

(Originally published in Analog Science Fiction and Fact, June 2003.)

ALOHA

by Ken Wharton

In their final moments together, as Hannah was about to convert, she treated Felix to a new sort of vista.

They were on a beach; that much was familiar. But the surrounding flora and fauna looked completely alien: towering cylindrical trees, sprouting leaves from only the very tops; other trees bearing spherical objects (fruits? nuts?) with colors Felix had never seen in nature; flying animals with ridiculous feather patterns and strange, pointed beaks.

Hannah, who usually chose familiar scenes from their distant past—except for that one abstract period 10^{80} years before—was clearly starting to lose her volition.

"Why this?" Felix asked her as they walked side by side in the warm, white sand. "And why this colorful skirt?" He almost mentioned the alien flowers around her neck, but didn't want to bombard her with too many questions at this difficult moment.

Hannah visibly struggled to respond. "I can think of some plausible reasons," she said. "But given what's about to happen, they're probably just rationalizations. What does it look like to you?" She opened up a bit of her soul—a rare, but not unprecedented event—and Felix examined her as closely as he dared.

"I think you're right," he said, staring into her as if he could memorize her nature, as if he could keep the parts he loved, to fend off the impending loneliness. "Future conditioning, I suppose."

She closed up to him, for the last time, and they resumed their walk toward the surf.

"I don't want to end," Hannah confessed. "I almost envy you."

"What's to envy? I'll be alone."

Hannah shrugged. "At least you'll *be*."

Felix didn't know how Hannah could see any comfort in what he would have to endure.

His fate was set by the laws of physics, without hope of reprieve. He would live out his remaining time alone, and then he would end, a cause without an effect. And with this hopelessness on top of losing Hannah. . . .

Felix finalized his decision. "I'm going to change, once you're gone. I've fashioned a block. To stop me from thinking about what happens after I end."

She smiled her most sorrowful smile, and Felix couldn't believe that any future conditioning could be affecting *that*.

"The last man in the universe, and he won't consider the future."

"I don't want to endure it. And I don't see what harm—"

"Well, *I'm* considering the future. What's the time-reverse of a broken heart?"

"After you convert, you'll see one right in front of you."

The waves lapped their bare feet for a timeless moment, but a dead calm soon fell over the ocean and even the tiniest ripples vanished.

"I think it's about to happen." Hannah lowered her head to watch her feet sink into the damp sand, air bubbles popping up around them. Then she looked up at Felix. "To think of all that time we forwarded, not knowing how little we had left. And now I'm left with no time to even remember this . . ."

"I'll remember it for—"

Felix broke off, realizing it had already happened. Around him, nothing had changed. Hannah's beach was still intact, and Hannah herself had barely moved. But that was expected—indeed, *required*. This may have been Hannah's causal end of the universe, but the physical laws of conservation demanded a momentary convergence between the Hannah from the past and the stranger from the future.

Already changes were becoming apparent to Felix, already the histories were diverging. It was more than just the jerky and unnatural motions from this woman in front of him. It was the way she looked at him. No longer could he see the love they had forged over nearly half the duration of the universe. But he didn't see the look of a complete stranger, either. In fact, Felix imagined that she looked eagerly expectant.

But expectant for what? This stranger was nearing the end of *her* causal existence, too. A few moments into her subjective future—a few moments into Felix's past—this woman's consciousness would cease as she merged with Hannah. All of her memories would lose their context, all of her history would be sequestered in an unknown future. In a very real sense, this woman's universe was about to end.

The woman awkwardly grabbed his hands. "Aloha," she intoned, some word in a language he did not know. Then she let go, backed away, and kept walking backward down the beach.

It was over, and Hannah was gone. He didn't feel anything yet—it still didn't seem real. Not with Hannah's double smiling at him from the distance.

Smiling? Surely this woman couldn't be expecting some version of an afterlife. Anyone who had survived to the temporal midpoint of the universe had to know that their time was quite literally up, had to know that cosmological boundary conditions imposed the same time-

symmetries on the universe that were found in the laws of physics. The artificial atoms that comprised her computational structure would survive, but the causal chain of her life was about to terminate.

Felix quickly turned and left the beach, flashing back to his most comfortable base-state. In a moment he found himself resting on familiar mosslands, directly between the double shadows of his ancestral mountain peak. And it was only then that he realized the woman might not even know what was in store for her.

By now Felix knew his own fate, without question. His friends and acquaintances had converted, one by one, and now he was the last of his kind, maybe the last entropy-increasing consciousness *anywhere*. But from the woman's temporal perspective, she would be almost the *first* to convert. Maybe she didn't know. Maybe she didn't understand.

Maybe he should talk to her.

Felix pushed that last thought away. Hannah was gone, and he needed to begin dealing with that fact. Inventing excuses to interact with her double was not what he needed right now. Interacting with *any* time-reversed person was difficult enough.

Felix had spoken to some of them already and had learned their primary language, backward sentence structure and all. But he had also learned how unwieldy it could be to hold even the simplest conversation. What do you say to someone who has already heard everything you'll tell them from that point onward, but doesn't remember anything you've already said? What's the point in communicating, when by expressing an idea all you accomplish is to erase it from the other's memory? Throw in the feeling of being manipulated—even though the only "manipulators" were the unfeeling laws of physics—and Felix had long ago sworn off any more mixed-boundary conversations.

No, there was no point. Hannah was gone, and his destiny was meaningless. Soon he would be no more able to affect the future than he could affect the past. Feelings of depression and loss were already closing in when he remembered that he had never activated his block.

In a moment it was done. And he did feel better, in some ways, though the emptiness in his heart now seemed even more pronounced. Felix still knew his time was limited, but with Hannah gone that almost seemed like a good thing.

But how much time did he have remaining? None of the other time-reversed people had been willing to tell him when he was due to convert, but today a new source of information had appeared. He might give this Aloha woman a chance to tell him. . . .

Soon, Felix told himself. First he needed time to mourn.

#

He approached the woman on her simulated beach. The vista had changed somewhat from his previous visit—the waves were moving offshore, for one thing—but the general feel was the same.

Seeing her again was more painful than he had expected; she still looked too much like Hannah. Her eyes searched his face, as if examining the remnants of his love.

"I don't know what to say," he began, careful to speak backward so she could understand.

"No, I don't suppose you do," she said dourly. Felix blinked. She made perfect sense, almost as if she were responding to him. But that would be impossible. . . .

She brightened. "Aloha, remember?"

Felix nodded, then stopped himself. This woman was experiencing causality in the opposite direction; responding to her would do no good at all. Neither would asking her questions. He mentally reversed the order of her last two sentences, and realized that she hadn't

responded to him, but rather to her own rhetorical question.

"It's hard for me to see you like this," Felix said.

Now she looked impatient. "I really wish you'd stop talking about those things."

Her impatience was infectious, and Felix launched into his prepared speech. "Look, I only have one thing to tell you, but it's important that you know what's happening. Surely some of you have observed that the universe is reversing its causal arrow. We first noticed it ages ago, long before anyone converted."

In fact, Felix had been one of the first to notice. The computations that enabled their continued existence had long been powered by the only energy source left in the universe—the occasional annihilation of electrons and positrons into two energetic gamma rays. Not even stray protons were still around to supply energy; apart from the ones they manufactured, protons had all decayed into positrons and other unstable products long ago. The energy supply dropped with time, constantly slowing down their conscious processes while making the rest of the universe appear to speed up. But Felix had noticed that their energy supply was falling faster than theory predicted, and soon it had become clear that the universe had thrown them one final twist.

"I'm sure you've noticed that there's a missing gamma ray component. Well, the gamma rays are *converting*. Instead of being governed by their past history, they're becoming governed by a causal chain in the opposite direction, coming from the future. Two converted gamma rays—against all respectable odds—will just happen to collide to produce an electron-positron pair. It doesn't happen everywhere at once, because that would require an additional level of coincidence, but the process is inevitable. The universe is starting to fill back up with matter, *converted* matter, matter with an opposite entropic arrow of time. Next, electrons will start 'undecaying' into antiprotons . . ."

Her look of impatience slowly vanished as he spoke, and Felix trailed off as he realized that he had just un-bored this woman with all his talking.

"Is that right?" Emotions flew across her face with such rapidity he could scarcely imagine what she was thinking.

"The point is," Felix said, "*you* don't have much longer. You'll convert at our next meeting."

Now she seemed calm again. "I thought you were going to stop coming to see me."

Felix took a step back in surprise. He had already decided that this was to be the last time he spoke with her. So why would she say this? Unless. . . .

He took another step backward, and then another, and finally turned and ran out of her control zone. *I won't come back*, he told himself, despite the fact that the universe had already determined that he would.

#

The funny thing about free will, Felix thought, was that it always maintained its own illusion.

Aloha (for that was what he had named her) had implied that they had met several times in her past—in Felix's future—so now he knew something about the choices he would soon make. In a universe where free will reigned supreme, it would be a simple matter to create a paradox. Felix merely had to choose not to see Aloha again, and the universe would be inconsistent.

He laughed out loud at the idea. As if *he* were more powerful than the universe.

No, paradox-prevention had turned out to be a major underpinning of reality, the lynchpin to explaining why quantum mechanics worked the way that it did. He couldn't force a

paradox, no matter how he tried.

But neither did the universe force *him*, manipulating his actions like a marionette. Physics was subtler than that, and the illusion of free will was infinitely resilient. He knew that he would eventually come to an apparently free decision to go see Aloha. And this was why he loathed these mixed-boundary encounters so intensely. Because, in the back of his mind, he'd always know that it wouldn't *really* be a unilateral decision, that it was forced upon him by future events.

And so his stubborn streak kicked in. *No free will? I'll see about that.* And he resolved to make the universe drag him into Aloha's zone, kicking and screaming. Never again, Felix vowed, would he go to visit her.

Instead, the universe brought Aloha to him.

Felix could have excluded her from his zone, but he was so stunned by her appearance—not to mention her wounded expression—that he didn't think of it until it was too late.

"What are *you* doing here?" he blurted out.

At that, Aloha's expression cleared, she sat down on the mossplants, and began to talk.

It was a rambling tale, as one would imagine, given that every thought logically preceded the one before. But over the next subjective hour, Aloha still managed to paint a picture of her home planet, her fleshlife, her culture.

Despite the recurring ocean scenery, Aloha claimed that she hadn't spent much of her life on the beach. Instead, she had lived her fleshlife in the mountains—much like Hannah. And the similarities to Hannah went well beyond that. Both had been the first in their family to transcend, both had a rather morbid sense of humor, both were absolutely brilliant mathematicians.

There were differences, too—after all, they had led entirely different lives on different planets. But the coincidences did make him wonder: How much of Hannah was still lingering inside this woman? If Aloha's influence could reach into the past and make Hannah produce an alien beach-scene, why couldn't Hannah's influence be reaching here, into the future? Maybe he hadn't lost her; not entirely.

Aloha's stories ended before Felix was ready, and asking her to continue would accomplish nothing. She got up to leave, smiling.

"Then I think it's my turn, this time," she said.

"I enjoyed that," was all he managed, before she flashed away. Felix stared at the spot where Aloha had just stood. "Very well," he muttered into the emptiness. "Free will be damned."

#

They met often. Sometimes in his zone, sometimes in hers, but always the routine was the same. One of them would talk, and the other would simply listen.

When it was his turn, he talked about whatever came into his head, bouncing randomly from his childhood to his final days with Hannah and everything in between. Aloha seemed to especially enjoy it when he talked about Hannah -- or perhaps he just tended to bring up Hannah when Aloha looked cheerful. By this point, Felix had effectively given up on separating cause from effect.

Aloha rarely talked about her recent history, but it was clear that she had a life partner, too. Unlike Felix and Hannah, they weren't the last of their kind, but love was love, even when time-reversed. Felix saw no evidence of this other person, and that made it easier to imagine that whenever Aloha talked about her partner, it was really Hannah's influence reaching into the

future and telling Felix how she felt about him. Even though Aloha sometimes went for entire conversations without even hinting that this other person existed, her casual comments on that topic kept Felix coming back for more.

One day, when he went to see her, the beach was gone. Now Aloha's zone had become a mountain scene in spring, just below the snowline. Thin white trees surrounded them on all sides, sporting small leaves that had wildly different shades of green on either side. Aloha looked the same, apart from her warmer clothing, but somehow Felix knew that this visit was going to be different from all the rest.

Upon seeing him, she smiled sadly and shook her head. "I guess 'Aloha' was appropriate, after all." Felix sat beside her on a fallen tree, waiting for her to say more, but today she remained thoughtfully quiet. Still, Felix hadn't made it to the temporal midpoint of the universe without learning a great deal of patience, and he waited her out.

At last Aloha began speaking again, but this time it wasn't a story about her distant past. Something, it seemed, had opened her emotional floodgates, and Felix sat in stunned attention. Instead of her usual reticence to talk about her partner, the words that came pouring out were almost beyond what Felix could handle. She spoke of her timeless feelings for a love who was no longer with her, feelings that Felix couldn't help but identify with.

"I miss him so," she said, shaking. She wiped her cheeks, smearing moisture onto them. "I mean . . . I mean . . . I miss *him*." Now she was crying, and Felix could almost see Hannah inside of her rising tears. "I miss you."

Felix caught his breath. Was Hannah speaking to him directly, one last message from the past? He reached out to her with both arms, and after a tiny hesitation she entered into his embrace. They clung to each other, all the while Felix knowing that this was as close as he'd

ever get to a final goodbye.

She disengaged from him quickly—too quickly. Felix almost felt betrayed as he looked into her moist eyes, despite the fact that they were looking back at him with real love.

"You're Hannah, you know," he said, the words that he had been holding back finally tumbling out of him, almost beyond his control. "I never told you, but that's why . . . that's why I've been coming to see you. When Hannah converted, she merged into you. And I loved her so much I can't seem to let her go."

Aloha's eyes were now clear. "Why are you doing this to me?" Her voice was weary, a side of her he had never seen. "Just stop this."

"—you coming to see me."

She interrupted him before he could begin his sentence. "Next time I'm going to exclude you," she said. "Don't come here anymore."

But you're not going to exclude me, Felix thought. In fact, from her time-perspective, she would soon decide to visit him regularly. Something had changed in Aloha today . . . but what? Did she *want* him to imagine that she held a little bit of Hannah inside of herself?

She glared at him. "I don't want to see you."

Whatever the reason, she no longer felt the same way. Out of deference to her current wishes, Felix retreated from her zone.

#

His next visit was not from Aloha, but from a dozen of the other time-reversed people. He had talked to some of them before, but never in a large group like this. And of course, they wouldn't yet know about those previous conversations.

Felix met them just outside his personal zone. They stood together in a group and eyed

him as they might a dangerous animal.

"Like when we're all going to die," said the stocky, bald man who had converted from his old friend Nemo.

"Just imagine what he knows," said another.

"I don't like where this is heading," said the only woman in the bunch.

After more random comments of this sort, several of the others started laughing at Reverse-Nemo, who was sporting a grim face and looking down at his empty, cupped palm. A small device materialized there, and Felix watched as Reverse-Nemo lobbed the device towards him in a perfect, parabolic arc.

Felix quickly decided not to catch it, wondering how this would look from a reverse-time perspective. The arc would have the same shape forward or backward in time, like all the laws of physics. But Reverse-Nemo hadn't *thrown* the object, he had *caught* it. If the device went clattering on the ground behind him, then how would it have—

As if by reflex, Felix reached up and snagged the device out of the air. Reflex? Or forces beyond his control? He was just starting to puzzle out what had caused the device to pass between them at all, when suddenly the device *spoke*.

"Say 'rhinoceros' and give this back to me," the device said, and Felix noticed that the others had stopped laughing.

Felix shrugged, repeated the nonsense word as best he could, then lobbed it back to Reverse-Nemo's hand.

Now Reverse-Nemo's grim look was replaced by open skepticism, and the device vanished just as it had appeared.

"Watch this," said Reverse-Nemo. "I think he's a fraud."

Now they all started talking at once, crowding around him.

"It's not just the gamma rays. What have I been telling you?"

"Impossible."

"It finally happened."

"What's going on with you?"

Felix wouldn't have been surprised if they had started prodding him. They had clearly never seen him before, never interacted with a time-reversed person at all. But Aloha hadn't treated him like this at their last meeting, which meant that they'd see each other at least one more time. So where was she? He made one last check for her face in the crowd before retreating into his zone and raising a full exclusion.

His time was almost up. Felix had suspected this before now, but the strange visit from the others confirmed it. Next would no doubt come the rationalizations.

Forced consistency was tricky business for the universe. With two symmetric boundary conditions on its temporal extremes—one at the Big Bang and another at the Big Crunch—the universe was a classic case of an overconstrained system. While this meant that the universe lost many of its degrees of freedom, this had usually been irrelevant to Felix, changing only the microscopic details of his quantum state, not the overall picture.

But now everything was different. Now the universe needed to control every detail, every decision he made, all in the name of paradox prevention. And the universe determined that Felix would decide to go visit Aloha, one final time.

Felix knew it must be a rationalization. While he could imagine some possible reasons behind the decision—he didn't want to be alone, he missed Hannah, etc.—deep down he knew he was being swept along by circumstances beyond his control.

Even so, the act of actually going to visit Aloha seemed perfectly natural, in accord with his usual perception of free will. Aloha didn't exclude him—somehow he had known that she wouldn't—although she looked rather despondent as he approached.

I should be the one feeling despondent, Felix thought. *It's my world that's about to end.*

"I don't know why we're even talking," she said, leaning toward him. "This is ridiculous."

"I've been lonely. I was hoping you'd tell me another story."

"You have no idea how hard this is."

Felix fell quiet and sat down, hoping that she'd speak to fill the silence. Instead, she slowly began to cry.

"Something's about to upset you," Felix noted out loud, talking more to himself than to Aloha. "And I don't imagine that it's because I'm about to walk away."

"It's a word that means both goodbye and hello," she said in one of her usual non-sequiturs, now crying harder than ever.

"I don't understand, Aloha," he said, slipping up by calling her that made-up name for the first time. "Help me understand."

But already the tears were slowing, Aloha now looking more withdrawn than sad.

"This *is*," she said. "This *is* impossible."

"I wish it *was* impossible." Felix shook his head. "But I'm afraid it's all very real. We're *never* going to be able to have a conversation, don't you see? One of us has to just *talk* to the other, like we did before. And it has to be your turn. I don't want to spend my last few moments talking. I just want to be with you at the end."

"Please go away. Go away. I can't bear to see you like this." But despite her words, she

looked deep into his eyes.

"I feel the same way, but I still can't leave you."

"Can you hear me? Are you still hiding in there, somewhere?" She blinked her moist eyes. "Oh, my love."

Felix felt a virtual pang in his virtual heart. *Love?* In their last conversation, she said that she missed him, and now she was professing her love? If Hannah was talking through Aloha, her influence should be getting weaker with time, not stronger.

Something didn't add up. What was happening here? The answer should be obvious, and if he couldn't see it. . . .

His block.

Something about his block was preventing him from making the final connection.

Aloha—Hannah—was pleading with her eyes.

"You always were a purist," Felix muttered, and he whisked away his block before he could change his mind. Immediately a dozen thoughts surged to the forefront of his consciousness, clamoring for attention.

For the first time since Hannah's conversion, Felix considered his own fate. Somewhere in the far future, he recalled, some time-reversed intelligent creature would be living on a planet orbiting a time-reversed star. That creature would transcend—just as Felix had—and would help construct a computational structure remarkably similar to Felix's own. Its subjective experience of time would slow down as energy sources became rarer and rarer, but it would survive to the temporal midpoint of the universe. And as the two of them approached the same space-time point from opposite temporal directions, the universe was forced to make them converge. Their lives were intertwined along the same standing quantum waves, and these final moments would

only serve to make the universe free of paradox.

But that line of thinking held an important fact: When Felix converted, he would be replaced by another. He had considered this before, but now he had new information. Now Felix knew exactly who he would become.

"You can't leave me alone like this," Aloha said, almost begging. "You can't be gone."

It was all very clear. Aloha was reliving Felix's earlier loss in reverse. Felix had the most intense feeling of *déjà vu* he had ever experienced, and it kept getting stronger, almost as if he was a character in a pre-scripted play.

"I've left you," he said. "I'm so sorry."

He forced himself to think backward, from Aloha's perspective. She'd soon terminate by converting into Hannah, reuniting their universe-spanning love after this brief off-sync interlude.

A smile began to creep across his face as the corollary of that thought sank in.

Yes, his existence was almost over. But when he converted, he'd be back together with the woman he loved.

Aloha's tears had vanished, replaced by a look of pure shock.

"Are you gone, like they were warning us?"

And *that* was why, Felix realized, *that* was why Aloha had been happy at the end of her existence. That was why she smiled. She knew that they'd be reunited—in a fashion.

But why did she say "Aloha," at that final moment? What did it mean?

"I don't believe it," she said.

And then he realized that she had already answered his question.

"Aloha," Felix responded through sudden tears of joy. "Aloha."

<end>