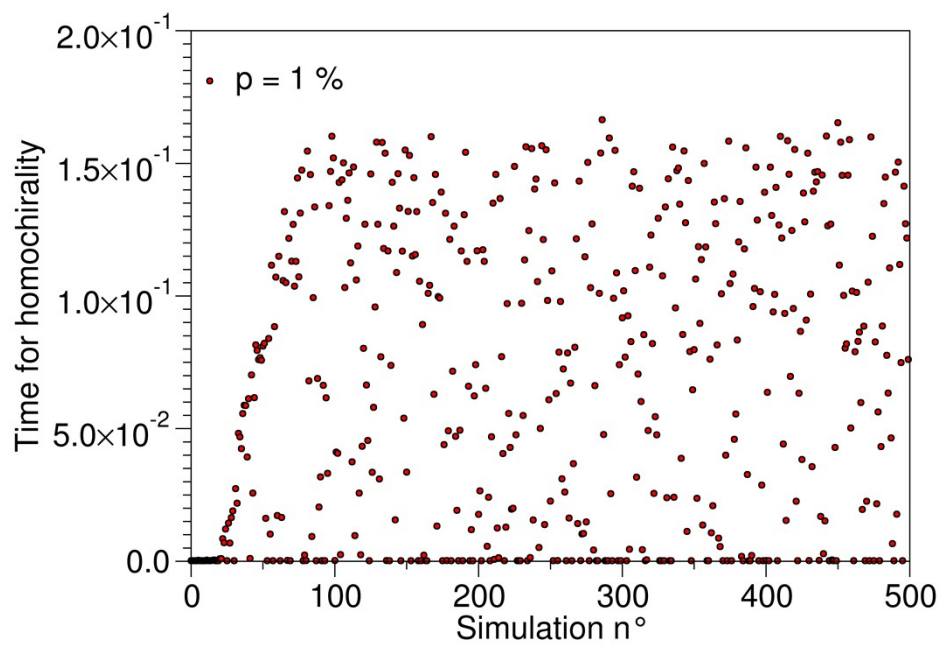
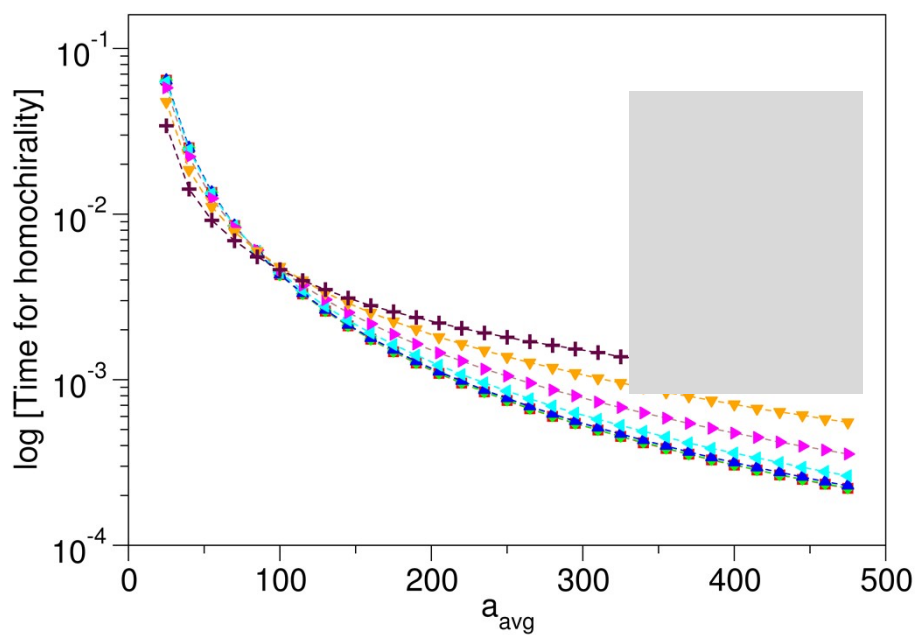
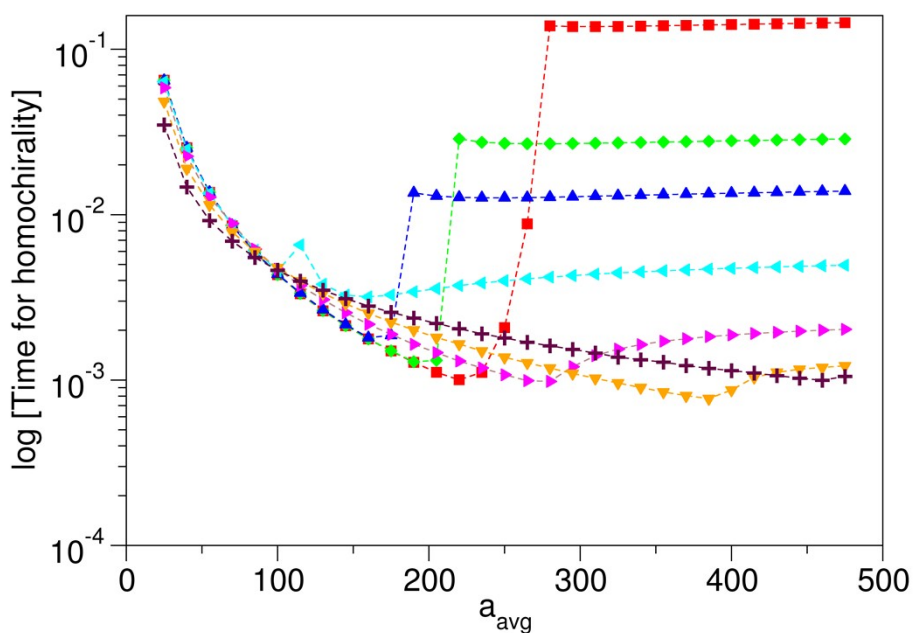


Figure S2 – Time required to reach global homochirality for five hundreds individual simulations using fluctuating initial conditions. Data were obtained using the same average achiral reactant concentration, $a_{avg} = 475$, but with two distinct slopes intensities according to the parameter p . Simulation parameters: $r_0^d = 1.0$, $s_0^d = 1.0$, $L = 0.1$.



(a)



(b)

Figure S3 - Evolution of the time required to reach global homochirality as a function of the average concentration of achiral reactant. Two distinct fluctuating initial conditions were isolated and used to perform the simulations. The results are respectively represented in (a) and (b). The various colours are associated to the various slopes intensities according to the parameter p . Dashed lines are guides to the eye. Simulation parameters: $r_0^d = 1.0$, $s_0^d = 1.0$, $L = 0.1$.