The Paradigm Discourses

"Faster Than Letter"

It's a rare person who wants to hear what he doesn't want to hear.

– *Dick Cavett*

Indistinguishability

Dual Pairs

After an hour of tinkering, the 12-foot track had multiple additions; little carts that carried two envelopes from the center toward each end, a Rube-Goldberg contraption in the middle that created a *dual stream of envelope pairs* stuffed with spooky coins, and another contraption on the right that *taped* them face to face (on the right but not on the left). Just before this mechanical beast, was a *flipper* one more mechanical hack that, with the flip of a lever, would rotate one envelope by 180°.

Taping and Flipping

Paradigm nodded at Theory, who strode to the whiteboard and gave a short lecture. "We've made two important discoveries; first that rotating one envelope halfway around (180°), with a spooky coin inside, flips the entanglement from anti-correlated to correlated. Instead of either silver-gold or gold-silver, one gets either silver-silver or gold-gold The second is just more quantum weirdness. Mathematics took a little convincing, but opening envelopes in pairs when they are face to face, so the addresses are hidden, makes them indistinguishable. Now, when opened together, there are no longer *four* possible random outcomes of equal likelihood, but only *three*. This means the odds they will match are *twice* as great as they won't. If one of the envelopes is flipped, the odds they will match are *half* as great as they won't. Binary bits can be mapped onto these two cases, allowing information to be sent on a packet-by-packet basis. Experiment will demonstrate."

Left and Right

Theory sat down, Proof and Reason took their places at opposite ends of the white track (Proof on the left, Reason on the right), while Experiment went to the center of the track and adjusted the location of the central contraption a tad to the right (in the direction of Reason) so that Reason would receive pairs of envelopes slightly before Proof received the corresponding pairs. He pushed the start button and out came a steady sequence of dual pairs of spooky-coin stuffed envelopes; one envelope of each pair toward Proof and the other envelope of each pair toward Reason. After six launches, the tracks held 12 pairs of envelopes, after those six seconds, the first pairs reached Proof and Reason.

Proof opened his envelopes separately and logged whether the coins matched. Reason opened each pair of face-to-face envelopes together with a flourish and logged whether the coins matched.

After 60 runs, Reason engaged the flipper, changing the connection between one envelope and its companion over by Proof from anti-correlated to correlated. Then they did another 60 runs.

The results were dramatic, clear, and uncontestable; when unflipped, Proof's tally was about twice as many matches as non-matches, and when Reason flipped, Proof's tally was about half as many matches as non-matches. What Reason did on the right, changed what Proof saw on the left.

After the last pairs of envelopes were opened, Paradigm stood, "We can conquer the randomness objection to faster than letter communication by semi correlating or semi anti-correlating a pair of otherwise random streams of envelopes, we just need a way to make the envelopes indistinguishable and a packet system. Reason sent two packets of 60 pairs of envelopes each, a 1-bit, and a 0-bit.

"By opening the envelopes in pairs, stuck to each other face-to-face, he made them *indistinguishable*, thus forcing the measurement to be in a 3D Hilbert space instead of a 4D Hilbert space. Equal 1/3 odds instead of equal 1/4 odds. By being closer, he forced the companion spooky-coins to collapse to classical coins, while still within their containing envelopes, before Proof could open them.

"By choosing to flip one envelope halfway around he changed the connection of the spooky-coins from anti-correlated to correlated, shifting the stats from the 'randomness' center," he finger-quoted it, "in the opposite direction. We have defeated the randomness objection to FTL."

He turned to Curiosity like a knight in shining armor, "My inquisitive lady, I give you Faster Than Letter communication."

Objections

First and Last

Dogma stood, violently, spilling what was left of his drink, "No, no, no! Paradigm, you are trying to pull another fast one. I swear, if someone identified you as the culprit behind crop circles, I wouldn't bat an eye."

With a modest bow, "I'm honored." Curiosity gently kicked him. "Behave."

Dogma went to the center of the white track, and after a moment of inspection, shifted the Rube Goldberg contraption of chutes and bins to the left, toward Proof. "Now it will be Proof who opens the envelopes 'first.' Try it again."

Experiment, "As you wish." True to the challenge, Experiment had Reason not flip for 60 pairs and then flip for 60 pairs.

The results were different, there were no correlations between the two streams of envelopes that Proof received, nor for Reason, not for either packet. Dogma gloated, "Whatever sleight of hand you've got going here, this disproves it. You can't claim that Reason opened his envelopes first, so you can't claim it was his openings that collapsed the spooky coins to real coins. 'Earlier' is not a relativistic invariant. Observers in different frames of reference might see Proof as the earlier opener, they would conclude he was the sender. If different observers can't agree on the causality, then it ain't real physics, it's magic, and there is no such thing in the realm.

"QED."

Cause and Effect

Paradigm, catching the warning glance from Curiosity, responded calmly. “You are correct. But notice that Reason’s coins weren’t correlated, whether flipped, or not. Did you miss that change? Something had to cause that difference in outcome; could it be Proof opening his envelopes, independently collapsing the spooky coins within to classical coins?

An FTL Protocol

Simplex

“But watch what happens if we now let Proof tape envelopes.” He moved the taper and flipper from Reason’s side to Proof’s side.

Experiment cleared the machine and started it up again. Like Reason before, Proof didn’t flip the first 60 pairs but did the next 60. Like Proof before, Reason opened his envelope pairs independently. The results were stunning, twice as many matches in the first packet, half as many in the second; a 1-bit and a 0-bit, now sent from Proof to Reason.

Paradigm cleared his throat, “Now, Proof is the sender, Reason the receiver; a simple simplex protocol.”

Packed Based

Mathematics, “I’d like to emphasize that packet size drives the signal to noise ratio.”

Curiosity, “The longer the distance the greater speed, and the distance really has to exceed the length of a packet for this to be useful, correct?”

“Affirmative.”

“So what?” Dogma exhaled. “It’s the same argument, just now centered on Proof rather than on Reason; different observers will not see Proof as earlier…”

Paradigm interrupted, “True, but we didn’t claim it was the first person to open who was the sender, we didn’t claim it was the closer person to open who was the sender; you *assumed* that. We just claimed that in the first configuration Reason was the cause, and in the second configuration Proof was the cause. We are talking about spacelike causality, not timelike causality. For a timelike cause, the first event is the cause, and the temporal ordering of cause and effect is a relativistic invariant, but for a spacelike cause, it is the *spatial ordering* of cause and effect that is the relativistic invariant. Once on the left, always on the left.”

Relativity

“But that’s the problem! In a timelike cause, there is an asymmetry, *earlier* and *later*, but in your mythical spacelike cause there is no asymmetry, left and right are symmetric. You can’t determine left from right, space is *isotropic*. Therefore, drumroll, you can’t determine who is the cause.

“Again, QED.”

Paradigm smiled, “But the fundamental laws of physics are time symmetric, are they not, just as they are symmetric in space? So why is there an asymmetry in time, but not, apparently, in space? Relativity married them, should they not be treatable as equals?”

Logic, “You are referring to the Arrow of Time problem.”

“Yes.”

Reason, “Perhaps it has something to do with dimensions; time is one dimensional, space is three dimensional.”

“Could be, we don’t know.

“But think of it this way,” Paradigm’s smile got bigger, “given entanglement and a restriction rule, in this case, indistinguishability, all we need to get FTL is to find a way to break that symmetry. We got a freebie with time, the realm gifted us *earlier* and *later*,” now he was out and out grinning, “we may have to work a little harder to break the symmetry of space.”

SSI

Understanding, chimed in, his deep voice automatically authoritative, “But you already did that, Paradigm, with the wave at the beach. The angle between them determines the direction of the zip. We’ve already broken the symmetry of space.” He looked out across the faces of his team, obviously pleased. “You’ all have figured out how to tell left from right.

“Well done.”