Optimal communication in a noisy and heterogeneous environment (supplementary material)

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Supplementary material for: Willem Zuidema (2003), Optimal communication in a noisy and heterogeneous environment, in: W. Banzhaf, T. Christaller, P. Dittrich, J. T. Kim and J. Ziegler (eds.), Advances in Artificial Life - Proceedings of the 7th European Conference on Artificial Life (ECAL), Lecture Notes in Artificial Intelligence, 2801, pp 553-563, Springer Verlag, Berlin.

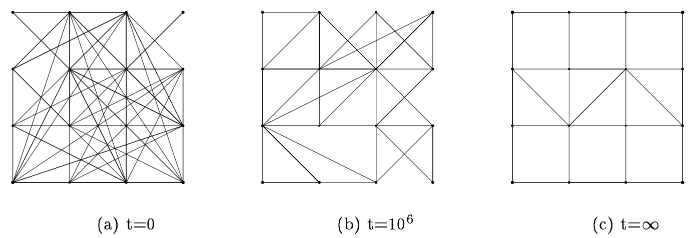
Distributed hillclimbing:
For g=0 to I do
  $i \leftarrow$ random integer, $0 < i < P$
  $j \leftarrow$ random integer, $0 < j < P$, $j \neq i$
  $m \leftarrow$ random integer, $0 < m < M$
  $f \leftarrow$ random integer, $0 < f < F$
  if g is even do
    $w \leftarrow$ quicksuccess-m(S^i, R^j, U, V, m)
    $f' \leftarrow S^i[m]$
    $S^i[m] \leftarrow f$
    $w' \leftarrow$ quicksuccess-m(S^i, R^j, U, V, m)
    if $w > w'$ do $S^i[m] \leftarrow f'$
  else do
    $w \leftarrow$ quicksuccess-f(S^j, R^i, U, V, f)
    $m' \leftarrow R^i[f]$
    $R^i[f] \leftarrow m$
    $w' \leftarrow$ quicksuccess-f(S^j, R^i, U, V, f)
    if $w > w'$ do $R^i[f] \leftarrow m'$

Spatially distr. hillclimbing:
For g=0 to I do
  $i \leftarrow$ random integer, $0 < i < P$
  $j \leftarrow$ random neighbour of i
  $x, y \leftarrow$ random element from $\{-1, 0, 1\}$,
  $j \leftarrow i - x\sqrt{P} + y$, $0 < j < P$, $j \neq i$
...

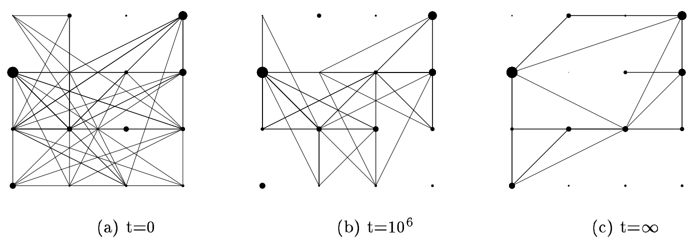
quicksuccess-m$(S, R, U, V, m) \leftarrow$
  $\sum_{f=0}^{F}$ V[m][R[f]] $\times$ U[S[m]][f]

quicksuccess-f$(S, R, U, V, f) \leftarrow$
  $\sum_{m=0}^{M}$ V[m][R[f]] $\times$ U[S[m]][f]

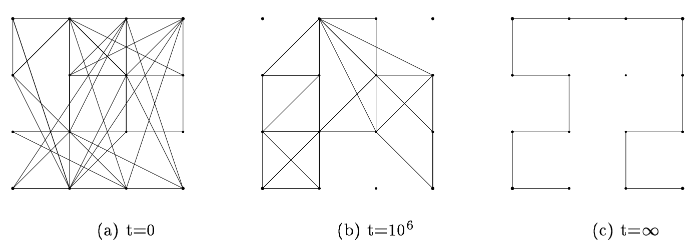
Fig. 1. The distributed and spatially distributed hillclimbing algorithms



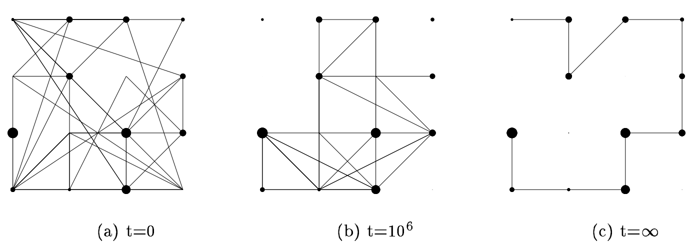
(a) U:2d, V:2d ho.



(b) U:2d, V:2d he.



(c) U:1d, V:2d ho.



(d) U:1d, V:2d he.

Fig. 2. Topology preservation at equilibrium in 4 simulations with 1d and 2d **U** matrices, and homogeneous and heterogeneous 2d **V** matrices. Shown are results at initialization (left column), intermediate time (middel column) and at equilibrium (right column). Nodes are meanings (diameters correspond to value), edges connect neighbors in signal space (several signals can map to a single meaning, such that nodes can have many neighbors; some meanings are not expressed, and the corresponding nodes are not connected). Common parameters are P=400, M=16, F=49.