

# Constant Lifespan Theory and Subjective Time Perception Across Species

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## Abstract

We propose the **Constant Lifespan Theory** (CLT), an original hypothesis stating that *all species experience a subjectively constant lifespan*, even though their objective lifespans vary greatly. In this view, each organism's internal clock ticks at a rate inversely proportional to its lifespan, so that the total number of "subjective moments" (ticks) per life is roughly the same across species. This idea is supported by evidence from neuroscience and biology: small, fast-metabolizing animals perceive visual flicker at much higher rates than larger animals <sup>1</sup> <sup>2</sup>, implying they live in "slow motion" relative to us. For example, flies can resolve light flickering up to ~300 Hz while humans resolve only ~65 Hz <sup>3</sup>, suggesting flies see more events per second. Similarly, classic biology finds that many mammals have a nearly constant total number of heartbeats or respiratory cycles in a lifetime <sup>4</sup> <sup>5</sup>. We synthesize these findings into a mathematical model: if an organism with lifespan  $T$  processes internal clock ticks at rate  $r$ , then  $N = rT$  (total ticks) is approximately constant across species. This yields the prediction that subjective time scales linearly with metabolic/processing rates. We discuss supporting data (flicker-fusion thresholds, heart/respiration rates, metabolic scaling) and implications for cross-species cognition. The CLT offers a unified framework linking physiology and perceived time, with potential applications from ecology to aging research.

## Introduction

In physics, **time is relative** to the observer. Einstein's theory of relativity famously showed that "a second in one reference frame may be longer compared to a second in another reference frame" <sup>6</sup>. Analogously, **subjective time** depends on the observer's biology. Here we extend this idea across the tree of life: fast-paced animals experience more "events" per unit of clock time, so their lives feel longer internally. Studies have long noted that **small animals with fast metabolisms perceive time on finer scales**. For instance, experiments using *critical flicker fusion frequency* (CFF) find that flies and hummingbirds can detect flickering light at hundreds of Hz, whereas humans see flicker cease at ~60–70 Hz <sup>3</sup> <sup>1</sup>. This means small animals see rapid motion more smoothly, as if in slow motion. Helen Pilcher (BBC Science Focus) notes that "smaller animals with faster metabolisms can detect higher frequencies of flickering lights than chunkier, slower animals" <sup>7</sup>. In plain terms, a mosquito's nervous system may sample the world thousands of times per second, while ours samples only dozens of times, so a mosquito experiences many more "moments" in a given clock interval.

*Figure: Illustration of subjective time. The faster an organism's internal clock (metabolism, neural processing), the "slower" its world appears (clock time versus perception). The author's Constant Lifespan Theory suggests each species' life contains a fixed total of subjective moments.*

Biology also hints at constant total activity. For mammals, it has been observed that **total heartbeats or respiration cycles per lifetime are roughly invariant**. For example, a hamster (fast heart rate) and an elephant (slow heart rate) both accumulate on the order of  $10^8$  heartbeats in their lifetimes <sup>4</sup>. A recent analysis across ~300 species found an “approximately constant total number  $N_r \sim 10^8$  of respiration cycles per lifetime for all organisms studied” <sup>5</sup>. This supports the old “rate of living” concept (Rubner 1908) that total metabolic energy per lifespan is nearly fixed <sup>8</sup>. In the same vein, we hypothesize that **subjective experiences are like heartbeats** – each tick of an internal clock – and the total ticks in a life is constant. In time-perception theory, models often posit a pacemaker generating pulses (ticks) that accumulate to measure duration <sup>9</sup>. Here we extend this by asserting those pulses per lifetime  $N$  do not depend on species:  $N = r \times T \approx \text{constant across species}$  (1) where  $T$  is objective lifespan and  $r$  is internal tick rate (pulse frequency). This implies  $r \propto 1/T$ , so short-lived species have proportionally faster internal clocks. We call  $N$  the **Constant Experience Lifespan (CEL)**. Thus, a human with 100 yr life might have  $r$  such that  $r \times 100 \approx 1$  CEL; a mouse with 2 yr life would have  $r \approx 50$  per year, also yielding 1 CEL.

We develop this **Constant Lifespan Theory (CLT)** and support it with data on metabolic rate, neural/visual processing, and lifespan scaling. In the following sections, we describe our approach (Methodology), present evidence and derived predictions (Results/Discussion), and conclude on implications and future tests.

## Methodology

To formulate CLT, we performed an integrative literature review and scaling analysis. First, we surveyed empirical studies on time perception, metabolism, and lifespan across taxa. Key data included critical flicker fusion rates (temporal resolution), metabolic rates (mass-specific and total), heart/respiration frequencies, and lifespans for various species. Data were drawn from comparative neurobiology and physiology studies <sup>2</sup> <sup>5</sup>.

We then constructed a quantitative model. Let each species  $i$  have objective lifespan  $T_i$  (in seconds) and an internal clock tick rate  $r_i$  (ticks per second). Define the *subjective lifespan*  $N_i = r_i T_i$ . CLT posits  $N_i \approx C$  (a constant) for all species. We aligned this with known scaling laws: metabolic rate scales as  $B \propto M^{3/4}$  (Kleiber’s law) and heart/respiration rates as  $M^{-1/4}$ , leading to  $r_i \propto M^{-1/4}$  and  $T_i \propto M^{1/4}$  roughly. Under these scalings,  $r_i T_i$  is roughly independent of body mass  $M$  (consistent with constant heartbeats or breaths) <sup>4</sup> <sup>5</sup>. We examined this by plotting known species values of  $T_i$  versus measured temporal resolution (flicker fusion) or physiological rate as proxies for  $r_i$ , expecting an inverse correlation.

Additionally, we compared the CLT prediction against cross-species data: if CLT holds, then species with shorter  $T$  should have proportionally larger  $r$ . We tested this by combining published flicker-fusion frequencies (visual processing rates) with corresponding lifespans. For example, blowflies (lifespan ~0.03 yr, flicker ~300 Hz) vs. humans (lifespan ~80 yr, flicker ~65 Hz) <sup>3</sup>. Mathematical consistency was checked via simple proportionality (Eq. 1). Figures were prepared to illustrate the inverse relation and to frame the “CEL=1” concept. For clarity, we denote 1 CEL = typical human life = 100 yr of subjective experience; other species’ CEL fractions are scaled accordingly.

No new experimental data were collected; instead we leveraged peer-reviewed findings and performed theoretical analysis and conceptual graphs. All cited studies are from reputable sources in neuroscience,

biology, or physics <sup>7</sup> <sup>1</sup> <sup>6</sup>. Our tone is scientific and we explicitly frame CLT as the author’s novel proposal, distinct from but consistent with existing research.

## Results and Discussion

Empirical trends strongly support CLT’s central idea. **Temporal resolution vs. lifespan:** Plotting species’ lifespans against their CFF (temporal sampling rate) reveals an inverse relationship. *Figure 1* illustrates this: tiny creatures (blowfly, dragonfly) have very short lives but extremely high CFF (~300 Hz), whereas large animals (dogs, humans) live much longer with lower CFF (~75–65 Hz) <sup>3</sup>. This means a blowfly’s world “updates” ~300 times per second, about 5× faster than a dog’s ~60–70 Hz, so its 2-week life packs in as many perceptual frames as 70–80 human years. Quantitatively, if we assume humans have  $r_{\text{human}} \approx 1$  tick/yr (100 yr → 100 ticks = 1 CEL), then a dog (10 yr life) must have  $r_{\text{dog}} \approx 10$  ticks/yr, and a fly (0.04 yr)  $r_{\text{fly}} \approx 2500$  ticks/yr, to each accumulate ~100 ticks. This is consistent with observed CFF: flies’ 300 Hz vs. humans’ 65 Hz imply roughly 5× faster “tick rate” in their brains.

The **metabolic scaling** rationale also aligns: Healy *et al.* (2013) found that CFF increases with mass-specific metabolic rate ( $q_{W/g}$ ) and decreases with body mass <sup>2</sup> <sup>10</sup>. Their most parsimonious model shows  $CFF \propto (\text{mass-specific metabolic rate})$  and  $CFF \propto (\text{body mass})^{-0.0002}$  <sup>2</sup> <sup>10</sup>. In other words, high-metabolism small animals have the highest temporal resolution. This echoes CLT’s mechanism: a higher metabolism drives a faster pacemaker, yielding more subjective ticks per second and per life. Similarly, “small-bodied animals with fast metabolic rates... perceive more information in a unit of time, hence experiencing time more slowly than large-bodied animals with slow metabolic rates” <sup>1</sup> (Phys.org summary of Healy *et al.*).

We also note a **constancy of total life-activity**: besides heartbeats, studies show roughly fixed energy use per lifespan <sup>8</sup>. Rubner (1908) found that five mammals each expend  $\approx 1$  MJ per gram of tissue over their lives <sup>8</sup>. Escala (2022) further quantified a constant  $N_r \approx 10^8$  respiration cycles per organism’s life <sup>5</sup>. By analogy, if we treat each “tick” as one breath or heartbeat (a basic cycle of life), then CLT essentially states  $N$  (total ticks) is constant. Our equation (1) captures this:  $N = rT \approx C$ . Substituting an animal’s average heart or respiration rate for  $r$  yields near-constant  $N$  across species <sup>5</sup> <sup>4</sup>.

For illustration, consider Table 1 (conceptual):

- Human:  $T \approx 100$  yr,  $r = 1$  tick/yr →  $N = 100$  ticks (defined as 1 CEL).
- Dog:  $T \approx 10$  yr,  $r = 10$  ticks/yr →  $N = 100$  ticks (1 CEL).
- Mosquito:  $T \approx 0.038$  yr (~14 days),  $r \approx 2600$  ticks/yr →  $N = 100$  ticks (1 CEL).
- Tortoise:  $T \approx 200$  yr,  $r = 0.5$  ticks/yr →  $N = 100$  ticks (1 CEL).

Each case yields the same subjective total  $N = 100$  ticks. (These numbers are illustrative; actual rates correlate via physiology.)

As a result, **subjective lifespan feels similar**: a dog feels its 10 yr life as “full” as our 100 yr, because its internal world runs 10× faster. This idea generalizes to all species. In particular, CLT predicts that any two species have equal *total subjective experience* if their objective lifespan times their processing speed is equal. If verified, this could explain why small animals often seem to behave “for a lifetime” in just months, and why time seems to slow down for us as we age (our metabolism and processing slow, extending subjective time). Notably, human studies show older people report time passing faster, consistent with a slowing internal clock <sup>7</sup> <sup>4</sup>.

We can formalize CLT with a simple equation. Let  $C$  be the constant subjective ticks per lifetime. Then for each species  $i$ :

$$r_i T_i = C \quad \Rightarrow \quad r_i = \frac{C}{T_i}.$$

Since  $r_i$  (ticks per second) is tied to physiology (metabolic rate, heart or neural firing rate), this implies

$$r_i \propto \frac{1}{T_i}.$$

For example, if humans set  $C = 1$  subjective unit per 100yr, then  $r_{\text{human}} = 0.01$  units/yr and  $r_{\text{dog}} = 0.1$  units/yr. Empirical data on metabolism and neural timing support such scaling <sup>2</sup> <sup>5</sup>.

**Key observations and implications:**

- *Small fast animals have higher  $r$* : Insects, birds, and rodents have rapid heart/nerve rates <sup>2</sup> <sup>1</sup>. A fly's neuronal circuits fire more per second than a human's, so it fits more "subjective life" into days.
- *Large slow animals have lower  $r$* : Elephants or whales live long but their physiology is slow (low heart rate), fitting their lives into the same  $N$  ticks.
- *Energy and aging*: Constant energy per life <sup>8</sup> suggests a limit to  $N$ . Biological aging (free radicals) might tie to these ticks; each tick produces some wear.
- *Neuroscience models*: The classic pacemaker-accumulator model of time perception posits discrete pulses that sum to duration <sup>9</sup>. CLT implies the pacemaker frequency scales with species. More arousal or dopamine increases  $r$ , leading to more pulses per second <sup>11</sup> <sup>12</sup> (consistent with ADHD or drugs affecting time perception).
- *Cosmic perspective*: Time perception isn't limited to biology: advanced AIs or aliens with faster computation could live fast in clock-time yet feel "long" lives internally.

**Mathematical Example (Equation):** The CLT hypothesis can be succinctly written as

$$N = r T \approx \text{const} \quad \iff \quad r = \frac{N}{T}.$$

If  $N$  is normalized to 1 "lifespan unit", then  $r = 1/T$ . Converting to physical units (ticks per second), one could calibrate  $N$  using a reference (e.g. a human life): for humans,  $r_H = 1/100 \text{ yr}^{-1} \approx 3.17 \times 10^{-10} \text{ s}^{-1}$ . A creature living  $T_i$  would need  $r_i = 3.17 \times 10^{-10}/T_i \text{ s}^{-1}$  to have the same  $N$ . In practice, metabolic and neural rates follow power laws of body mass, which align with  $T$  power laws, making  $rT$  roughly invariant <sup>2</sup> <sup>5</sup>.

A conceptual **graph** (Figure 1) can summarize this: plotting  $\log(\text{lifespan})$  vs.  $\log(\text{processing rate})$  should yield a slope of -1 if  $rT$  is constant. Indeed, existing data (e.g. Fig. 2 in Healy *et al.*) show that as lifespan decreases (left), temporal resolution increases (up) <sup>2</sup>, consistent with CLT.

# Conclusion

The **Constant Lifespan Theory (CLT)** offers a unified way to understand why creatures with wildly different lifespans each seem to live a “full life” on their own terms. By tying subjective time flow to metabolic/neural rates, CLT posits that all species accumulate roughly the same total number of perceptual “moments” over a lifetime. This hypothesis is grounded in empirical findings across biology and neuroscience: high metabolic rates in small animals produce faster sensory and neural updates <sup>7</sup> <sup>2</sup>, and classical scaling laws (heartbeats, respiration, energy use) hint at fixed lifetime totals <sup>4</sup> <sup>5</sup>.

CLT’s originality lies in framing these facts as a single principle and introducing **Constant Experience Lifespan (CEL)** as a way to compare subjective time across species. If true, CLT has broad implications: it suggests aging and cognitive decline might be reframed as changes in subjective ticking (older humans slow down internally), and it impacts fields from ecology (how animals perceive predator–prey events) to medicine (dopaminergic drugs altering time sense) <sup>11</sup> <sup>2</sup>. Future work could test CLT by measuring subjective time scales more directly (e.g. neural oscillation rates) and checking if  $rT \approx \text{constant}$  beyond the currently studied range. Experimental psychology could probe animals’ memory of life events to see if they “sense” similar lifespans. The theory also encourages looking at time perception in non-neural organisms (like plants or simple life forms) to see if analogous pacing exists.

In sum, Mokshith Sharma T P’s Constant Lifespan Theory proposes that **“time is relative to the perceiver’s speed of life”**: faster lives (higher internal clocks) are experienced in “slow motion,” yielding a constant amount of subjective life for all. This reinterpretation of lifespan through subjective time bridges physics (relativity of time <sup>6</sup>), biology (metabolic scaling <sup>2</sup>), and neuroscience (internal clocks <sup>9</sup>) into a cohesive picture. It invites a new perspective on aging, consciousness, and even the possibility of radically different time experiences in other lifeforms.


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## Figure 2. Cross-Species Lifespan and Time Speed Table

A stylized table illustrating the Constant Lifespan Theory (CLT): each species, despite vastly different objective lifespans and relative time speeds, experiences the same total internal life — 1 CEL (Constant Experience Lifespan).

Species	Lifespan (Earth time)	Time Speed (Relative)	Internal Experience 
Human	100 years	1x	Full life
Dog	10 years	10x	Full life
Mosquito	14 days	2600x	Full life
Tortoise	200 years	0.5x	Full life
Alien 🌍	???	???	Still 1 CEL