Why Reasonable Minds Differ

--learning modeled on changing confidence in beliefs

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Reasonable people usually differ for good reasons that may be understood in terms of their confidence in their beliefs and how that confidence and then their beliefs change as they learn more.

Symbols in capitals represent confidence *expressed as odds*. [Odds are conventionally defined "probability divided by (1 – probability)".] Such a symbol can also represent the belief held at that confidence, if that is unambiguous.

Y	initial confidence in initial belief being correct (**Y**esterday)
T	current confidence (**T**oday) in belief **Y**
L	learning, confidence of added information regarding belief **Y**
S	confidence of specific study confirming **Y**
A	confidence in relevant authority
n	index number of step of learning

The "Learning Equation" of this model (and also the definition of **L**) is

<1> $$\mathbf{T = YL}$$

This describes our *a posteriori* confidence **T** in some belief as our *a priori* confidence **Y** times the odds of what we have learned **L** in the interim. This relationship can be evaluated in one's head.

Learning is expressed as the confidence held in some information package, such as a scientific study **S** and its relevant authority **A** . **A** is defined as the square root of the logarithmic product:

<2> $$\log L = \pm\left|\log S \cdot \log A\right|^{1/2}$$

--with due regard for the **±** sign of the square root.

Because a person is not ordinarily aware of the confidence one places in authority, **A** is estimated by soliciting **Y** and **T** and obtaining a formal value for **S** (-- often over-estimated by study authors), and then solving <2>.

Learning continues, so <1> is iterative:

<3> $$\mathbf{Y_n = T_{n-1}}$$

What we learn affects our confidence in the authorities that founded our beliefs (for example, parental authority for the existence of the tooth fairy).

Authority is involved in dramatic feedback loops that often control human undertakings. How well a particular simulation of learning works in practice depends on the validity of the modeled feedback.

These considerations lead to appreciation both of the importance of *a priori* beliefs and of human reliance on authority, leading to practical insights into the nature of one's own beliefs and those of others. Because of the tautologically-imposed simplicity of this model, a wide range of easy simulations is feasible.

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examples follow

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--Examples relating to the study: "Nuclear Flashback."

The following generic examples illustrate a few reasonable viewpoints regarding the question of whether the world's largest underground nuclear explosion -- Cannikin -- is leaking monitorable, long-lived radioactivity to the open environment in accord with the scenario proposed by Greenpeace in 1996. Let:

Y Pre-"Nuclear Flashback" confidence that any such leakage is occurring.
T Confidence in early 1997 that such leakage is occurring.
L Change in confidence due to "Nuclear Flashback" and attendant reviews.
S=19 Stated confidence level in **Y** of reference study, "Nuclear Flashback."
A Confidence in the relevant authority, according to:

T=YL $\log L = \pm|\log S \cdot \log A|^{1/2}$

(1) The actual study: Based on previous experience, the study designer estimated that Cannikin is leaking detectable with the designed study at **Y**=9. The study designer credited the confidence of the study confirming **Y** at **S**=19. After the study result this designer expressed confidence **T**=24 in **Y**. Based on this, **L**=8/3, from which it follows, the study authority was only **A**=1.6 for the designer, attributable to great concern for avoidance of *future errors* of over-confidence.

(2) Scientific environmentalist: As above, **Y**=9, with the authority of the scientific study as usual: **S**=19=**A**=**L**, and hence **T**=171. With the scientific enthusiast already confident Cannikin was leaking, the Greenpeace study is seen as proof BEYOND ANY REASONABLE DOUBT: Why isn't everyone convinced?

(3) Naive scientific reviewer: The naive reviewer has no prior opinion: **Y**=1. The study is accepted at face value: **S**=19=**A**=**L**, and hence **T**=19, scientific proof.

(4) Environmental moralist: All technological conclusions are rejected out of hand: **A**=1, although the study itself is not challenged, **S**=19. But **Y**=99 is accepted on faith in appreciation of nuclear testing being inherently "bad" or even "evil." Hence, L=**1**, and **T**=99. No technical evidence, pro or con, affects the true moralist's beliefs because those are outside the belief system. (--The inverse analysis describes the "technology afficionado.")

(5) Unaware public: The issue was unknown beforehand: **Y**=1, and the study conclusion is unknown: **L**=1=**A**. Hence, **T**=1: The unaware public remains.

(6) OTA open-minded scientist: In 1989, the Office of Technology Assessment opined "essentially no possibility" of such monitorable leakage, say: **Y**=1/99. An open-minded scientist credits the study as given: **S**=19=**A**=**L**. Hence, **T**=1/5.2. Thus, the open-minded OTA scientist who fully credits the Greenpeace study still opines the odds are better than 5:1 against **Y** .

(7) OTA conservative: An "OTA conservative" begins with **Y**=1/99. But rather than credit the study with any authority, a reason for discrediting it is found. The most dramatic is: "Is that their best shot? If Cannikin were truly leaking, the values would be huge!" Hence, **A**<1, say: **A**=0.9, even with **S**=19. Accordingly, **L**=0.57 and **T**=1/173. For the person TRULY convinced Cannikin is NOT leaking, the Greenpeace study -- though meeting the standard of a scientific proof of leakage-- may still, quite reasonably INCREASE confidence that there is NO leakage.