

Preamble to PhD thesis:
The Ant, the Grasshopper and Complexity

Sam Johnson

Once upon a time, in a charming and peaceful little valley, a grasshopper sat under the shade of a sunflower, idly strumming up a tune, when a young worker ant came into view. The grasshopper watched as she trundled her way laboriously up an incline under the weight of a large piece of leaf. When she was close enough, he hailed her:

‘Ahoy there, friend. I hope I won’t seem tactless if I point out what a singularly cumbersome bit of leaf you have there. Would you not rather put it down for a while and join me for a quick jam session? You could bang along on some twigs or something.’

‘Thank you for the offer, but I must continue on my way,’ replied the ant, glancing up in slight surprise at being thus addressed.

‘Oh, what a pity,’ the grasshopper rejoined. ‘And where, if I may be so bold as to inquire, would you be taking your rather unappetising ration of cellulose?’

‘Well, I can’t say I really know... I just follow this trail of pheromones I’ve come across. I’m sure it’s for some noble purpose though.’

‘Ah, that must be reassuring. And I suppose when you get to wherever it is you don’t know you’re going you intend to eat your bit of leaf...’

‘Oh no, I can’t digest something like this – who do you take me for?’

‘You can’t? Well, how strange...’

‘What’s strange?’

‘However did an animal evolve which, instead of engaging in biologically reasonable (not to mention enjoyable) activities, such as playing music to attract sexual partners, prefers to lug useless bits of leaf about? How on earth can that serve to spread your genes?’

‘I’m not interested in music or sex, whatever those are. I just follow simple rules, like all my identical sisters. You could say we’re automata.’

‘Thanks, I was going to but wasn’t sure whether you’d be offended. Well, let me wish you an agreeable day of toil, you frigid little automaton.’

With that, the grasshopper gave a big leap into the air, slightly exasperated by the folly so often displayed by his fellow insects. Looking down, he spotted a few more ants, all carrying leaves in the same direction as the one he had just met. Intrigued, he fluttered slightly higher (since grasshoppers can, actually, fly, if not all that well). He realised the ants were all heading for a nest some way off. In fact, there were many ant trails leading to various sources of food. It dawned on the grasshopper that although the individual ants were just boring little morons idiotically following rules, the nest as a whole was managing to find the closest leaves, bring them back along optimal routes, and feed them to its plantations of fungi. The colony was behaving like an intelligent organism, in some respects not so different from he himself, who functioned thanks to the cells of his body – each with the same genome, like the ants – cooperating through the obedience to relatively simple rules.

This thought impressed the grasshopper very much, driving him to flutter even higher so as to see things in greater perspective. From there he considered the apparently fragile web of trophic, parasitical and symbiotic interactions linking all the living beings in the valley – a network which nonetheless must have evolved a particularly robust structure not to shatter at the first environmental fluctuation. He became so enthralled by the idea of such complexity on one scale emerging from simplicity on another that he didn't even pay any attention to an attractive young grasshopperess making her wanton way just below him. Instead, he couldn't help fearing that a butterfly he noticed gently flapping his wings would probably set off a hurricane somewhere. As he flew ever higher, he began to see snowflakes glide by, overwhelmingly intricate and beautiful patterns self-organised out of the simplest little water molecules. Finally he was so high that he began to reflect on how the very stellar systems, galaxies, clusters, superclusters, filaments of galaxies... – of which his whole world was but an infinitesimal component – also interacted with each other via the simple rules of gravity and pressure to form objects marvellous beyond conception.

What he didn't notice until it was too late, as he left behind the cosy protection of the atmosphere, was how ultraviolet sunlight and ionising cosmic rays were steadily burning his wings each to a crisp. Beginning to fall, he only hoped he would have time to consider the several morals to his tragic tale. But after a while spent plummeting to his doom he realised that, the freefall terminal velocity and life expectancy of a grasshopper being what they respectively were, he would most likely die peacefully of old age somewhere along his way down – never again contemplating his Edenic valley except, like some prophetic locust, from afar.