

## TITLE: Adjusting the Novelty Thermostat: Courting Creative Success Through Judicious Randomness

Though most researchers' definitions of creativity include both novelty and appropriateness, novelty is often spoken of as the more crucial factor. However, novelty is not an end in itself. Rather, it is something that must be judiciously managed in order to strike a balance between stagnation and disorder. This paper analyzes novelty and creativity by comparing systems of human creators to populations of agents optimizing over a fitness landscape. In this model, the novelty of a solution is its distance from other known points on the landscape, and the appropriateness of a solution is the goodness of that point. Each agent engages in a trajectory search, with the decision to accept or reject new solutions based on some function of novelty (distance) and appropriateness (goodness).

Two principal conclusions arise from this model. First, the statement that creative solutions are both novel and appropriate is partially redundant. This is because a population of agents will easily find new solutions that are nearby other known solutions. This enables the system to quickly converge to a local optimum, which becomes the standard against which competing solutions are judged. While discovering these low-hanging fruit is not seen as exceptionally creative, finding a significantly better solution is. This exceptional solution will necessarily be far from others. However, it is the higher goodness that makes it noteworthy. Indeed, other solutions that are equivalently distant from the standard are highly unlikely to have an acceptable level of goodness. Thus, while exceptionally creative solutions are perforce distant (novel), it is their goodness (appropriateness) that distinguishes them.

This leads to the second conclusion, which is that novelty only plays an independent role in creativity judgments when a new contribution fails to exceed the goodness of known contributions. When creators, managers, funding agencies, and others decide to pursue an idea that differs from prior solutions in structure or approach without making a significant improvement in the outcome, they help the search's attempts to escape local optima. In this way, the extent that novelty is rewarded for its own sake is analogous to the "temperature" parameter in simulated annealing, as well as parameters that balance diversification and intensification in other metaheuristics.

Results are presented from a metaheuristic optimizer that accepts or rejects new points based on a combination of the goodness of the point and its distance from other points, i.e., novelty. By adjusting the weight of distance/novelty in this formula, the algorithm exhibits similar dynamics to simulated annealing, particularly in the importance of the adjustment schedule. This parallel suggests that rather than viewing novelty as the defining characteristic of creative solutions, it should be viewed as an enabler of creative progress, though one that only works when properly managed.

This work contributes clarity to often-unchallenged assumptions about what differentiates creative and conventional ideas. It likewise challenges the common belief that the best way to be creative is to be different. Finally, this work illustrates how managers, funding agencies, and others who decide what kinds of research and development to support can tune the results they get by choosing how much novelty to reward at what time.

**KEYWORDS:** Novelty, Metaheuristics, Encouraging Creativity