

Computational Creativity : Constraints, Chunking, and Temperature

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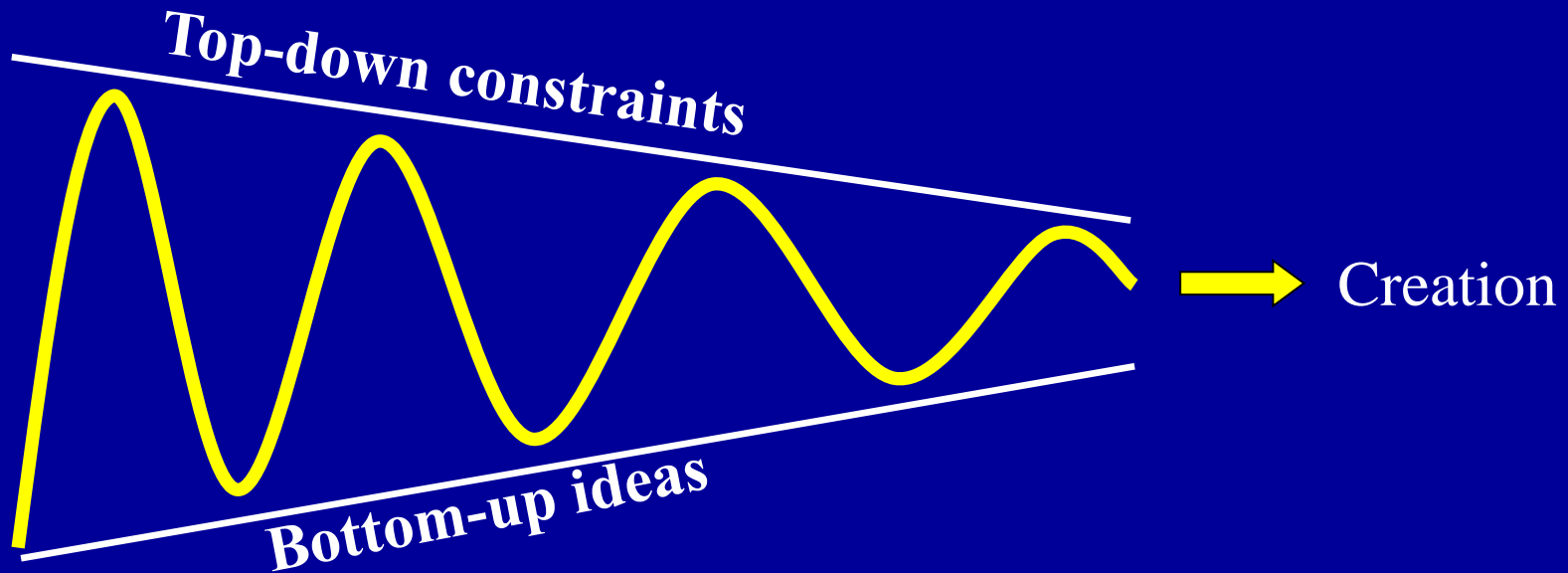
U. de Bourgogne, Dijon, France

Constraints, Chunking and Temperature

Computational Creativity requires:

- I. A continual interaction between **bottom-up ideas** and **top-down constraints**.
- II. Chunking of information.
- III. A temperature function.

I. Creativity requires a continual interaction between **bottom-up ideas** and **top-down constraints**.



II. Creativity requires chunking

Consider the following anagram:

A T I Y R I V C T E

Top-Down Constraint:

The word is not “CREATIVITY”

III. Creativity requires temperature

Key intuition:

I have some choices, each with a value, and I have to pick one. Depending on how sure I am of the values, I will put more or less faith in them when making my decision. Temperature is a measure of how sure we are of our choice.

Not sure at all: randomly pick one of the choices

...

...

Very sure of the values: always pick the highest value..

Computational Temperature

You have R possible choices with a priori values of V_1, V_2, \dots, V_R

P_i is the probability of selection choice i

T is the computational temperature.

$$P_i = \frac{(V_i)^{\frac{1}{T}}}{\sum_{j=1}^R (V_j)^{\frac{1}{T}}}$$

Temperature and Choice

Three choices with values: $F_1=2$, $F_2=3$, $F_3=5$

$$T = 4$$

$$\Pr(F_1) = \frac{2^{\frac{1}{4}}}{2^{\frac{1}{4}} + 3^{\frac{1}{4}} + 5^{\frac{1}{4}}} = 0.30$$

$$\Pr(F_2) = \frac{3^{\frac{1}{4}}}{2^{\frac{1}{4}} + 3^{\frac{1}{4}} + 5^{\frac{1}{4}}} = 0.33$$

$$\Pr(F_3) = \frac{5^{\frac{1}{4}}}{2^{\frac{1}{4}} + 3^{\frac{1}{4}} + 5^{\frac{1}{4}}} = 0.37$$

$$T = 2$$

$$\Pr(F_1) = \frac{2^{\frac{1}{2}}}{2^{\frac{1}{2}} + 3^{\frac{1}{2}} + 5^{\frac{1}{2}}} = 0.26$$

$$\Pr(F_2) = \frac{3^{\frac{1}{2}}}{2^{\frac{1}{2}} + 3^{\frac{1}{2}} + 5^{\frac{1}{2}}} = 0.32$$

$$\Pr(F_3) = \frac{5^{\frac{1}{2}}}{2^{\frac{1}{2}} + 3^{\frac{1}{2}} + 5^{\frac{1}{2}}} = 0.42$$

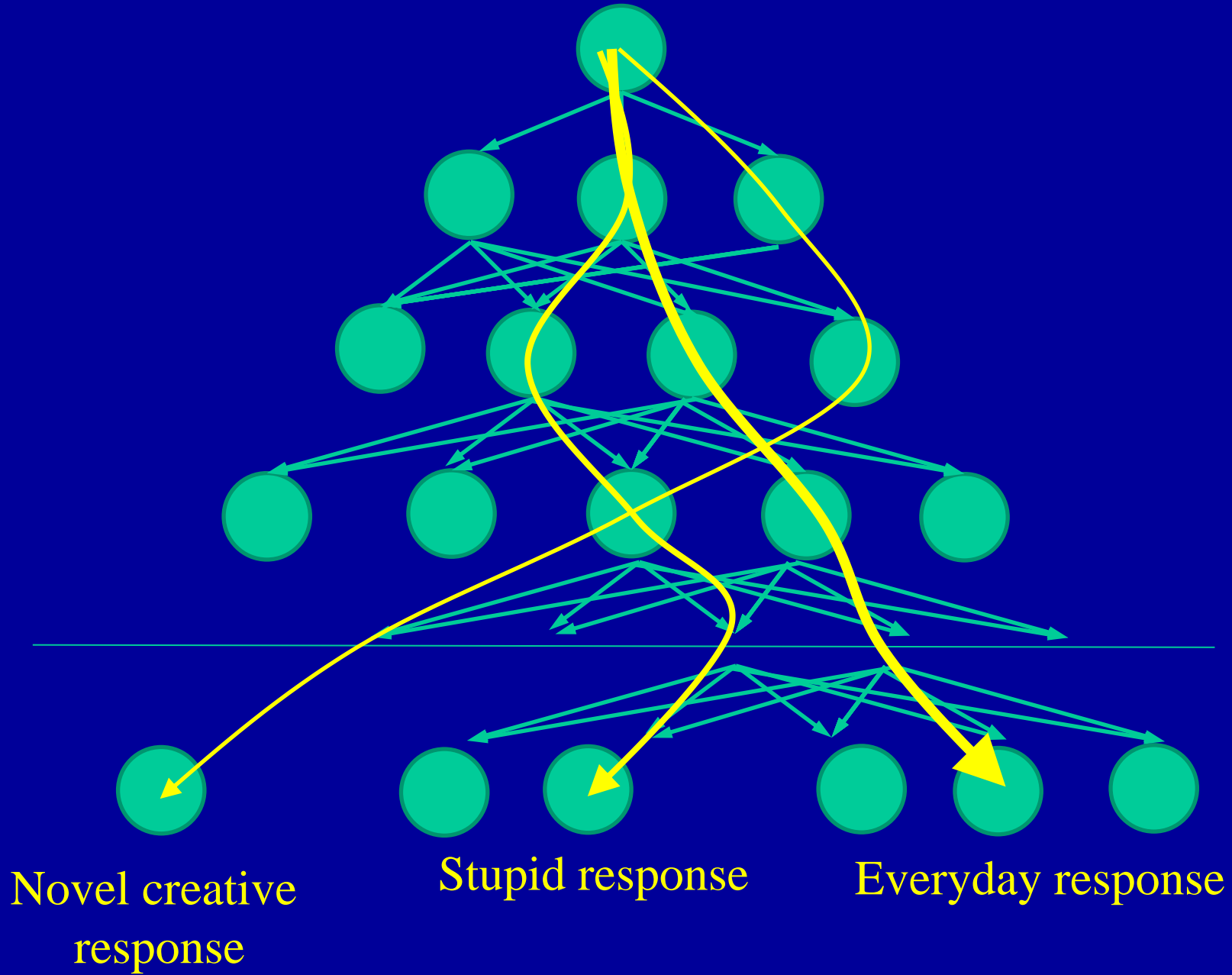
$$T = \frac{1}{3}$$

$$\Pr(F_1) = \frac{2^3}{2^3 + 3^3 + 5^3} = 0.05$$

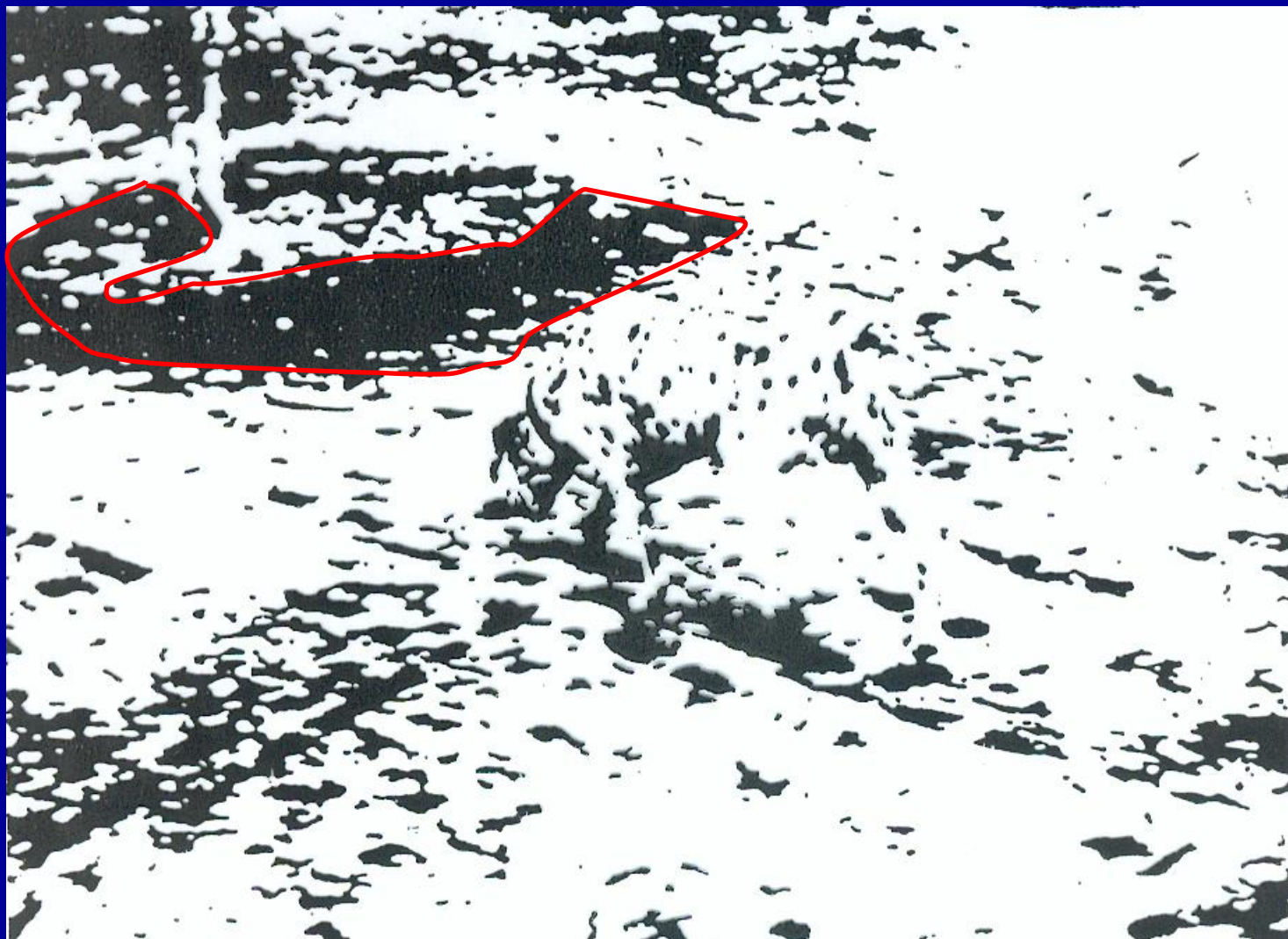
$$\Pr(F_2) = \frac{3^3}{2^3 + 3^3 + 5^3} = 0.17$$

$$\Pr(F_3) = \frac{5^3}{2^3 + 3^3 + 5^3} = 0.78$$

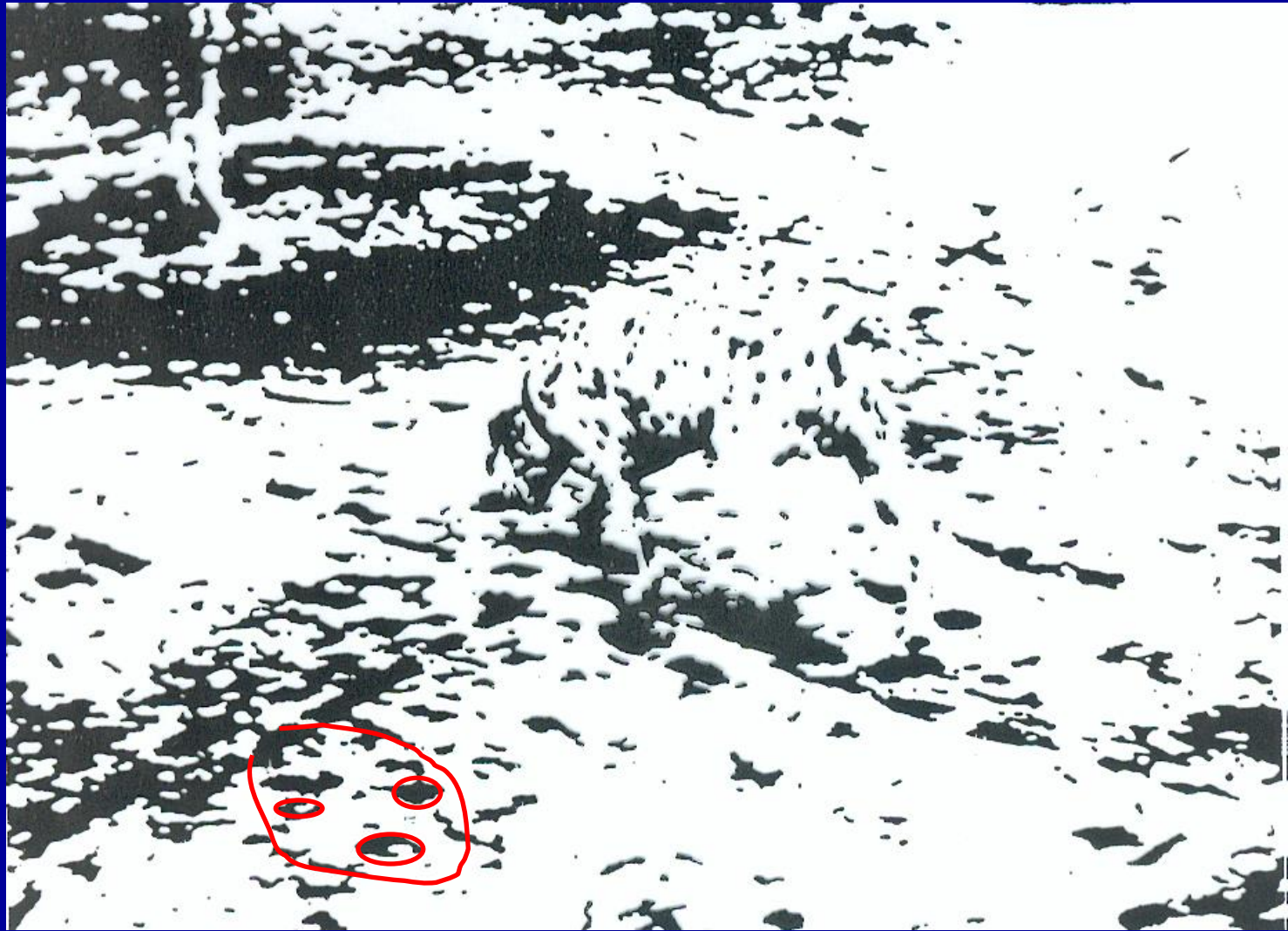
Probability of selecting F_3 as temperature decreases.







“A dark spot. Hmmm.... Doesn’t look like anything.”



“Pictures often have faces in them. Is that a face in the lower-left hand corner?”



“Nah, doesn’t join up with anything else.”

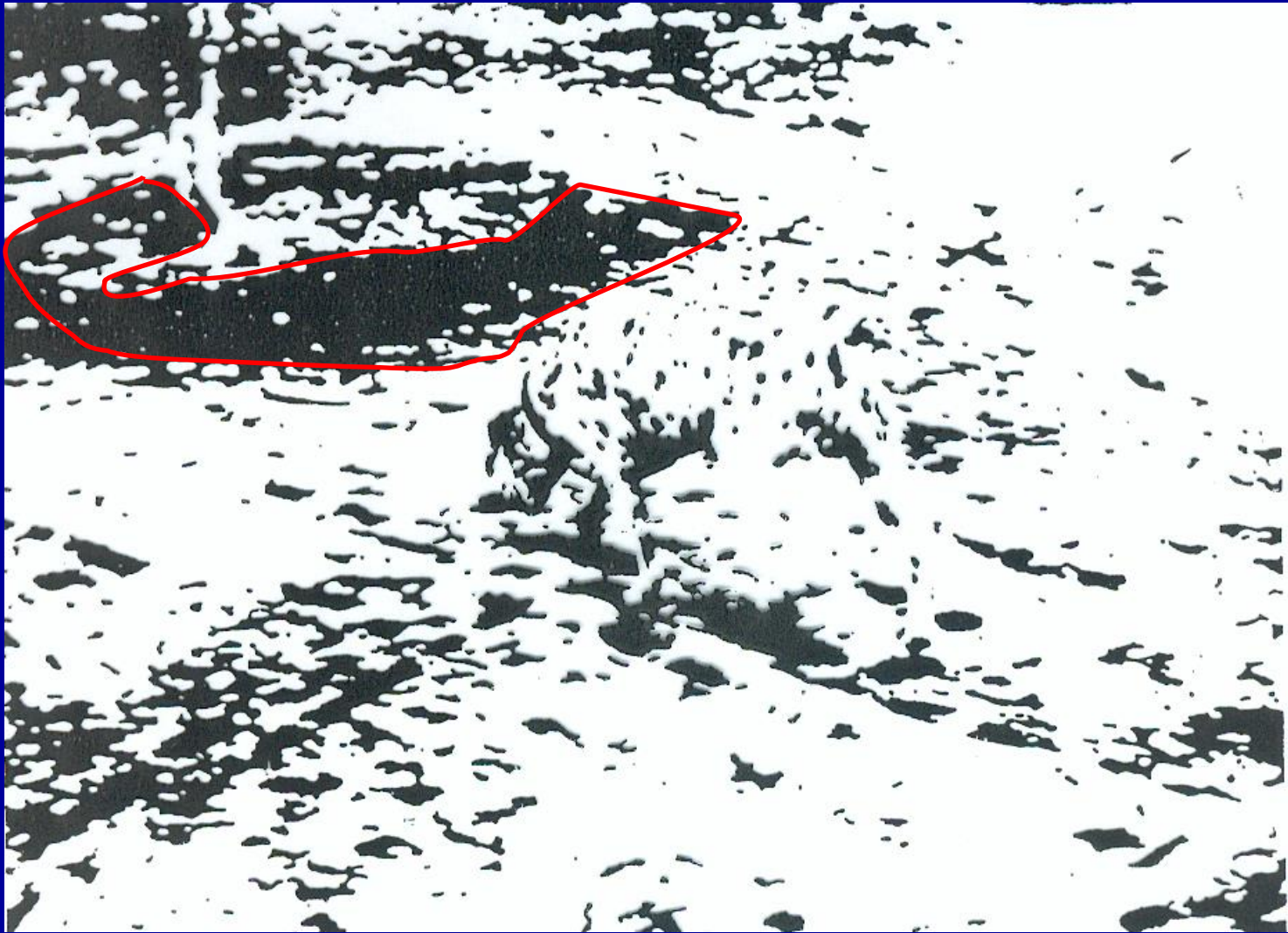




“Oh, THERE’s a face.”



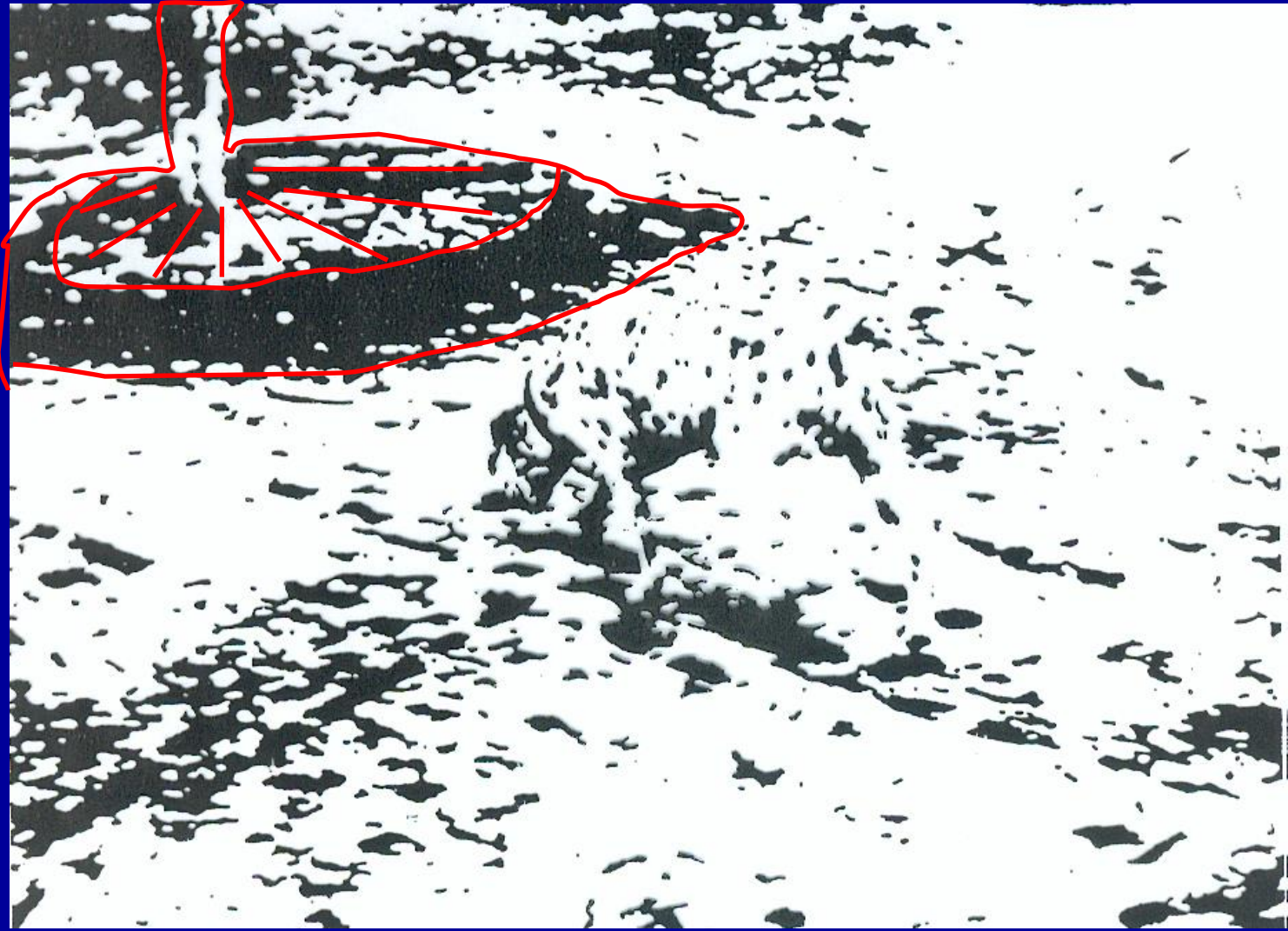
“But, again, it doesn’t make sense, just an isolated face...”



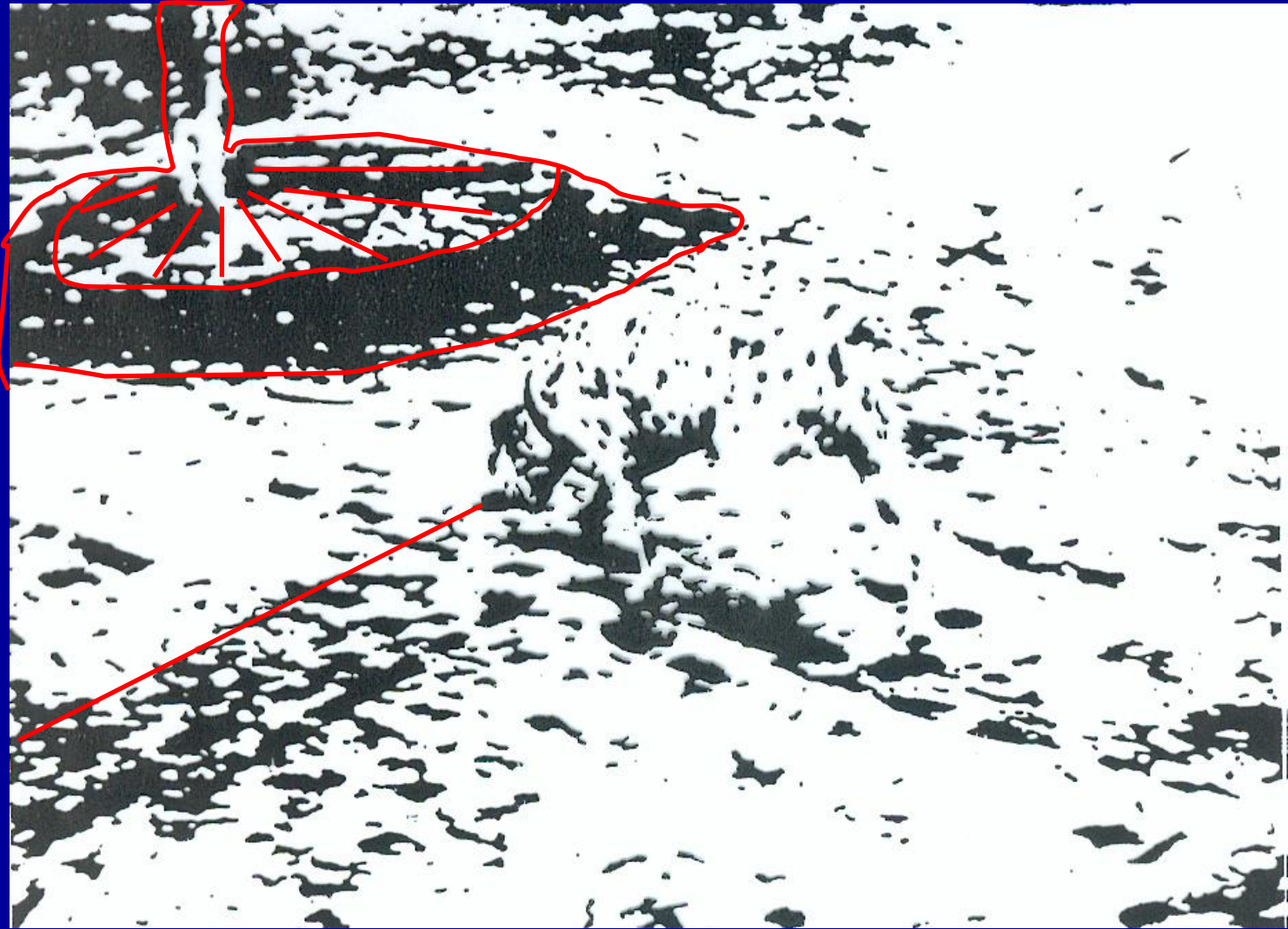
“Let’s look at that dark spot again. A shadow?”



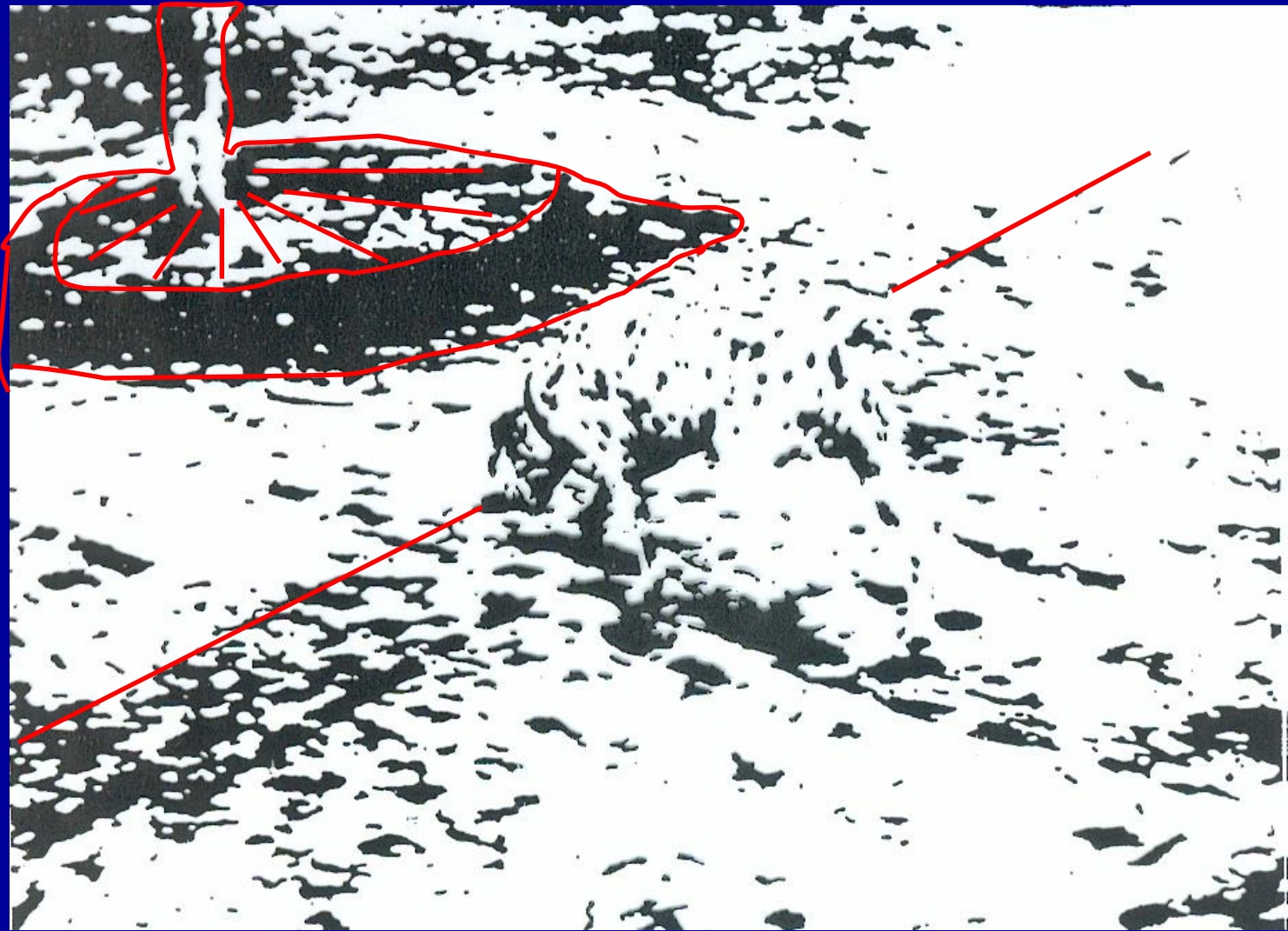
“Hey, TREES produce shadows. Is there a tree around?
THAT could be a tree!”



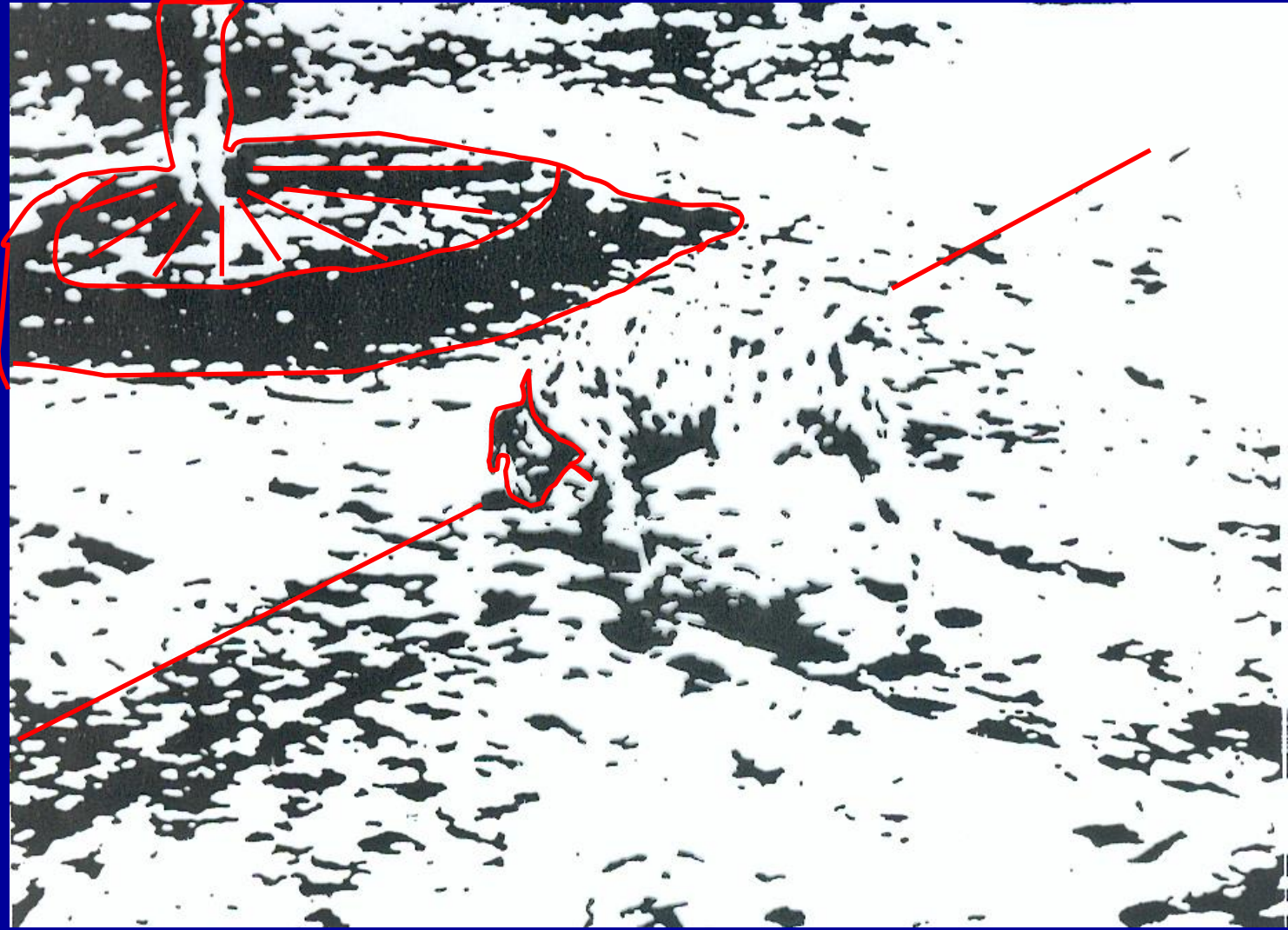
“If that’s a tree, that could be a metal grating.”



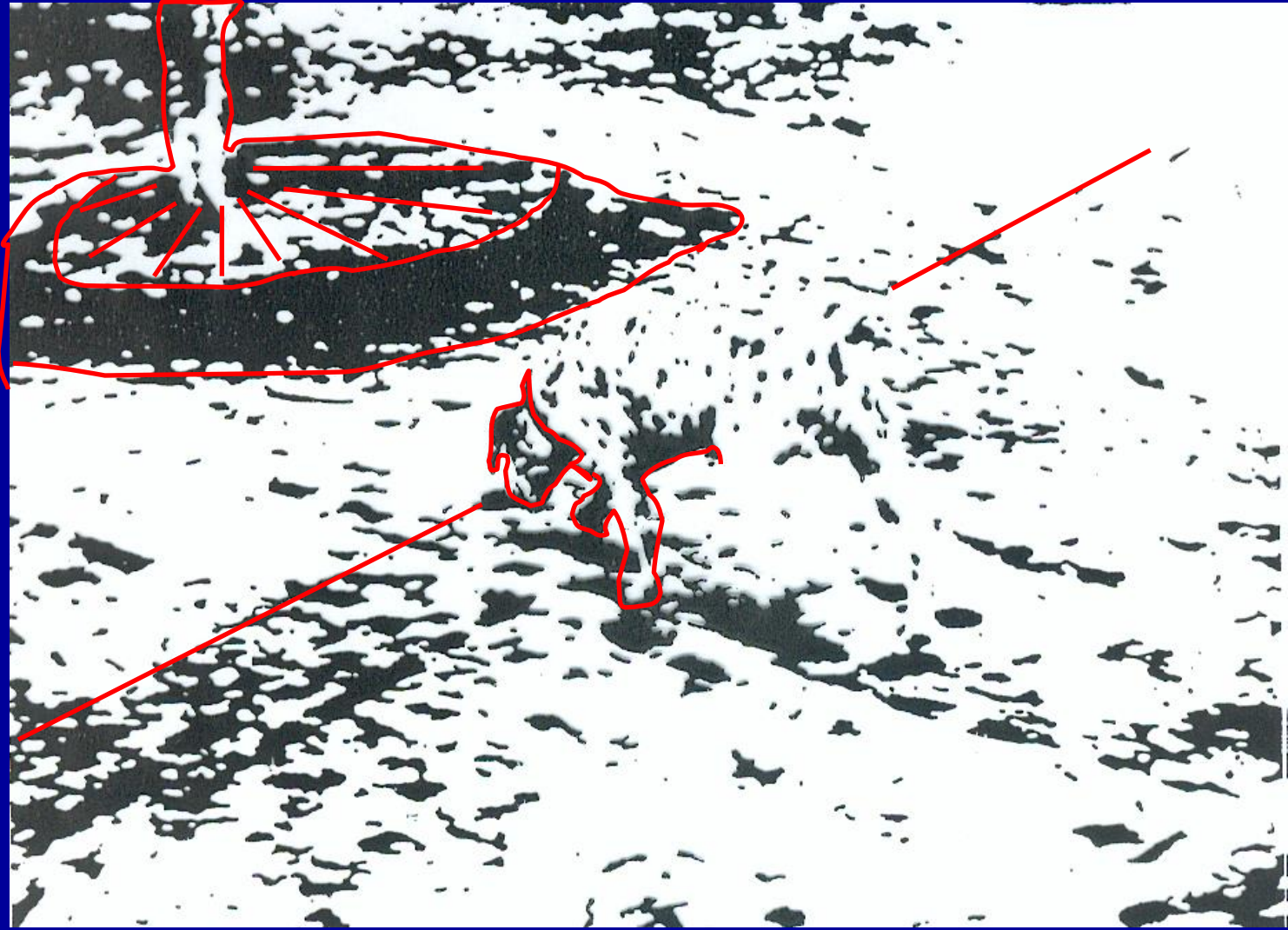
“But trees with metal gratings like that are on sidewalks. So where’s the kerb?”



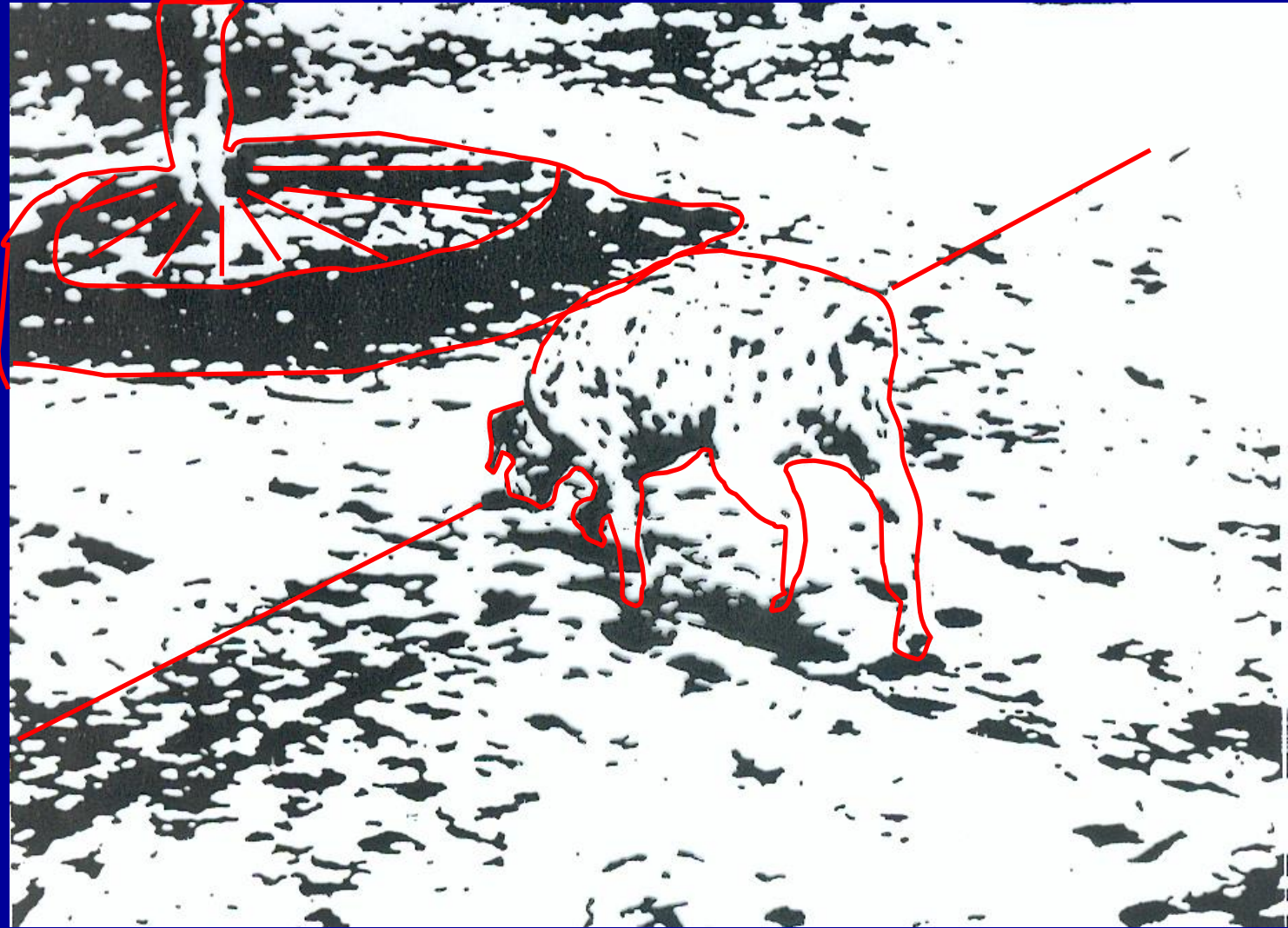
“If this is a kerb, it should go on straight. Does it? Yes, sort of.
Now what’s this thing in the middle?”



“That sort of looks like a dog’s head. That could make sense.”



“But heads are attached to bodies, so there should be a body. Hey, that looks like it could be a front leg.”



“The rest fits pretty well with that interpretation, too. Why so spotty?
A dalmatian, yeah, sure, drinking from a road gutter under a tree.”

Summary

Computational Creativity requires:

- I. An interaction between **bottom-up ideas** and **top-down constraints**.
- II. Chunking.
- III. Temperature.