h ↑

$\log(|X|/\Delta x)$ — uniform on X   differential: X

+3 — ...   scale $d^3 \Delta x$
+2 — ...   scale $d^2 \Delta x$
+1 — ...   scale $d \Delta x$
h=0 — uncertainty on scale Δx
-1 — ...   scale $d^{-1} \Delta x$
-2 — ...   scale $d^{-2} \Delta x$
-3 — ...   scale $d^{-3} \Delta x$

h = reduce
uc. by
for $d^{\Delta h}$

-∞ exactly specify outcome
    infinite precision/certainty

H ↑

$\log(|Y|)$ discrete/coarse-grained: Y
bin size $\Delta x^{(k)} = d^{-K} \Delta x$

ΔH = reduce
uncertainty by
factor $d^{\Delta H}$

K

$+\log\left(\dfrac{\Delta x^{(k)}}{\Delta x}\right)$

+4 — ...   uncertainty uniform on d^4 outcomes
+3 — ... d^3 outcomes
+2 — ... d^2 outcomes
+1 — ... d outcomes
H=0 — exactly specify outcome

if we refine, need to keep the
reference scale fixed

- to relate H to h have to hold a consistent reference scale/uncertainty
  fixed (H=0 keeps changing meaning, want h=0 to have a fixed meaning.
- relative entropy argument fixed relative to maximal uncertainty
- **Interpretation**: if $h_d[X] = K$ then X is as uncertain as a uniform
  distribution on region of size $d^K \Delta x$ (*)
    - usually use $\Delta x = 1$

defined relative to
a reference precision

- justifies the two new properties of h...

    1. unbounded below: see next notes page

    2. scaling/behavior under linear transformations: ...