

A Signal-Centric Perspective on the Evolution of Symbolic Communication (Supplementary Material)

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CONSTELLATIONS FOR THE SIGNALING SYSTEMS EVOLVED AT VARIOUS LEVELS OF NOISE

In Figures 2-8 we show the constellations of signals of the best signaling systems evolved in each of the 20 evolutionary runs in a subset of the experiments with noise reported in Section 5.3 of the main text, namely: regression and classification settings, with unlimited amplitude, 3 trials per concept, and Gaussian noise $\mathcal{N} \sim (0, \sigma^2)$, with $\sigma = 0.1$, $\sigma = 0.2$, $\sigma = 0.5$ and $\sigma = 1$.

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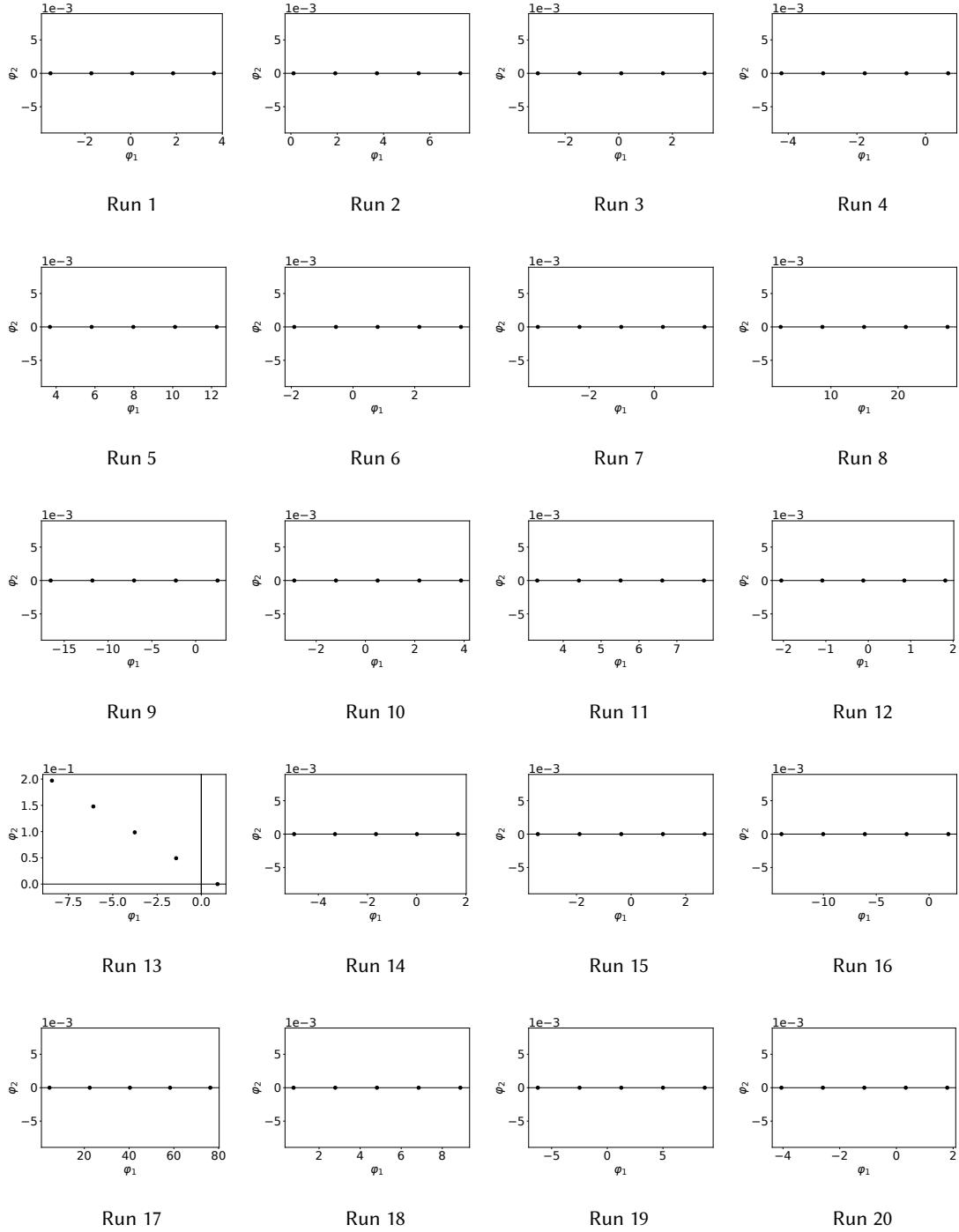


Fig. 1. Constellation of signals of the best signaling systems evolved in the regression setting, unlimited amplitude, 3 trials, $\sigma = 0.1$.

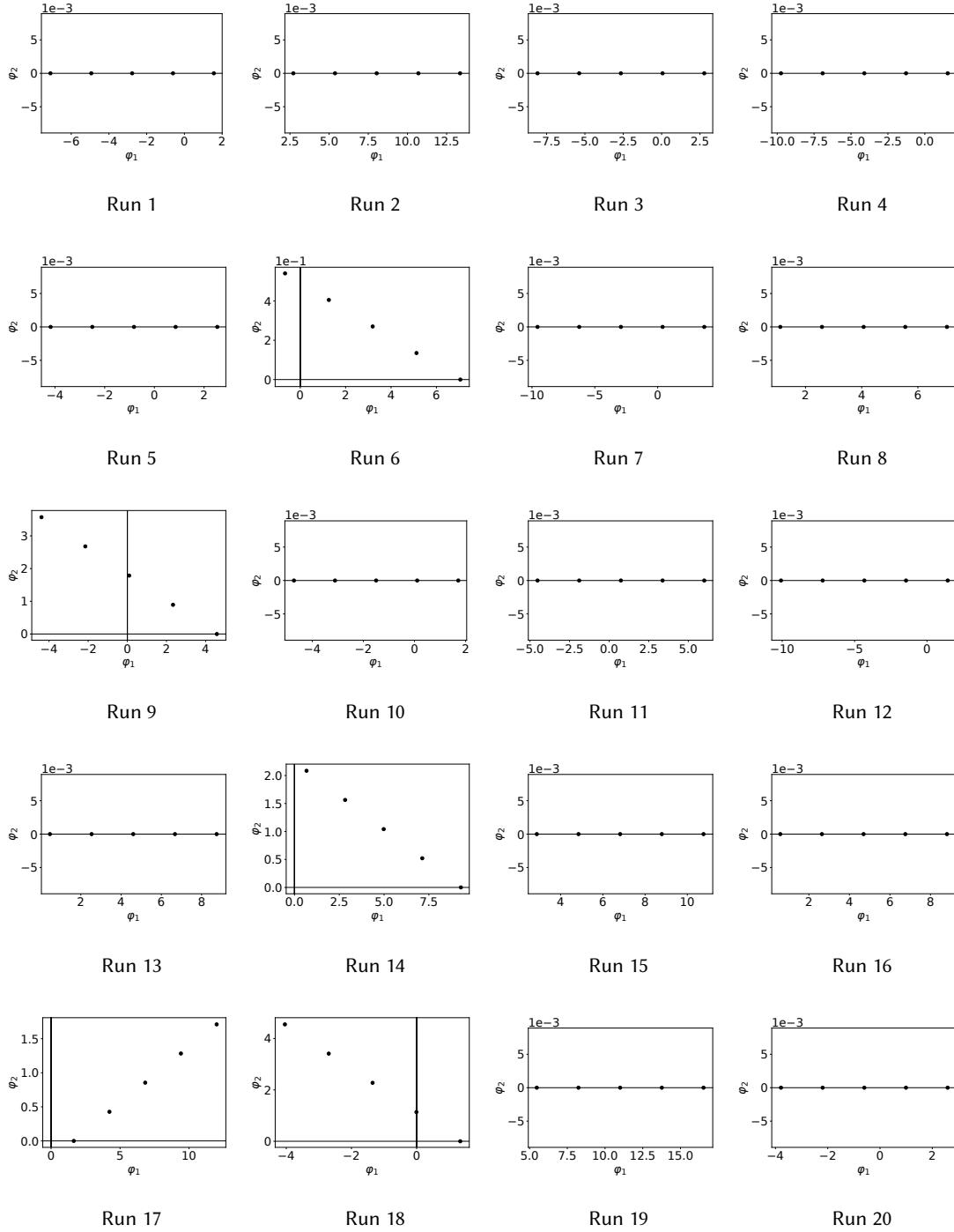


Fig. 2. Constellation of signals of the best signaling systems evolved in the regression setting, unlimited amplitude, 3 trials, $\sigma = 0.2$.

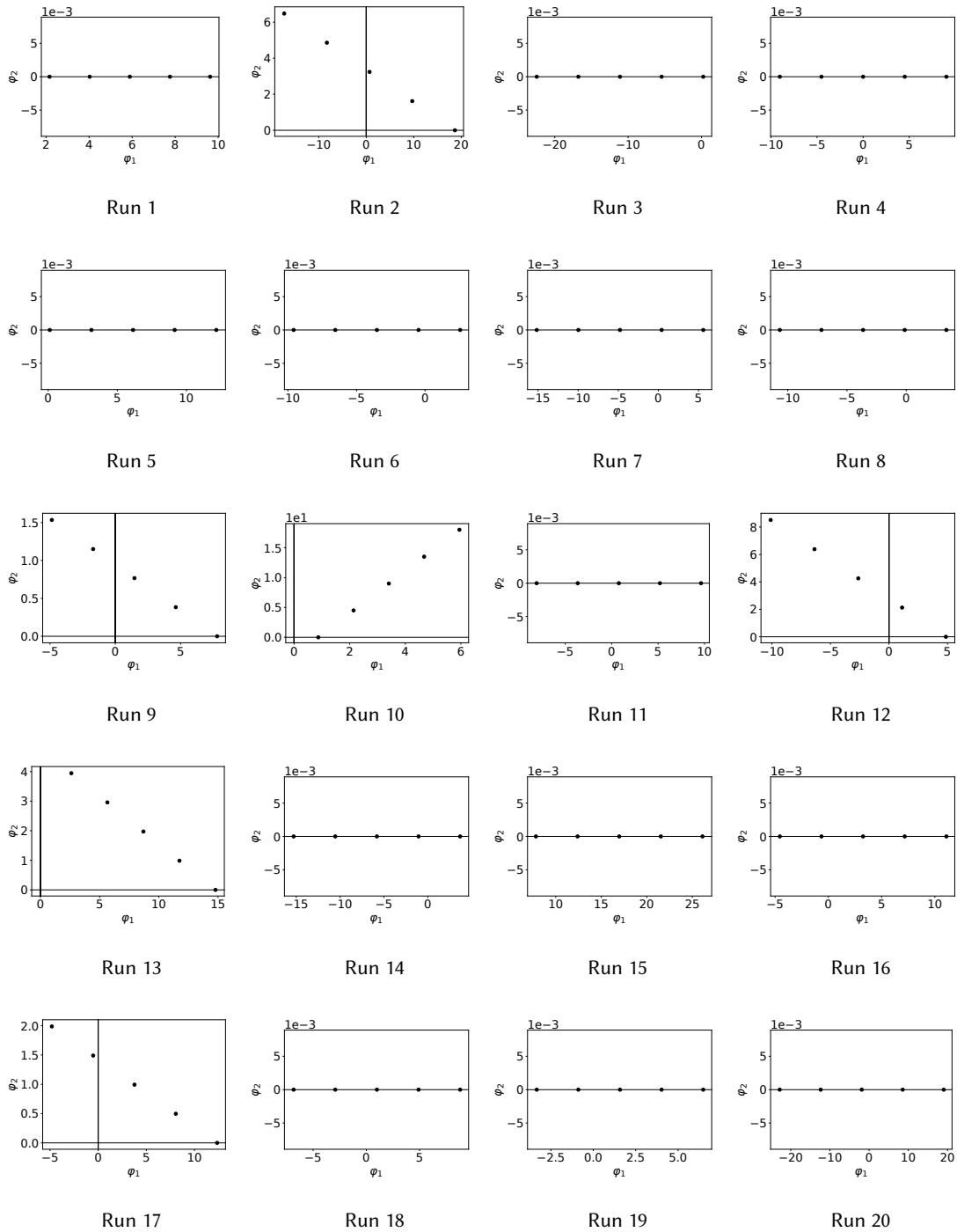


Fig. 3. Constellation of signals of the best signaling systems evolved in the regression setting, unlimited amplitude, 3 trials, $\sigma = 0.5$.

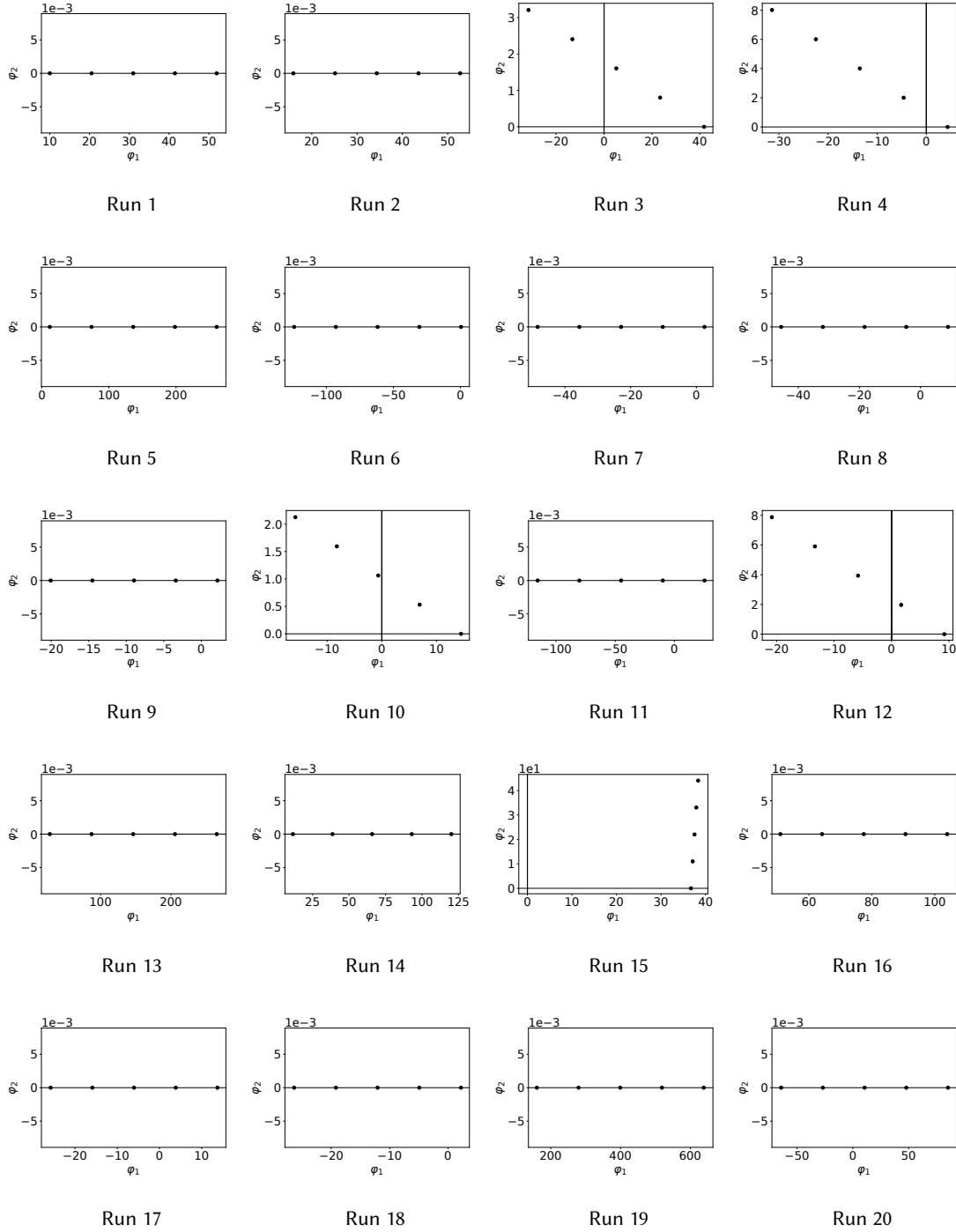


Fig. 4. Constellation of signals of the best signaling systems evolved in the regression setting, unlimited amplitude, 3 trials, $\sigma = 1$.

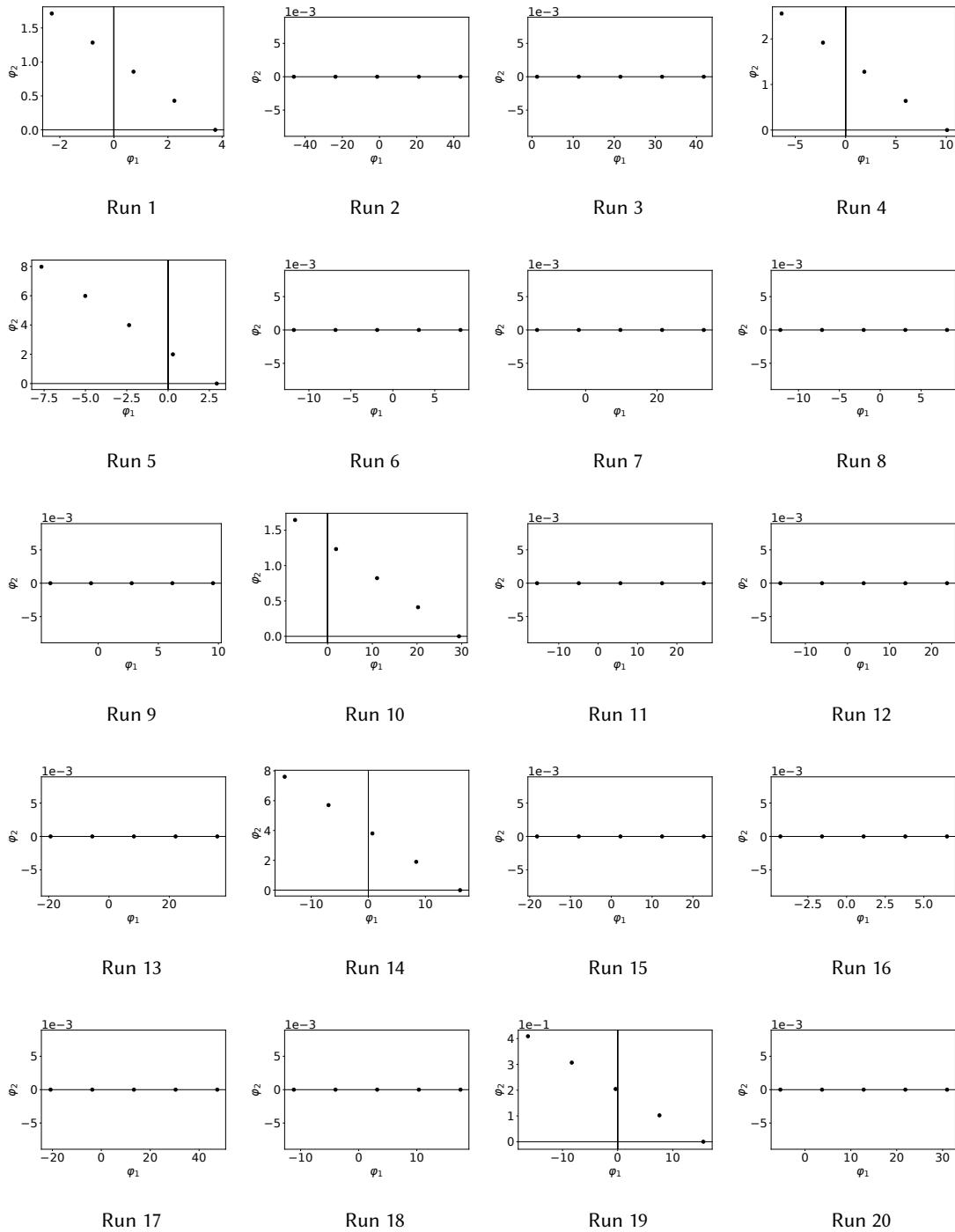


Fig. 5. Constellation of signals of the best signaling systems evolved in the classification setting, unlimited amplitude, 3 trials, $\sigma = 0.1$.

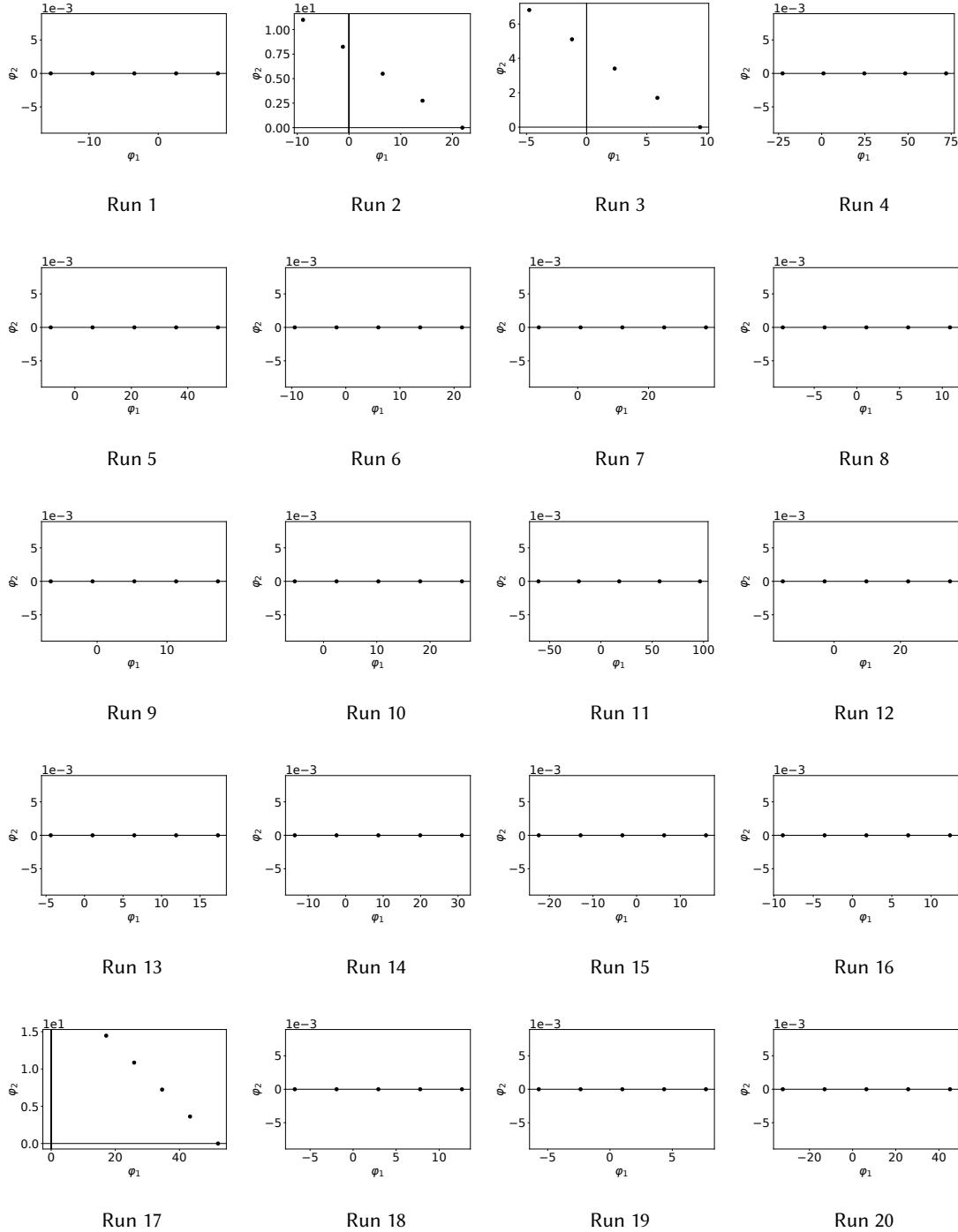


Fig. 6. Constellation of signals of the best signaling systems evolved in the classification setting, unlimited amplitude, 3 trials, $\sigma = 0.2$.

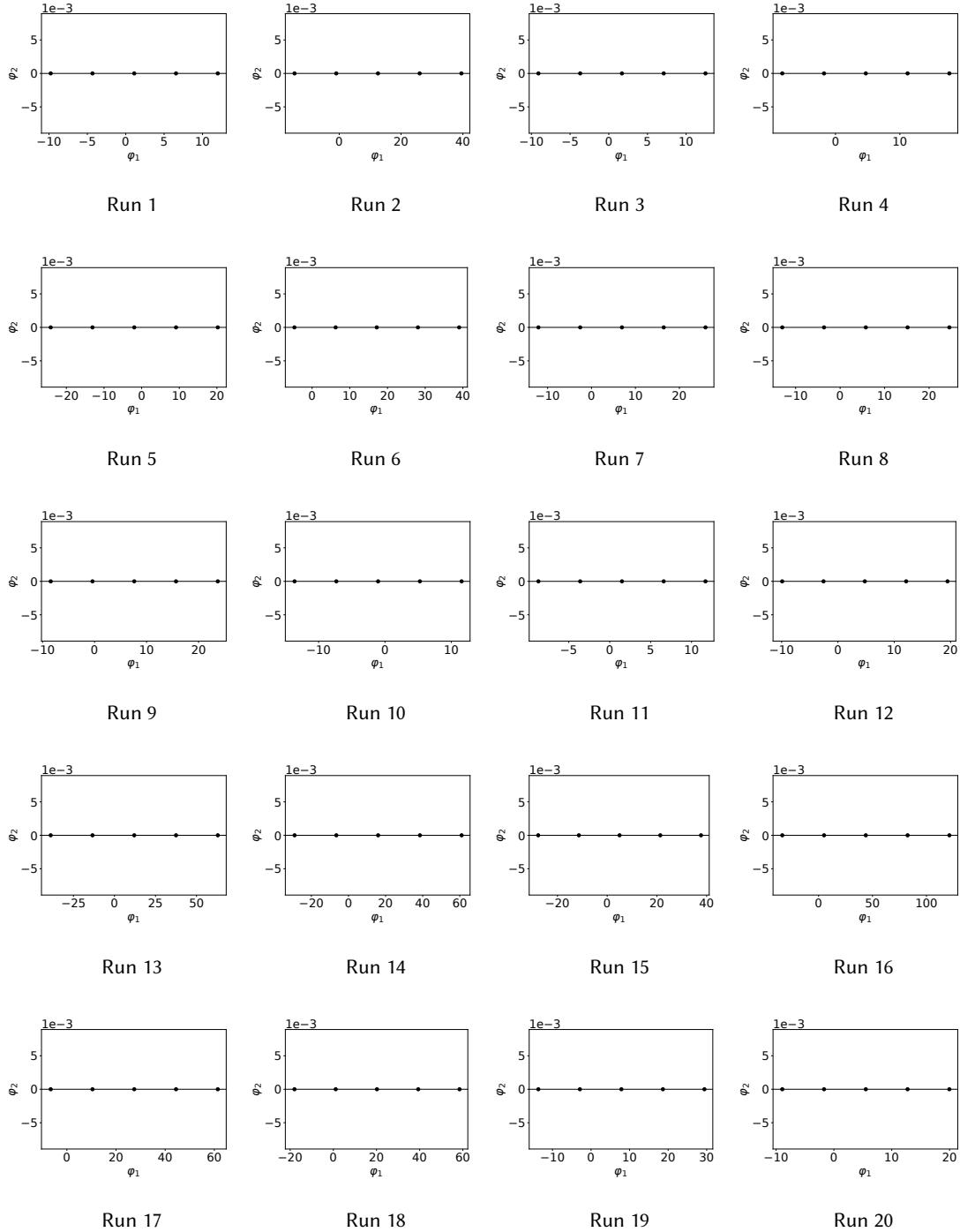


Fig. 7. Constellation of signals of the best signaling systems evolved in the classification setting, unlimited amplitude, 3 trials, $\sigma = 0.5$.

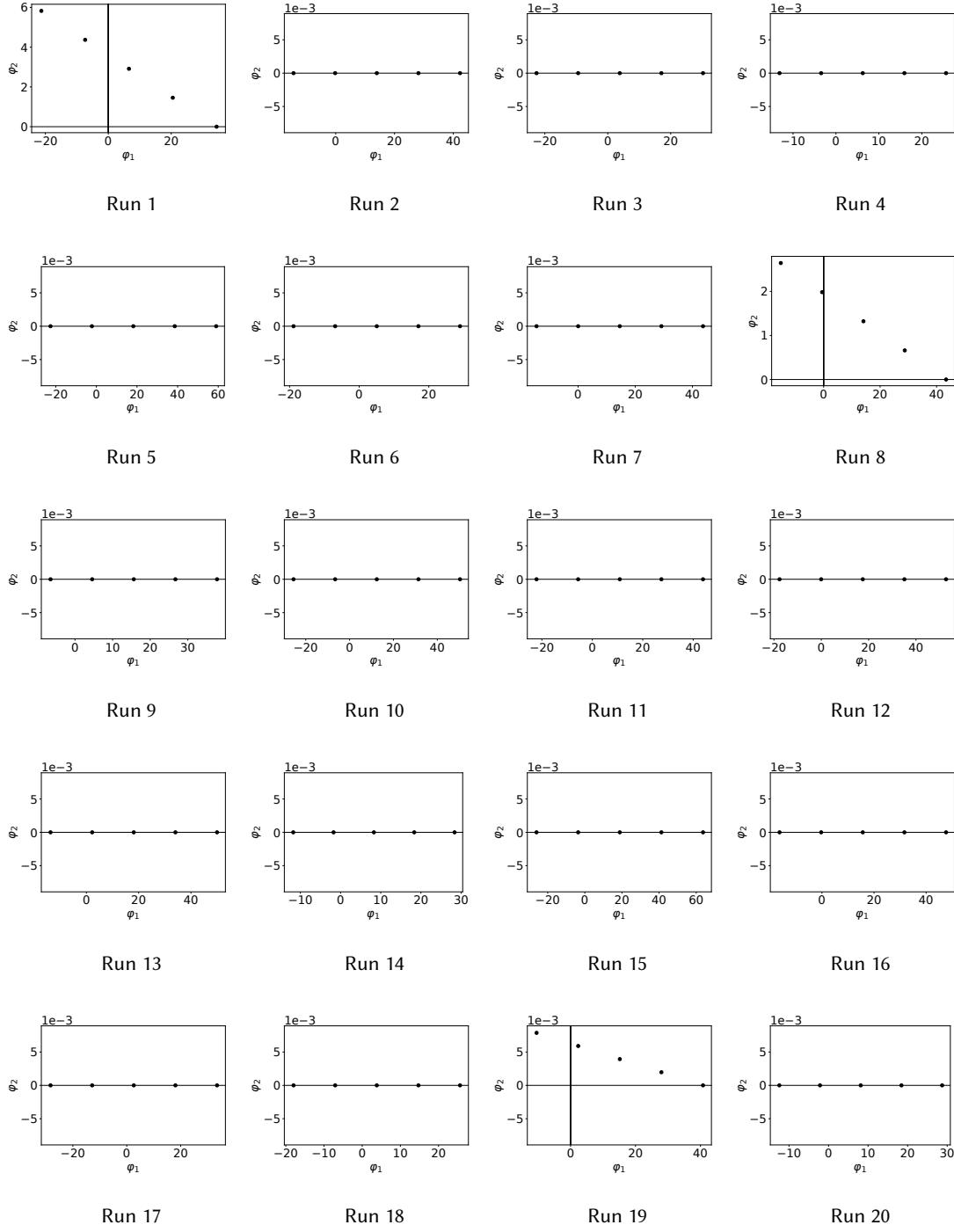


Fig. 8. Constellation of signals of the best signaling systems evolved in the classification setting, unlimited amplitude, 3 trials, $\sigma = 1$.

EXAMPLES OF EVOLVED SENDER/RECEIVER NETWORKS

In Figures 9-10 we show some examples of the networks evolved in the regression and classification settings, respectively, with both unlimited and limited amplitude, 3 trials per concept, and Gaussian noise $\mathcal{N} \sim (0, \sigma^2)$, with $\sigma = 0.1$.

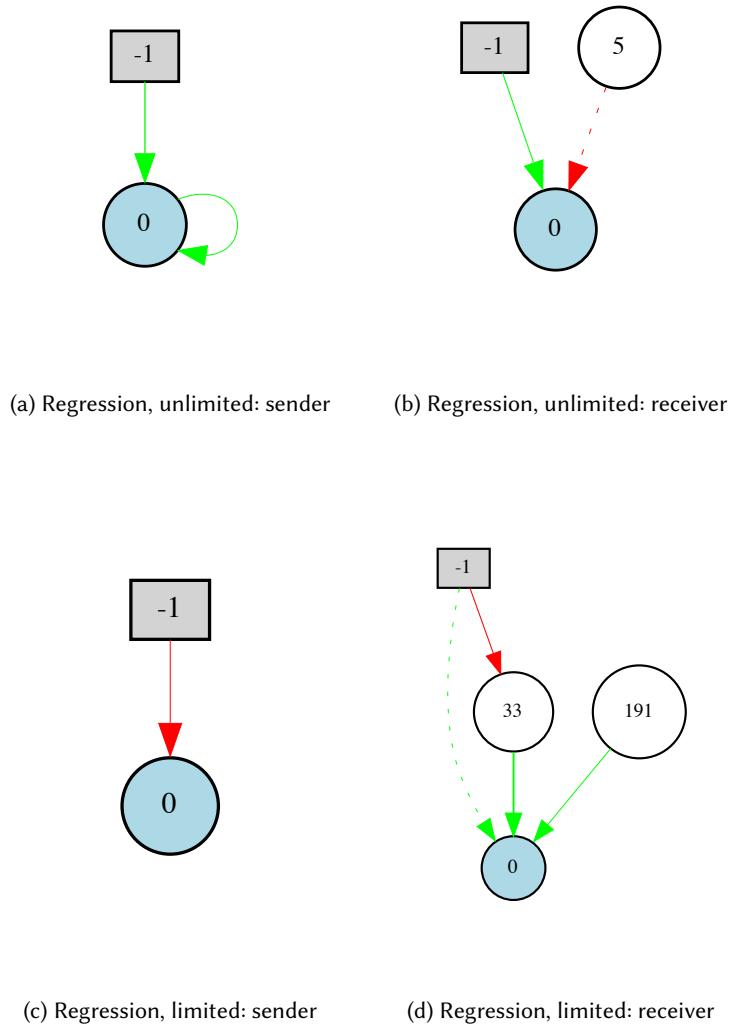


Fig. 9. Examples of the networks evolved in the regression settings, 3 trials, $\sigma = 0.1$.

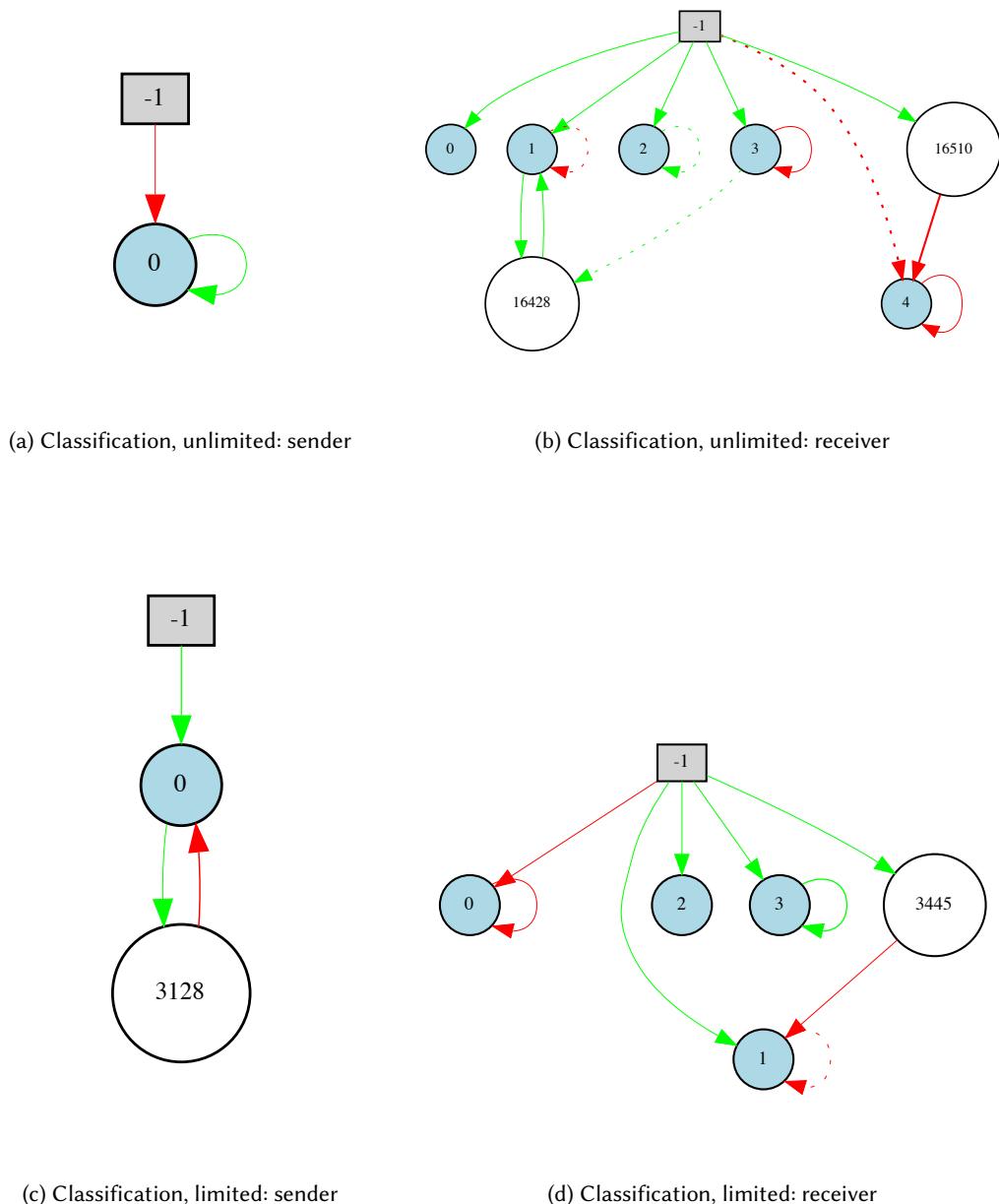


Fig. 10. Examples of the networks evolved in the classification settings, 3 trials, $\sigma = 0.1$.