

## **Identity**

- 1) **An individual spider web  
identifies a species:**

**an order of instinct prevails  
through all accidents of circumstance,  
though possibility is  
high along the peripheries of  
spider**

**webs:  
you can go all  
around the fringing attachments**

**and find  
disorder ripe,  
entropy rich, high levels of random,  
numerous occasions of accident:**

- 2) **the possible settings  
of a web are infinite:**

**how does  
the spider keep  
identity  
while creating the web  
in a particular place?**

**it is  
wonderful  
how things work: I will tell you  
about it  
because**

it is interesting  
and because whatever is  
moves in weeds  
and stars and spider webs  
and known

is loved:  
in that love,  
each of us knowing it,  
I love you,

for it moves within and beyond us,  
sizzles in  
winter grasses, darts and hangs with bumblebees  
by summer windowsills:

I will show you  
the underlying that takes no image to itself,  
cannot be shown or said,  
but weaves in and out of moons and bladderweeds,  
is all and  
beyond destruction  
because created fully in no particular form:

if the web were perfectly pre-set,  
the spider could  
never find  
a perfect place to set it in: and

if the web were  
perfectly adaptable  
if freedom and possibility were without limit,  
the web would  
lose its special identity:

**the row-strung garden web  
keeps order at the center  
where space is freest (interesting that the freest  
“medium” should  
accept the firmest order)**

**and that  
order**

**diminishes toward the  
periphery  
allowing at the points of contact  
entropy equal to entropy.**

A. R. Ammons, in *The Selected Poems, Expanded Edition*, New York: Norton, 1986, p 27-29.

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*Order and Accident*  
Gale Rhodes

The center of a web is the signature of the spider's species, and web after web, the spider recreates its characteristic pattern. But the narrator in Ammons's poem notes that, at the web's boundaries, the spider must connect it to the surroundings. For this reason, the setting of the web determines its nature near and at its periphery. The narrator expresses this trend by use of the thermodynamic term *entropy*, a measure of disorder.

The scientist speaks of the entropy of *systems*. A system is simply a part of the world that we choose to isolate and study – say, a cornfield, or a flask containing water and some dissolved chemicals. We say that the entropy of a system is high if the system is disordered, that is, if we can see no pattern in the arrangement of its parts. If the parts are neatly arranged in a simple pattern, the entropy is low. To return to the example in the poem, the entropy of the web is lowest – the web is most ordered – at the center, where it makes a simple spiral, but entropy rises away from the center. At the points of suspension, the spider maps the web onto its surroundings, and the web's entropy is equal to the entropy of the leaf tips, house

eaves, twigs, or utility wires to which the web is attached, in what appear to be "... numerous occasions of accident."

This same trend is apparent in protein identity. Homologous proteins (families of proteins, such as cytochrome c and hemoglobin, that serve the same functions in many different organisms) share the same important residues at their active or functional centers. Moving outward to parts of the protein that simply give it structural integrity or solubility, we find more variation among family members. In the core of the protein, even the substitution of one aromatic side chain for another might disrupt the structure, and thus most internal mutations are not accepted. On the other hand, for many surface residues of water-soluble proteins, which need only allow interaction with randomly moving water molecules that make up the surroundings, almost any polar side chain is acceptable. A diagram of conserved amino acids in homologous proteins shows us which parts that are critical, where the organism can accept no occasions of accident. In this view, the center of the spider web is not so much a mark of identity as an evolutionarily conserved active site, in which most mutations damage the web's effectiveness, and are not successful.

There is a subtle and interesting connection between entropy and description. An ordered, low-entropy system is easy to describe: "The corn is planted at intervals of 2 feet in rows three feet apart." This description might tell us precisely the locations of thousands of cornstalks. But if the corn is planted at random, a high-entropy system, and we want the same precise description of the whereabouts of every stalk, we must describe each and every location, requiring far more words. In like manner, it takes many words to describe the web's points of contact: "One suspending line is connected to the left end of the fluorescent light above the sink. Another runs to the right window frame 2.4 feet above the sill. The third drops from the left center of the web to the top of a small pestle that sits in a mortar on the sill. The three main supporting strands meet to form a triangle with the following sides and angles: ... ." But we can describe the heart of the web succinctly: "It's a garden cross spider web, 5.5 inches in diameter." A short description means low entropy. Think about it: you need 40 Ramachandran angles to describe the conformation of 20 residues of polypeptide in high-entropy random coil, but you can describe any length of low-entropy alpha helix with only two angles.

Returning to the poem, notice that when the narrator generalizes beyond the specific example of the web, the tone and language of the poem become more mysterious. What is "the *underlying* that takes no image to itself" and that is "created fully in no particular form"? How is it made manifest in spider webs and moons

and bladderweeds, and in those ubiquitous nucleotide-binding domains of proteins, for that matter?

The narrator finds it interesting that order (low entropy) prevails at the center, in the midst of the air where the spider could do anything she wishes. In the heart of the web, she is not constrained by having to make connections, yet she slavishly, precisely stamps her identity in the web's active site, its crucial functional center. On the other hand, she must make the entropy of her web rise smoothly toward its boundaries, until the contacts match the disorder of the surroundings. Can you apply this view of the spider's identity, and protein identity, to *human* identity, and more specifically, to the love expressed by the narrator?