Stranded in Time: A Story Exploring an Intersection of Fiction and Science

By: Konrad Sebastian Gomez-Haibach

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This is a brief set of parallel chapters fusing *This Is How You Lose the Time War* by Max Gladstone and Amal Al-Mohtar, and *The Order of Time* by Carlo Rovelli.

Red looks down at her hand holding a two-tine carving fork.

Staging the scene took a lot of detailed work, more than it takes to win a battle or start a duel between two warlords. The fireplace casts a flickering light in the room of an older, slightly disheveled drawing room in the castle. A window is slightly ajar, and it's curtain occasionally flaps and curls in the light, fall breeze. The light from the fireplace highlights the Graf Wolf Lorenz von Hofkirchen carelessly slumped over with his head resting on a small book on his desk. The rest of the table is in disarray, the inkpot is tipped over and ink is dripping on the floor. A candelabra is lying on its side on the floor next to the puddle of ink. A half-eaten roast chicken and a carving knife in a bowl are just out of the dead Graf's reach. Red picks up an off-white napkin from the floor. Death is rarely neat, and it needs to look like a struggle.

Red grabs the Graf's hair and lifts his head off the book. Some of the fresh ink from the journal has smudged his cheek. The journal page reads,

> *September 22, 1672*
>
> *The accountants finished tallying the grain harvested from my fields this year. 1538 barrels of clean grain will keep my serfs fed during the long winter that my Prince's ministers have forecast.*

Now that the harvest is in, I have to start training my serfs to fight for the Emperor Leopold in case there is a war next summer. You never know what the high nobility might plan for.

There is a faint rustling as I am writing this, it seems a bat has flown into the cast~~~

The entry is good enough for the purpose. Commandant, in her upstream pod, predicted with her calculations that amplifying the vampire legend will topple the Austro-Hungarian empire. The accusations and mutual distrust among scientific, religious, and political powers will eventually slow progress in biotechnology. Red carefully lowers the head back onto the book, making sure the smudges on the book and cheek match again.

She must hurry; the technicians are going to be here any moment to exsanguinate the body. Red plunges the carving fork into the Graf's cold neck leaving two neat holes. The pierced jugular vein weeps a few drops of blood. She dabs the blood with the napkin from the lips of the wound. The finishing touch is to drop the blood-stained napkin just-so onto the floor. A single step whispers on the wooden floor, someone approaches.

Red whirls into a crouch to face the intruder and stops. A courier in Agency livery steps out of the shadows and silently hands Red a note.

Red – urgent

A promising Strand is forming where we can get a head start on the Garden and permanently gain the upper hand.

~ Commandant

Being reassigned before the mission is complete is rare. A botched mission or a crisis are the only cases Red had ever heard of. Agents oversaw the mission's execution, and it was their care and diligence that prevented the strand from collapsing or being diverted. There was also the cost to be considered, slipping between the strands is not possible without the giant hyperspace machines at the Agency. You don't just jump up-, out- or down-strand without considering what was to be gained. Red felt for the coordinates hidden in the message and prepared for the jump to the field office.

Red stands at attention in a scriptorium, next to a hooded, almost skeletal monk who is transcribing from one illuminated manuscript to another. The scriptorium is dank from the winter wind blowing in through the windows from stables outside. Through those same windows, rhythmic wails can be heard from the penitents self-flagellating in the courtyard. The illumination on the page being written is of a bleeding Christ on the Cross. A Roman archer is using Christ for target practice in the center of a farmer's market. There is a hum of activity as operatives also dressed as scribes pass messages. The bony, ink-stained hands of the Commandant finish the last sentence on the page with a small flourish.

The inky fingers wind and unwind the loose threads of a cloak sleeve as the Commandant speaks, "You may stand at ease. We have an opportunity to deeply damage the Garden and perhaps set them back permanently. If we alter the timing of the discovery of the Braid to a time when mechanical technology is in ascendance, the Garden will be eliminated from most of the Strands in the Braid. The Strand in which the decision point is, is fragile but getting stronger. It is an opportunity we can't afford to miss."

Agents are chosen for their natural independence from relationships. The request is a cruel twist, either to be discovered as a traitor and die or eliminate the possibility of ever being with Blue.

“I want you to write a letter to Carlo Rovelli, a Professor of Physics who discovers the nature of Time. He needs external support for his ideas, or he won’t have confidence in them. Like the Bible I am translating, word choice is critical as it affects how he frames his theories.”

The Commandant hands over a scrap of leathery parchment filled with dense calligraphy. “Technicians have drafted the letter, but it needs to be in your voice. You are one of my best agents. I need this to succeed.” A blackened, bony finger points at Red. Red considers if the finger is accusing her of having treasonous thoughts.

Agents are exacting in the execution of their tasks. Red cannot appear otherwise, or the Commandant will doubt her loyalty. Is the Commandant already aware of disloyalty? Red stiffens, hoping the change in stance seems a normal change in posture. She doesn’t think the Commandant noticed, and yet, she is already subconsciously composing her next letter to Blue.

Red travels out of the protective bubble, four centuries upstream, to another continent and 29 strands over. The technicians had already arrived in the bare campus office. They wear decontamination suits to avoid leaving traces. The face shields give them an appearance of anonymity or exchangeability. Even with the suits, their motions are graceful and efficient with no wasted motion. Boxes of books are placed on the shelves and a nameplate is put on the door. Campus IT systems have already been infiltrated and Red’s new identity as Professor Orowitz has been established. They are efficient.

All that remained was for Red to write the letter in her own words. Thinking to herself, “Bluesy, did Mrs. Leavitt’s Guide to Etiquette and Correspondence have anything to say about business letters?”

Red reaches inside her jacket to stroke an envelope.

She strides across the Furman campus, trying not to hurry and blend in with the students. There is an animated conversation on the bench over by the path. In another spot there are a couple of springtime sunbathers settling down on a newly verdant lawn. Many students are hurrying between classes. Everything is in motion.

She glances at their faces, while hiding the fear that a Garden agent will interfere. Why is she so nervous? It is the simplest part of the mission. Being on the move is less dangerous than hiding out in a borrowed office trying to write a letter in technical speech. She says silently, “My cerulean Blue is comfortable with this role. B has played the role of scholar many times before. I feel a little more like you. Have you noticed that living the role inevitably changes how you weigh your choices?”

The mailroom is a utilitarian space, severe white walls with a single counter and bins. At one end of the counter sits the mail clerk, intently studying a textbook. The scene is static, almost timeless in its brutally ascetic design. Maintaining her pace, she approaches the wide, laminated desk and taps the counter for attention. The sound echoes in the room. Red hesitates, briefly considering if the Commandant has taken the form of the clerk for another debriefing. The clerk

looks up puzzled at the interruption, breaking the impression. “Would you mail this letter addressed to Carlo Rovelli at the University of Pittsburgh?” The request is succinct and the minimum required. The clerk takes a moment to note the sender and recipient addresses, adds it to the logbook and puts the letter in the postage meter. A clack is heard and the letter is tossed carelessly into a large metal box along with the other letters to be sent. Time moves forward with increasing disorder.

Rovelli, having arrived in the morning at the Physics department, makes his way into the office with a cup of espresso. Keeping the murky liquid in the tiny cup is a challenge, the hallway floor is spotted from others’ accidental sloshes. He moves carefully thinking. “Small changes in how I move my body will reduce the future probability of oscillations from building up in my cup.” He nudges open his office door with a shoulder, while watching the cup. When he looks up, he sees the envelope placed neatly on the blotter on his desk. He leans, flips the envelope over and inspects the return address to see who might have sent it. Upon seeing that it is from Furman University he eagerly drags his chair from under the desk, across the carpet and sits down to read the letter. Rovelli peels open the envelope and begins to read.

Prof. Oroitz
Physics Department
Furman University
3300 Poinsett Highway
Greenville, SC 29613

Dear Professor Rovelli,

I really enjoyed your talk on quantum gravity and the problem with time. I believe you're right. The problem at the quantum scale is that there is no such thing as "time" much rather it is the probability of moving from one state to another. The only thing we observe is that at the macroscopic scale, the system, *S*, moves to increase disorder. This implies that if we can act on *S* and change the amount of order, we can affect the direction of time within *S*. Further, we know that on the macroscopic level, there is a predictable progression from state to state, these are high probability transitions. Small perturbations can cause a bias toward a new subsequent state. We also know that there are general patterns or themes within time that are revisited.

On the large scale, I am sure you are familiar with chaotic attractors, the paths around which lead to specific themes. That is, each of the paths from state to state are non-intersecting but follow similar orbits around the attractors. In some cases, small changes in the initial state can lead to big effects, changing the order, frequency, and probability of the themes. Like the motion of the planets, it is impossible to predict how changing specific events might affect the distant future. The further ahead one tries to look, the less certain the predictions will be. This is consistent with a sense of

disorder; we don't know which attractor we will orbit or whether we will visit many attractors. Many paths are indistinguishable at their end, but the particular end is not known.

These paths are a progression of quantum states that the system *S* progresses through. Each state has a specific probability of transitioning to another state. Often, those probabilities are narrow, it is difficult to transition to a low-probability state, the Newtonian-like trajectories are often followed. In special cases the probability distribution is broad, and it is possible that many divergent trajectories could result. This uncertainty in the future is both like a change in initial state or a "decision point" in the future of *S*. Lorenz describes a similar uncertainty as the 'butterfly effect," where the choice of a butterfly to flap its wings or not to flap in Brazil is a decision point that influences how severe a storm which spawns tornadoes in Kansas is. My decision to mail this letter to you at this moment may be one of those decision points, or perhaps it is inevitable. As a typical actor, we may never know the eventual consequences of our actions since we neither know our trajectory precisely nor do we know the attractors.

I believe that it is possible to travel in time, by stepping outside of *S*. A time traveler can then make small alterations in the probability of some events. This is the purpose of my

research into Strand Theory. Strand Theory posits that by examining strands in which a different set of events occurred, we may be able to come to understand the events which caused the strands to diverge. A single strand may be represented effectively by the chaotic attractor model, like Lorenz describes, where many similar strands run piecewise parallel to each other.

Applying this Strand Theory, a time traveler might manipulate events to hop to a different strand by altering the probability of just a few events in a strand to make a particular future much more likely, which would serve their own end. Being able to move in time, a time traveler is in a unique position where they can create causes and observe the outcome. This avoids the problem of uncertainty present resulting from alterations to the strand.

I hope this letter has deepened your understanding of one of the multiple theories surrounding the order of time. I encourage you to further develop your understanding of quantum gravity and how time works. I look forward to reading your publications.

All the best,

~Alex Oroitz
Professor Oroitz
Furman University

A Buddha-like creature sits in front of a temple.

Agents can wait, but they often choose not to. Red sits in lotus position on the gravel path within the contemplation garden on the Furman campus. Her hands lie on her lap with the palms facing the sky. The sun shines through her pseudoskin revealing a layer of iridescent red-gold armor. From a distance, the shimmer and seams of the plates resemble the creases and folds of a draped, gilded robe. The light warms the armor underneath. It is a pleasant feeling, as if she is glowing from within. Behind her is a white and brown Japanese Buddhist temple whose name promises peace. Despite Red's statuesque appearance, there is turmoil in her core.

The purpose of remaining at Furman is to be available just in case Carlo Rovelli responds by return letter or a phone call. The letter was intended to be more like a message in a bottle, a one-way missive and not a conversation. Commandant's calculations were vague of the outcome, so waiting became necessary. Jumping back and forth along a strand is both wasteful and challenging for Agents to focus on timelines. Waste, because the operating the hyperspace engines increases entropy in hyperspace, accelerating the heat death of the universes. Challenging, because jumping confuses an agent's awareness of the multiplex causality of events.

Agents don't usually think about the nature of time. Writing the Rovelli letter required ingesting contents of academic letters and publications all the way from Newton to Rovelli's present. The style of writing is confusing and convoluted. Newton said in *Principia*,

> "Absolute, true and mathematical time, of itself, and from its own nature flows equably without regard to anything external, and by another name is called duration: relative, apparent and common time, is some sensible and external (whether accurate or

unequable) measure of duration by the means of motion, which is commonly used instead of true time ....”

Do they really understand each other? Newton, and many others, only had it partly right because they could imagine only one deterministic path even though their language seems to cover multiple possible strands. Maybe that is one reason there are so many strands in the braid that start from the time of the prophets.

Buddhas had it partly right long before the mathematicians and physicists. The Flower Garland Sutra teaches about the multiplicity of universes and the possibilities of connections between them. Viewed from outside the strands, individual beings are like dust in the wind, but their individual choices can result in storms of change across the Braid. Rovelli is important because he began the explanation of “how” and not the “what.” He is the butterfly which intensifies the storm because it chose to flap its wings.

Now would be a perfect time to find a letter from Blue. The shadows from the tree leaves are lazily flickering as the sun rises into the sky. The morning breeze gusts and a few green leaves dance as they fall. A stingless carpenter bee weaves in the air as it investigates the eaves of the temple. None of these have a message from Blue. A sterile peace is here; there is no comfort of love.

Students are beginning to leave the dormitory. It is time to start the daily routine. Pseudoskin folds out of the way as she unfurls the armor on her back to reset the plates. The unfurled armor arches over her head as if they are the blood-red wings of an angel of war. After a shake and rustle, the armor coils back into place forming itself into rosettes on her back. The pseudoskin camouflage knits itself back into a white, loose-fitting blouse, khakis and an oversized belt. Her

rust-colored hair is knotted in a tight French braid, resembling the fashion worn by a mannequin at a Banana Republic storefront.

Agents have no need for direct sustenance. They taste to analyze the makeup of the object and sometimes to make it part of themselves. A morning chai latte from Starbucks is just more camouflage. The line at the campus center winds through the space. On the untouched newsstand, an article on the front page of the *Wall Street Journal* announces, “US to Fund Ukraine Counteroffensive in Crimea.” The war in the Ukraine is a touchpoint in this part of the Braid. Just up and over one strand, the conflict flashed into a small nuclear war after a wayward bomb re-ignited the graphite core at the abandoned Chornobyl fission reactor. Millions of innocents died of starvation in the following nuclear winter. Hundreds of millions more across the world had their lives end early over the next century, victims of radiation-induced cancers from the fallout. The simmering struggle for dominance and sovereignty led to space war and total devastation a millennium later. She was there, and so was Blue. That was where Blue laid the first letter, and where Red found it.

The Starbucks counter’s conventionality makes for a good environment for clandestine meetings. The standardized clutter of baked goods, an espresso machine, miscellaneous bottled beverages, and cash register provides cover. The clatter of dishes, roar of the milk frother, smell of honey, cinnamon and vanilla and caramelized sugar overwhelm other senses. A blonde, ponytailed barista turns to face Red, mechanically sliding an order pad and pen into the space between them. “Your order please?” Red says with a hint of Southern drawl, “A short chai latte, skim milk, if you would.” The barista jots the order down in cryptic shorthand and passes it off to another employee. A few moments later, a paper cup of hot chai with felt pen markings seems to appear

in the order pickup, the sound of the barista announcing the order masked by the cacophony of the crowd.

Red grabs a few recycled paper napkins and walks through the doors to an outside stone table. Spycraft habits are good to practice, being alone and able to watch all approaches. The morning is still too damp and chilly for others to ask for a seat. Her senses tell her there is a message from the Commandant in the graffiti on the table. She delays reading the message, “Not yet, I want to write.” With the steaming cup out front, shielding her fingers from view, Red begins to work the fibers in the napkin to record her code.

Dear Bidibodi Bidiblue,

Just saying your name gives me a measure of stability and strength, even when I think of my risk of being discovered by the Commandant. We live a life of risk, starting wars, extinguishing civilizations, creating peace, opening minds. We are chess pieces being played on a board by invisible hands. Without looking ahead, the moves and countermoves are limited. Can we escape the board and create our own fate? Is that as silly an idea as the name I called you above?

We can write letters without expecting a response, can’t we?

I am near a strand branch both of us have visited. The space war that will happen a millennium from now has its roots here. Although I can’t calculate it, the probability of both of us being present to create that total annihilation must be unimaginably small. Even desolated threads seem

to have value, small changes can cause the path to veer off in surprising directions, at least to us rooks, knights, and bishops.

Both of us have been taught that a branch happens when there is a decision point where the probabilities of alternative outcomes are nearly equal. Can we construct a thread that escapes the braid, a sequence of low-probability events that winds its way into somewhere else? I will have to think about that some more.

I have been thinking about the structure of the Braid a lot these days, partly because of the both of us and partly because of where I am, in the mountains near a Buddhist temple. The temple is alone, just like me, and isolated from her people, just like me. That isn't my point.

About 2500 years downbraid, the Buddhists considered the nature of time. They wrote in the Flower Garland Sutra in the Bodhimanda about the multiplicity of possible timelines and how each of those timelines contained a universe within itself. There is humor in considering there are an infinity of Buddhas and students of Buddhism across the Buddhaverse, each moving along their timelines. I suppose there is an infinity of enlightenment as well in the Buddhaverse. Buddha Gautama did say that the beginning and the end of time were unknowable for mere mortals, but the time surrounding the "now" was obvious. A fire starts with firewood and ends with ashes. The sutras also describe the nature of causality, but they thought of a chain of events not as an immutable one-thing-leads-to-another, but simply likelihoods. Does the match for lighting the fire need one or two strikes? Predicting the future for them was difficult.

I think that is the challenge for all prophets. They can't be precise with what they know and believe, so they write in poetry and analogy. Language is an aid and a hindrance in

communication. You have the advantage over me, being able to share thoughts through the Garden. I envy it, and yet I treasure our ability to share across the void.

It has been a long letter and a long time.

Yours,

Red

Finished with knitting the letter into the napkin fibers, Red slips the napkin under the armor of her hip for safekeeping. With prestidigitation, she simultaneously brushes her other hand across the graffiti covering the rough, pebbled surface of the table. The Commandant has summoned her to help a microbiologist on Strand 23 to create a counter-virus for a pandemic further upstrand.
