Search processes guided by objectives are ubiquitous in machine learning. They typically reward the artifacts of search based on their proximity to an a priori target, and terminate upon solution space convergence. Some recent studies take a vastly different approach, capitalizing on the disconnect between mainstream methods in artificial intelligence and the field's original, biological inspirations. In particular, natural evolution has an unparalleled propensity for generating well-adapted artifacts, but these artifacts are decidedly non-convergent. This new class of non-objective algorithms induce a divergent search dynamic by rewarding solutions according to their novelty with respect to prior discoveries. However, nature, the benchmark for creative discovery, has no need to characterize and enforce novelty; rather, it is guided by a simple constraint: survive long enough to reproduce.

The premise of this study is that such a constraint, called the minimal criterion, can be harnessed in a coevolutionary context where two populations interact and find novel ways to satisfy their reproductive constraint with respect to each other. This approach, called minimal criterion coevolution (MCC), is first demonstrated in a maze domain where mazes of unbounded size and complexity along with effective solutions are evolved in a single run, validating the method's propensity for open-ended discovery. A more natural method of diversity preservation through resource limitation is then introduced and shown to maintain population diversity without explicitly comparing genetic distance. Finally, the method is demonstrated in an evolutionary robotics domain where it coevolves increasingly complex bodies with brains to effect locomotion. The benefit of these contributions is a framework for producing open-ended dynamics in a general context and without the need to characterize behavioral novelty.

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The public is welcome to attend.