INTRODUCTION

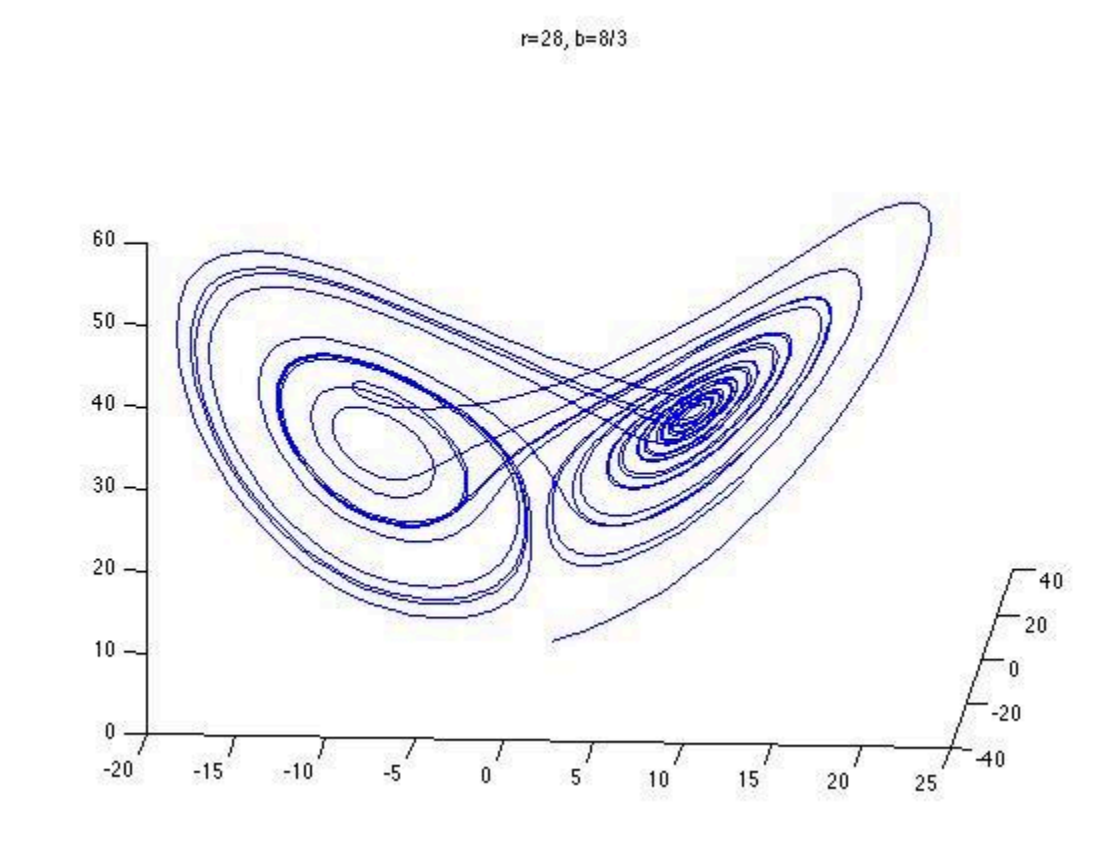
1. **Chaos Theory:** “Chaos Theory” is a term coined by Edward Lorenz in the 1960s after discovering that minuscule changes in a weather model usually result in a massive differential shift in the overall outcome. Chaos Theory posits that complex systems that concern multiple alternating and inter-locking variables are incredibly difficult to predict consistently and reliably over long-term simulations. Hence forth, these “chaotic systems” are highly unstable and involve a multitude of internal dependencies. For example — If a system has four successive steps (being A/B/C/D), and each step has four sub-paths (such as A/B/C/D - a, A/B/C/D - b, A/B/C/D - c, and A/B/C/D - d), then each are aligned in a predictive process that starts with a version of A and ends with D (with B —> C in the middle), there would be 4 x 4 x 4 x 4 = 4 * 4 = 256 different outcomes and holistic sequences that could possibly be derived from the initial dataset. As more steps and sub-paths are introduced into a sequence, the more unpredictable it becomes. This shows to us that whilst two sequences may begin similarly (only diverging into a separate sub-path), it could result in a plethora of different final verdicts. However, critically, chaotic systems are not random. They are deterministic (meaning they follow strict rules), but the rate of divergence increases drastically as the sequence continues (due to the deterministic value of the chaotic system itself). This rate of exponential divergence is known as the Lyapunov Exponent. Each step is calculable, but as each core phase of the sequence progresses, the possibility of accuracy in terms of forecasting the end result becomes lower and lower, to the point it isn’t logistically possible to reliably cast these predictions past a certain point. This sensitive behavior is visually captured by the Lorenz Attractor, a strange geometric pattern that illustrates how the system's path remains constrained by a set of rules but never exactly repeats itself.
2. **Dynamical System:** A Dynamical System is a system whose state changes or alters over time according to a fixed rule. These rules are typically represented by certain mathematical equations. Chaos Theory is specifically

the study of complex, non-linear dynamical systems that exhibit chaotic behavior. The weather (which was covered in the discovery of Chaos Theory itself), the double pendulum, and population models are all examples of dynamical systems. The concept of a sequence (specifically the previous given sequence of A/B/C/D or A —> B —> C) is an example of the evolution of a dynamical system.

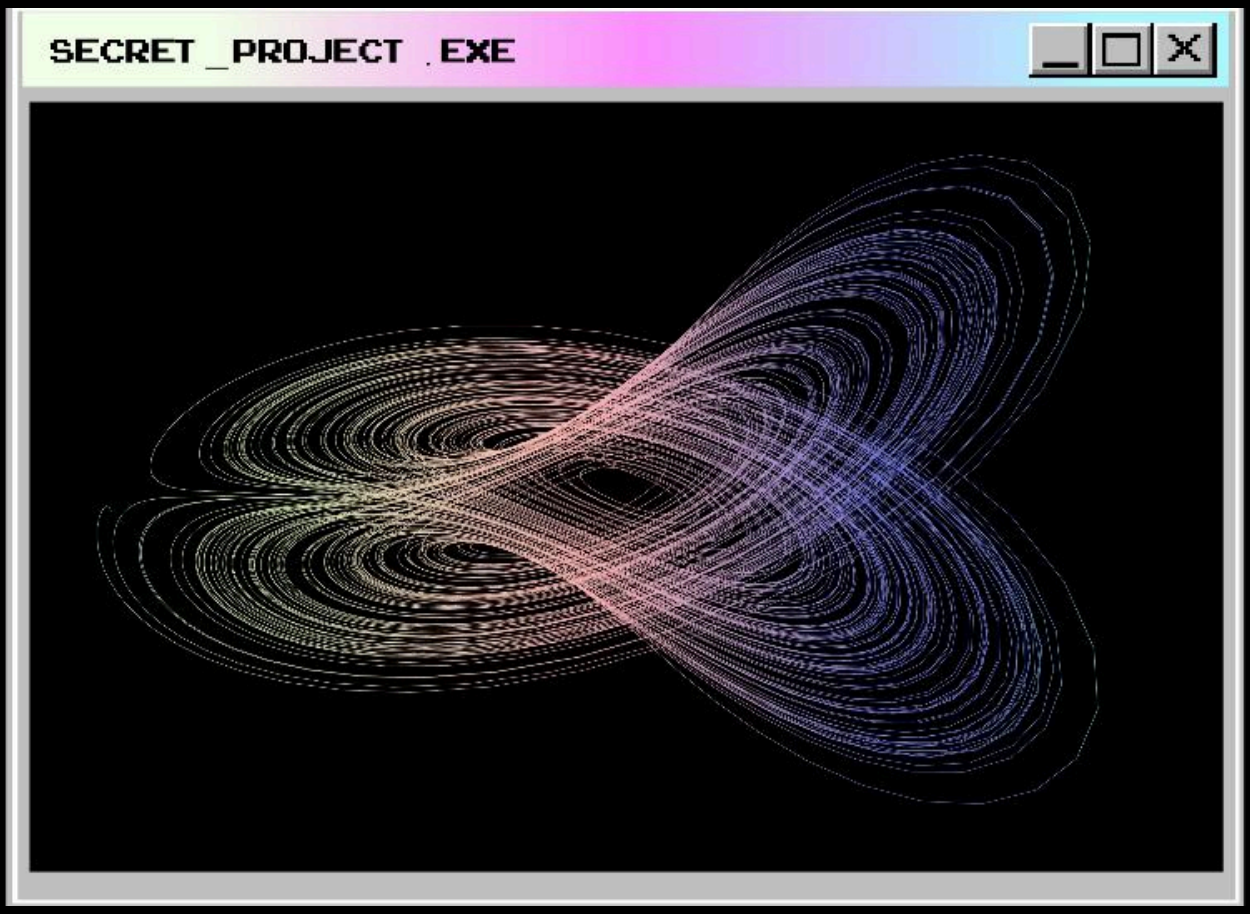
3. **Non-linear System:** A Non-Linear System is a system where the output is not directly proportional to the input, or where simple addition/scaling of solutions doesn't function nor work. Mathematically, it's a system that cannot be described by linear equations (for example, y = mx + b). This would reflect a deterministic chaos system (such as one modeled on human behavior, for example). In a linear system, two nearby starting points will remain predictably near each other. In a non-linear system (the type that exhibits chaos), the deterministic rules cause the sensitive dependence on initial conditions (The Butterfly Effect). Non-linearity is the bane of chaos as a whole.
4. **The Butterfly Effect:** This term goes hand-in-hand with Chaos Theory as a whole, being the driving property behind the entire field itself. This term was coined in a similar manner to Chaos Theory, the name itself embodying what it means (even one small flap of a butterfly's wings could cause a tornado). The Butterfly Effect posits that in a sequence (such as A —> B —> C), altering the first step even to a minute degree; it could result in the entire sequence changing. For example, in our sequence of A —> B —> C, if A is compromised - C cannot exist as originally forecasted, if at all (despite being an entire step, a letter in this case, away from A). With this, The Butterfly Effect is most accurately defined as the main property behind what drives chaotic systems, proposing that even small changes in initial phases of sequences can alter the entire sequence itself by the time the final phase is concluded, regardless of how many phases are included in-between (meaning that alterations in initial stages indirectly shift stages that come far after it).
5. **Lyapunov Exponent:** As covered before, the Lyapunov Exponent is the divergence rate caused by The Butterfly Effect and Chaos Theory as a whole, being the mathematical representation of it. The more steps that are

present in a deterministic sequence, the higher the divergence rate - and hence a higher Lyapunov Exponent.

6. **Lorenz/Strange Attractor:** A geometric representation for how a chaotic system's path remains constrained (due to determinism) but will never repeat itself and will thus increase in unpredictability as the system progresses. It defines the long-term, bounded behavior of the system.



7. **Fractal:** A complex, never-ending pattern that is self-similar across different scales (i.e., if you zoom into a small part of the shape, it looks exactly or statistically similar to the whole figure). Many of the forms generated by chaotic systems, such as the boundaries of their basins of attraction or the structure of a Strange Attractor, are fractals. This provides a visual and mathematical bridge between the chaotic, unpredictable behavior and the underlying deterministic rules, given the fact they are represented in a non-integer dimension. This links to non-linearity as a concept, given neither are capable of pure mathematical representation.



APPLICATION

1. **Variables:** Variables are the differing impactful aspects that operate within a chaotic system, directly altering the sequence as a whole as it progresses.Variables are a cornerstone of Chaos Theory in practice and are the crux of scaling a chaotic system, as it showcases real-time morphing of the sequence. For example, going back to the previous analogy A/B/C/D - a/b/c/d, the differing subpaths would be either direct causations of or direct variables themselves that must be accounted for. Variables overlap greatly and often “bounce off” one another when within a chaotic system. For visualization purposes, imagine a small cardboard box. Now, throw three rubber balls into the box. Each ball may bounce off one another, which may cause that ball to bounce into the third, then it may occur again as a result, and so on and so forth - These balls represent variables. To accurately

“solve” a chaotic system, all variables must be accounted for and perfectly comprehended. If even one minute variable is miscalculated (tying back to the analogy - If a rubber ball is missed, the bouncing effect projection would be entirely wrong), the sequence could play out in a completely different manner (proven via the established definition of The Butterfly Effect, where if A is compromised then C cannot exist as it once was intended if at all - Despite there being a letter/step between the two). There are six primary factors to consider when attempting to decipher how difficult a chaotic system is to “solve” — **1) Number of variables**. The more variables that are present within the system, it equates to more variables that need to be calculated. If a chaotic system’s variables are not fully accounted for, it cannot be solved (as previously shown). For example, if chaotic system A has five total variables (miniature system) and chaotic system B has seven total variables (larger system), B would be exponentially harder to solve due to not only possessing more variables that need to be accounted for (again, if even one variable is misrepresented, The Butterfly Effect posits that it will inevitably result in the sequence holistically altering), but also because variables overlap and bounce off another. Even if two new variables are introduced, the entire system is morphed and altered as a result. **2) The impact of variables**. Now that the discussion of how the quantity of variables impacts a chaotic system, the quality of said variables must also be crucially determined. Variables have differing levels of impact on a chaotic system’s structure, with some contributing less than others and vice versa. No two variables will ever have the EXACT same magnitude of impact. Back to the rubber ball analogy, let’s say ⅔ of the balls were small-sized. However, the final one was medium-sized. Obviously, the impact of the larger ball will be greater in the box compared to the two smaller balls (despite all three still contributing), and thus the varying levels of quality are a massive indicator over which chaotic system possessed the more difficult sequence prediction (**NOTE —** Quality/impact of variables would also tie into scope of said variables, and are deeply intertwined). **3) Synergy of variables**. With quantity and quality established, how variables connect to one another is also a major factor. The “closer together” each variable is, the more difficult it will be to predict the sequence. If the variables all are inter-connect, they will have a far higher Lyapunov Exponent compared to a

variety of variables that are rather detached from one another - regardless of quantity or quality (assuming the system on which they operate is equal, of course). **4) The length of the sequence**. Naturally, as steps progress, the Lyapunov Exponent increases greatly (as elaborated on before). a sequence with three predicted steps (1 —> 2 —> 3) will always be easier to project than a sequence with five predicted steps (1 —> 2 —> 3 —> 4 —> 5), of course only if the chaotic system is shared between the two (obviously if both sequences possess different chaotic systems, quality of said systems must be established via variable detection - Which was covered the first three methods of deciphering the quality of a chaotic system). The length of the sequence can also be shown via parallel sequences that are projected to converge at a certain point (for example — X —> O —> Y —> **L** AND F —> G —> H —> **L**). Length should not only be considered as a linear sequence-based sum, but rather the amount of steps (quantitative) that are taken into account and projected to converge. **5) Contextual adversity.** This is a cornerstone of every feat's framework, so it shouldn't necessarily be a shocker to include it here. In this case, contextual adversity (CA) is measured by the amount of prior information obtained before enacting the forecast. If character A had a year to study a slightly more complex chaotic system than character B, but character B only had a few hours, it would entail that character B's feat is more impressive (debatably, of course). **6) The margin of error**. If a margin of error is present in a feat of predicting a chaotic system, the system was not fully solved (as it would be dubbed a semi-solved chaos system). A margin of error is a permissible or tolerable degree of deviation from a correct or exact value of a target, and henceforth if a feat has a margin of error when predicting a chaos system - The chaotic system was not entirely solved, as major variables were either omitted or incompletely accounted for. The most common form of a margin of error is a quantity or contingency-based system, where the outcome is drowned out by multiple predicted sequences that cover for gaps in the character's knowledge/analysis (**NOTE —** Simply because a prediction has a contingency, does not mean the system was not solved - Unless it's directly shown the original prediction failed. If it didn't, then you cannot detract from the feat itself by labeling it as a semi-solved system. This differs from a quantity-based prediction, where the positive net gain simply has to

outweigh the negative net loss - Meaning, sequences weren't predicted accurately, even if most were). However, if two feats that display sequences both hold a margin of error, it must be determined which predicted projection had the smaller/more unforgiving one - That is the ideal method, in combination with the previously stated four, to determine which feat showcases better grasp over a chaotic system.

2. **Accurate Forecasts:** Accurate predictions that forecast a sequence within the system (however it disregards timing and such), showcase undoubtedly high levels of understanding over that specific system. However, it isn't the pinnacle of chaotic system solving. It showcases the fact that the character in question has an immaculate grasp over the major variables, but obviously couldn't delve deeper into the system due to more subtle variables. If they were able to, the projected sequence would need to align temporally (given the fact that temporal factors are omitted, it implies there was a margin of error, even if it was incredibly small). This type of chaotic system solving (and the temporal version of it) can only exist if there is a lack of a net gain and net loss outweigh multi-sequence prediction argument within the feat (otherwise, it'd only remain as a semi-solved chaotic system). (**NOTE —** Successfully predicting a sequence, especially without temporal accuracy, does not imply the system that was forecasted is more complex than another - That is still a debatable point of discussion).
3. **Temporal/Precision Factor - The confirmed state of solving a chaotic system**: The only way in which a chaotic system is confirmed to have been solved (purely), is via the projected sequence having a marginal error permission of zero (or a marginal error so low it can't even be argued as above permissible). The best subset of feats to show this, are temporal predictions (in a chaotic system). Temporal predictions are forecasts that align perfectly with the projected sequence, down to the point even the timing of steps within the sequence was correct. This is proven via the convergent final outcome aligning with a precise timing, that the character intended. As The Butterfly Effect dictates, all previous steps must've been predicted temporally/perfectly in order for the outcome to align temporally as well (If A is compromised, C cannot exist as intended if at all). If the final step aligns perfectly with an intended temporal mark, it is not debunkable that the steps that occurred beforehand operated in a margin of error that

totaled to roughly zero (this is proven once again, by the posit of The Butterfly Effect - Chaotic System solving that notably isn't temporal is still subject to refutation entirely). Temporal prediction feats within a chaotic system account for every single variable, subtle and major, down to a precise timing-based point. If even one slight variable was off, the final convergent outcome would NOT align temporally and thus the projected sequence would fold in onto itself (A effects B, B effects C, so on and so forth). One temporally miscalculated step would cause the subsequent step to be thrown off temporally as well, until all steps after it are completely disabled from being temporally correct. Not only this, if even one variable is omitted, it could very well throw off the entire system, as variables overlap and bounce off one another (as previously established). If this never occurs, it is only possible that the chaotic system as a WHOLE was completely and purely solved (due to how The Butterfly Effect functions and the instability of the system itself, particularly when in contact with variables that must be temporally forecasted). To determine the quality of a temporal prediction feat, the precision of the timeframe (whether it's a minute or a second) should be taken into account. Having, say, a one minute temporal prediction isn't necessarily the same as having a noticeable margin of error. Since the timeframe is still so small, and given how even the smallest step being thrown off balance can impact the entire sequence, the precision is still completely uncanny and impossible without accounting for every variable down to a point that is at least within a few milliseconds of timeframe (as even a forecast aligned at a specific minute would be thrown off by a 10 second morph in a step, as it then delays every subsequent step, which was displayed within the posit of The Butterfly Effect. With that, since every step is designed to mold to a certain temporal point, delaying the interval could very well result in completely shattering the projected sequence, making the final outcome null). (**NOTE —** Temporal predictions do not necessarily imply the system is more complex than another, simply that the caster has a fundamental perfect understanding over that specific system's large web of detailed variables - Which usually implores greater cognitive faculties compared to semi-solving or even baseline solving a more complex system, however that of course, is discussion-worthy).

4. With all these aspects in place, there are three main types of chaotic system solving —> **1) Semi-solving**, which would imply a character has a solid grasp over a chaotic system - Yet, isn't able to make 100% accurate sequence predictions based upon it reliably, usually defaulting into a positive net gain to loss ratio to compensate for the gaps in their understanding (omitting the temporal factor). This is also commonly shown via certain steps in sequences failing or not functioning completely as intended. **2) Baseline Solving**, which implies a character is capable of predicting a sequence within a chaotic system with accuracy - Yet, notably misses the mark in touching every variable due to lacking temporal value. The character is able to reliably predict step-by-step order of a sequence within the system, but doesn't have enough in-depth variable comprehension to align them temporally. **3) Pure/Perfect Solving**, which implies a character is able to cover every single variable to such an exact degree that temporal predictions within the sequence are now plausible. The character in question is able to make sequence-based predictions in the system down to the timing of a specific step, implying each variable is calculated perfectly. This is the pinnacle of chaotic system solving (without the quality of the system being determined first), and is concrete due to how The Butterfly Effect functions. (**NOTE —** To an extent, ALL characters operate under a chaotic system. This is simply a method one can use to determine who has superior control over variables when within a system, which directly contributes to one's cognitive and tactical ability to a rather massive degree).
5. It should be worth noting, for example, that simply because a baseline solve exists, it does NOT mean it outclasses every semi-solve feat. How so? The complexity of the system itself is crucial to how valuable the solve-type truly is. To determine the quality of a chaotic system, we look at four main components —> Quantity of variables, impact of variables, synergy of variables, and sequence length. Each should be compared to an in-depth degree to decipher which system is more chaotic in nature, which would correspond to how valuable the achieved feat is. To determine how impressive the feat is after inferring the chaos-level of the system, we must look at two main factors —> Contextual Adversity (how much prior information/analysis was had) and Margin for Error (the permissible amount of error the prediction can hold). Once arriving at a conclusion for these two

factors, in combination with the initial system comparison, a direct and most empirically sound conclusion can be made of how valuable a character's chaotic solving feat is (especially compared to another).

6. After determining the chaotic value of the system (via the four main comparison points), the feat itself (CA & Margin of Error), as well as the type of chaotic solving it operated on (semi-, baseline, or pure/perfect), a reasonable holistic viewpoint can be established and compared to similar feats. The typing of a chaotic system solve does not necessarily matter, as long as the feat quality or chaos value of the system completely overshadow it (and vice versa). As such, it's valuable to compare on all fronts and this is simply a way to grant the most logically sound system of deciphering feat quality when present within a chaotic system. Pure/perfect solving **usually** entails higher cognition due to acknowledging all possible variables simply due to the nature at which it operates (and as established, even two extra variables in a system result in an exponential divergence due to overlapping and inter-connection), as a final anecdote.

FEAT VALUE

1. **Why is this important for general outsmarting?:** The control a character has over a chaotic system, a system that may be more complex than another- Is directly relevant to the discussion of determining which character possesses a higher ceiling for cognitive and tactical tasks. How so? Well, let's say character A operates on a chaotic system more complex (via the four main components) compared to character B, and is able to control the variables within this system to a higher degree. This would naturally imply character A has a superior ability to detect natural external factors within their environment and how to manipulate them utilizing logic and reasoning, which is a massive indicator of which character would be more proficient in a greater range of situations and scenarios. Obviously, this becomes more nuanced as the comparison becomes notably closer. For example, a character may have superior CA compared to another character who has a more complex system, and thus discussion is crucial to deciphering which is

superior (usually then finally decided by noting which character displays a higher typing of chaotic system solving). This is fundamentally a more refined version of the argument behind feats performed within a macrocosm, directly showing us how to quantifiably judge and discuss this with utmost validity and clarity by taking advantage of Chaos Theory as a whole, using variables as a conduit to ensure the scale at which a character operates is identified clearly and effectively for comparison's sake. This specific and crucial rule of outsmarting would be most aptly dubbed the “chaos factor” behind one’s feats, which would encompass the system (complexity of said system determined by the four aforementioned components), the feat framework (contextual adversity & margin of error), and overall typing of the chaotic system solving/navigation they exhibit (of which there are three).

2. **Why are temporal prediction feats so indicative of absolute cognitive abilities?:** Whilst semi-solving and baseline solving are both generally accepted as difficult in their own right, pure/perfect solving is undoubtedly the highest level (assuming all three have roughly equal systems). For example, let's say a chaotic system revolves around multiple individual agents that operate based on their own psychological identities. This obviously tethers to each agent’s behaviors, which differ greatly from subject to subject. Within even one choice or decision a human makes, multiple domains play into it, and one singular domain can't account for everything. For example, imagine you’re greeted on the street by a random man. The response could be evaluated by an endocrinologist, who takes into account the hormonal state; a neurologist, who evaluates the brain reactions in the milliseconds after receiving sensory stimuli (which directly ties into the man’s response and how quickly it was deployed); a psychologist, who takes into account the person's past experiences; etc. A singular person’s psychological build comprises decades worth of experiences and conditioning, each one building up to a specific state in which the person now currently operates. Each factor would need to be analyzed nigh-perfectly to make a consistent temporal prediction surrounding even that ONE agent in the chaotic system (**NOTE —** each domain - Which would include endocrinology, psychology, neurology, etc would need to be comprehended perfectly by the caster - Suggesting flawless innate intelligence rooted in multiple and all fields of human behavior). Factor in

the holistic group of agents, and the fact that them merely interacting generates a multitude of new branching variables (such as social interaction, bonding, dialogue, etc), the chaotic system now becomes a nearly IMPOSSIBLE equation for the caster to calculate reliably (especially down to a singular temporal point - Instead of simply getting an answer right, which would already be difficult given the already established variable intricacy, it would be more akin to getting the answer correct at the precise millisecond, adding another full layer to accuracy in the form of complexity). The system is a framework of a multitude of psychological profiles formed over decades of experiences and conditioning all overlapping and forming branches of layers upon layers of new variables as a result due to social behaviors and interactions. Each generation must be predicted perfectly, as even one slight deviation in an initial step causes the end result (intended to be temporal) to cease its alignment with temporal forecasting - Thus causing the sequence to shatter. Again, this is shown to us via The Butterfly Effect, where C cannot feasibly exist as intended if A by proxy does not hold the same forecasted position. Now, factor in the physical scale in which each agent operates - For a temporal prediction, it would require a precise comprehension over the physical rate at which each subject accomplishes tasks in the environment such as walking, running, etc. This factor is impacted by fatigue and the human body's tendency to burn energy, which is a factor that changes and alters from subject to subject (depends on age, holistic diet, growth, genetics, emotional state, etc). It would require a fundamental perfect understanding over each subject's exact biological composition, and how they differ from one another (again, suggesting near perfect insight into all fields of biological composition featured in the human body). Not only this, it would require perfect visualization over the physical area in which the agents are operating, as to calculate how the physical action would align with the physical environment to produce a tangible rate needed in the calculation. This variable connects to the previously established variables concerning psychological profiles - With even more variables that branch off as a result. The end result is a system that is clearly impossible to predict temporally due to the immense diverging rate at which the Lyapunov Exponent is applied here, having to cover even the slightest deviations. As such, characters who have feats of this typing (and given the

system is complex enough), it would conclude that the raw computing power within their cognitive functions is far beyond any realistic grasp or median (which would also link to that character now automatically possessing near perfect logical reasoning, which will be elaborated on within the next two points).

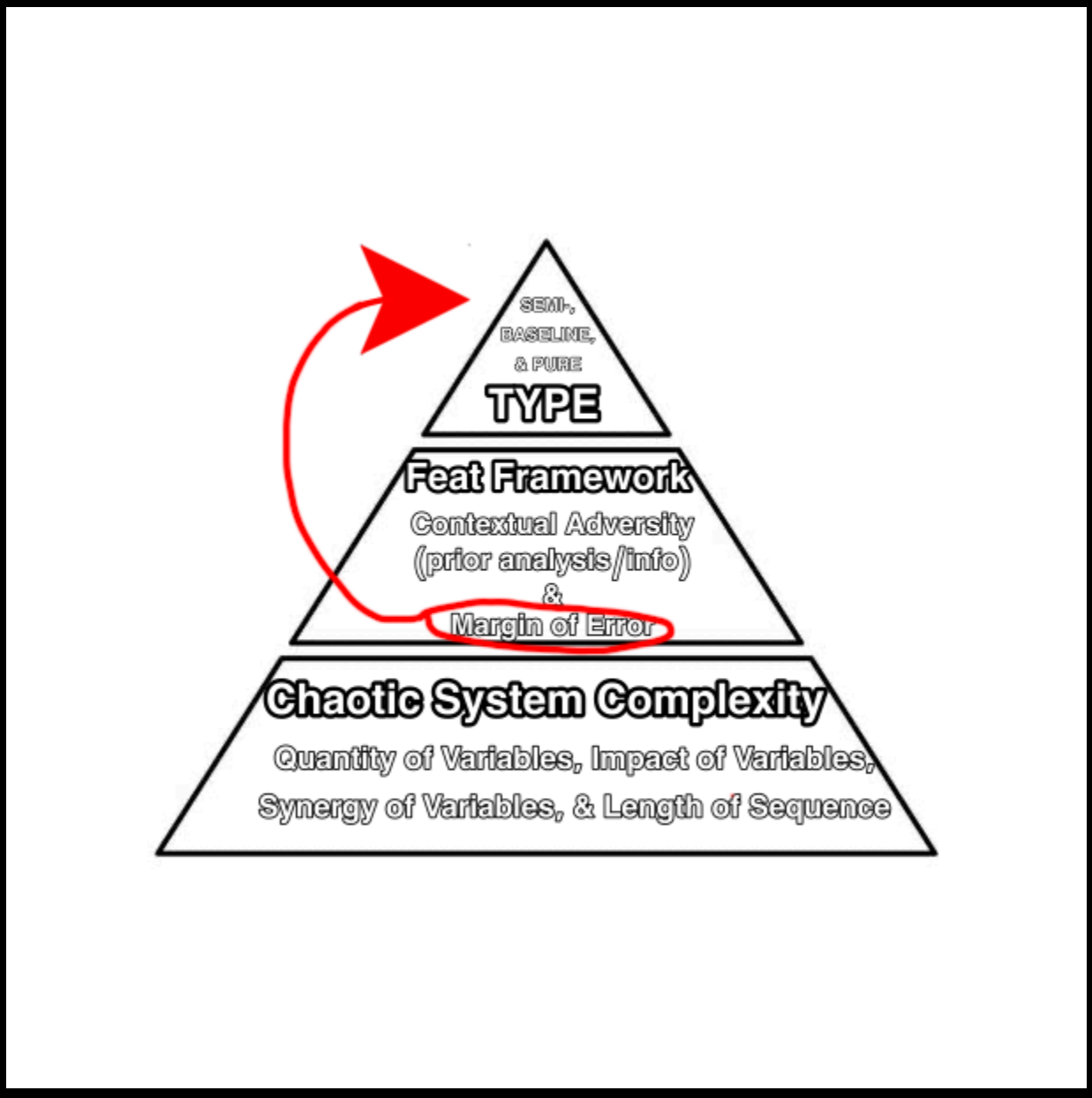
3. **Chaotic Systems Are Equations/Problems (logistically):** Forming an equation based upon a chaotic system requires calculation concerning a set of variables, which goes hand-in-hand with traditional problem solving. In fact, as chaotic systems progress in complexity and precision (within the sequence prediction), these "problems" actually become far more difficult to "solve" compared to more novel equations or deductive processes due to the multitude of variables (that all impact one another) and the exponential divergence caused by the Lyapunov Exponent. With each step of the sequence, this equation becomes more difficult to solve multiple-times fold due to deviation. As stated before, the only absolute proof of a chaotic system being completely solved without room for major refutation is the presence of a temporal prediction. As such, it can be stated that temporal predictions are a sign of purely solving an "equation" in the form of the chaotic system, which encompasses hundreds of thousands of moving parts that must be accounted for nigh-perfectly (dependent on the system, of course). If even one variable is misrepresented, the entire "answer" to the equation could be rendered completely incorrect (C cannot exist if A is compromised). This would be a feat of solving an equation that is by all means impossible logistically, meaning that the character's overall cognitive faculties operate at a level far beyond any absolute computing power we can conceptualize.
4. **Solving Chaotic Systems indicate LR above traditional deductive processes (varying):** If a character showcases a feat revolving around a complex chaotic system, it is reasonable to conclude this would scale their logical reasoning (given the previous establishment of a chaotic system functioning as an equation). The more impressive the feat of sequence forecasting, the higher indication of reasoning-based ability. A feat of temporal prediction within a chaotic system (assuming it's rather complex) would imply logical reasoning that is far above traditional measures such as deductive processes and such (obviously this would vary) due to the chaotic

system itself being an equation with a deviation rate and divergent property (Lyaponuv Exponent) far beyond these mundane processes, which would naturally converge in the final forecast needing to be absolutely precise given a web of thousands of overlapping and inter-locking variables - Each one needing to be calculated PERFECTLY. A character being capable of juggling these variables all at once to create a convergent point would be hypothetically an incredibly refined version of flash arithmetic - Calculating the possible outcomes and web of variables within their minds to a temporal point (which is the highest degree of confirmed precision within chaotic system solving). This would also indicate enhanced levels of parallel cognitive processing, due to following lines of variables within the mind to an exact point and reasoning out when certain lines would converge and how they'd overlap - All operating based on variables that cannot be adequately shown via mathematical visualization (shown by the existence of the Lorenze Attractor and fractals), meaning these factors in the equation surpass other types of equation-based phases in terms of complexity. (**NOTE —** Obviously, this would scale other cognitive abilities besides LR. However, LR is typically the most overlooked one and deserves its one implementation. The greater the typing, the more impressive this feat of juggling variables would be - With semi-solving being the innate least in this specific area, and temporal predictions naturally being the greatest by far. Baseline solving would also entail great problem solving abilities dependent on the complexity of the system).

5. **Laplace's Demon:** Laplace's demon is a hypothetical, all-knowing intellect that, if aware of the precise location and momentum of every particle in the universe (variables in this case), could use the laws of classical mechanics to predict all future events. This entity was proposed by Pierre-Simon Laplace in 1814 (hence the namesake) as a vivid articulation of causal determinism (the rule of determinism being a key element in Chaos Theory as a whole), the philosophical idea that every event is the necessary result of preceding events (The Butterfly Effect's posit). Laplace's Demon is one of, if not the most, complex hypothetical concept of absolute problem solving. If a figure that embodies Laplace's Demon were to enter a chaotic system, the projected result would be that the concept would be capable of reliably predicting the sequence in which variables align down to a temporal point.

This not only further strengthens the previous point of temporal predictions being indicative of completely solving the chaotic system (and thus solving an equation beyond our conceptual grasp of calculation), but it also establishes how characters who have temporal prediction feats that exist in a complex chaotic system fundamentally act as Laplace's Demon conduits - as every variable is accounted for perfectly due to temporal accuracy (similar to how Laplace's Demon accounts for every particle perfectly), the character is able to create reliable and consistent forecasts on the future sequence of said variables. This would tie back to the conclusion arrived at in the previous point, being that temporal prediction feats are examples of problem solving ability beyond or relative to our peak hypothetical conceptual model of absolute problem solving ability (thus the LR displayed is far beyond realistic or limited comprehension, surpassing traditional deductive processing). The closer to the hypothetical peak of Laplace's Demon a character's feat is (precision-wise), the greater problem solving ability they must exhibit.

DIAGRAM



(Pyramid diagram of how to evaluate a feat within a chaotic system)

SOURCES

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